General Physics
Multiple-Choice Questions

Waves
Thermodynamics
Electricity and Magnetism

Dr. Abdulaziz Aljalal
Prof. Ibraheem Nasser
Mr. Khateeb-Ur-Rehman

Physics Department
King Fahd University of Petroleum and Minerals

العبيكان
Obeikan

جامعة الملك فهد للبترول والمعادن
عمادة البحث العلمي

King Fahd National Library Cataloging-in-Publication Data

Al – jalal, Abdulaziz

General physics multiple – choice questions. / abdulaziz Al – jalal; Ibrahim Nasser; Khateeb Urrehan. – Riyadh, 2008

248 p; 21x29.7 cm

ISBN: 978-603-54-0583-6

1- Physics

I-Ibrahim Nasser (co. author)

II- Khateeb Urrehan (co. author)

III- Title

553 dc 1429/6302

L.D. no. 1429/6302

ISBN: 978-603-54-0583-6

صدر هذا الكتاب بدعم من جامعة الملك فهد للبترول والمعادن ضمن اتفاقية نشر خاصة بين شركة العبيكان للأبحاث والتطوير وعمادة البحث العلمي في الجامعة

الطبعة الأولى

١٤٣١هـ/ ٢٠١٠م

الناشر: العبيكان للنشر

الرياض – شارع العليا العام – جنوب برج المملكة

هاتف: ٢٩٣٧٥٧٤/٢٩٣٧٥٨١ فاكس: ٢٩٣٧٥٨٨

ص.ب: ٦٧٦٢٢ الرمز ١١٥١٧

التوزيع: مكتبة العبيكان

الرياض – العليا – تقاطع طريق الملك فهد مع العروبة

هاتف: ٤١٦٠٠١٨/٤٦٥٤٤٢٤ فاكس: ٤٦٥٠١٢٩

ص.ب: ٦٢٨٠٧ الرمز ١١٥٩٥

Forward

This book is a collection of 954 multiple-choice questions for the first-year university-level general physics course. They cover the material for waves, thermodynamics, electricity, and magnetism. The correct answers can be found at the end of the book.

These questions have been given, over couple of years, to first-year students in General Physics II (Phys102) course at King Fahd University of Petroleum and Minerals (KFUPM). The students who take phys102 are expected to become engineers or scientists. Phys102 is one-semester course and it has two major exams and a final exam. Each major exam contains 20 multiple-choice questions and covers one-third of the course. The final exam contains 30 multiple-choice questions and covers the whole course. The average time allowed for each question is 6 minutes.

The questions are organized according to the sections of Phys102 textbook The textbook used for Phys102 is Fundamental of Physics by Halliday, Resnick and Walker, 6th edition. Phys102 covers chapter 17 to chapter 31.

The numbers at the right side of the first line of any question refer to the chapter number and section number of the textbook. The numbers at the right side of the second lines of some questions contain information about the quality of the question and the performance of KFUPM students. The first number is the discrimination factor which shows how good the question in discriminating good and weak students. The second number is the percentage of students who got the question wrong.

The following are conventions used in phys102 exams.

- The sign * indicates multiplication.
- The sign ** indicates power to. For example, 10^{-3} is written as 10**(-3).
- All Greek letters are written explicitly as they sound. For example, λ is written as lambda.

This collection might be very useful for students to prepare for Phys102 exams. We advise students to study and understand the material very well before attempting to practice some of these questions. These questions should not be used as the sole or the main mean to prepare for the exams.

Instructors might also find this book as a valuable source for questions that can be used as examples or in tests. The statistics provided with some of the questions might be used as a reference to compare performances.

Many faculty members of the Physics Department at KFUPM have contributed in collecting or writing these questions. We would like to express our thanks to all of them. All these questions are taken from the archives of phys 102 old exams. Any issues and infringement related to copyright material in this book is the sole responsibility of the authors of this book.

Dr. Abdulaziz Aljalal,
Dr. Ibraheem Nasser, and
Mr. Khateeb-Ur-Rheman,

Dhahran, September 2005.

Acknowledgement

This project has been supported
by ***King Fahd University of Petroleum and Minerals***
under Book Writing Project Int-384.

Contents

Chapter 17 Waves-1

17-3 Transverse and Longitudinal Waves

Question 1
The velocity of a traveling wave on a string under fixed tension
(a) increases when the frequency increases
(b) does not change when the frequency increases
(c) decreases when the wave length increases
(d) decreases when the amplitude increases
(e) decreases when the frequency increases

17-4 Wavelength and frequency

Question 2 C.38-32%
A sinusoidal transverse wave travels along a string. The time for a particle on the string to move from maximum displacement to zero displacement is 0.170 seconds. What is the frequency of the source?
(a) 8.96 Hz
(b) 5.88 Hz
(c) 2.94 Hz
(d) 1.47 Hz
(e) 23.3 Hz

17-04

Question 3
A sinusoidal wave is described as:
y = (0.1 m) * sin[10*pi*(x/5 + t - 3/2)],
where x is in meters and t is in seconds. What are the values of its frequency(f), and its velocity(v)?
(a) f=5 Hz, v = 1 m/s moving in +x-direction.
(b) f=5 Hz, v = 5 m/s moving in +x-direction.
(c) f=5 Hz, v = 1 m/s moving in -x-direction.
(d) f=2 Hz, v = 5 m/s moving in -x-direction.
(e) f=5 Hz, v = 5 m/s moving in -x-direction.

17-04
Question 4 0.32-53%
A sinusoidal transverse wave is traveling on a string. Any point on the string:
(a) moves in the same direction as that of the wave.
(b) moves in a uniform circular motion with a different angular speed than that of the wave.
(c) moves in a simple harmonic motion with the same angular frequency as that of the wave.
(d) moves in a uniform circular motion with the same angular speed as the wave.
(e) moves in a simple harmonic motion with a different frequency than that of the wave.

17-04
Question 5 0.59-38%
Consider a wave described by the equation:
y(x,t) = A cos (k*x-w*t).
At t = 0, the displacement is zero at x= :
(a) 1/5 wavelength, 2/5 wavelength, . . .
(b) 1/2 wavelength, 3/2 wavelength, . . .
(c) 1/4 wavelength, 3/4 wavelength, . . .
(d) 1/3 wavelength, 5/3 wavelength, . . .
(e) 1/2 wavelength, 1 wavelength, ...

17-04
0.4-26%

Question 6
A sinusoidal wave is described by the equation
y(x, t)= 2.0 sin[5*x + 15*t]
in SI units. How far does this wave move in 15 seconds?
(a) 15 m.
(b) 45 m.
(c) 5 m.
(d) 55 m.
(e) 90 m.

17-5 The Speed of a Traveling Wave

17-05

Question 7
For a certain wave, the maximum transverse velocity is 6 m/s, and the maximum transverse acceleration is 12 m/s**2. Find the amplitude of this wave.
(a) 5 m.
(b) 3 m.
(c) 9 m.
(d) 1 m.
(e) 7 m.

17-05
0.51-35%

Question 8
A sinusoidal wave traveling in the positive x direction has an amplitude of 10 cm, a wavelength of 20 cm, and a frequency of 5.0 Hz. A particle at x = 0 and t = 0 has a displacement of 10 cm. Write the equation of the displacement of the particles as a function of x and t.
(a) y = (0.1 m)*sin[pi*(10x-10t-3/2)]
(b) y = (0.1 m)*sin[pi*(10x+10t-3/2)]
(c) y = (0.1 m)*sin(10x-10t+pi/2)
(d) y = (0.2 m)*sin(pi*(10x+10t-3/2)]
(e) y = (0.2 m)*sin[pi*(10x-10t+3/2)]

17-05
0.46-32%

Question 9
A harmonic wave is described by y = 0.2*sin(25x-10t) (SI units). How far does a wave crest move in 20 sec?
(a) 20 m
(b) 5 m
(c) 8 m
(d) 50 m
(e) 0 m

17-05
0.62-40%

Question 10
A transverse wave of 0.5-m wavelength is moving in a stretched string with a speed of 5 m/s. If the maximum transverse acceleration of the particles in the string is 80 m/s**2, find the amplitude of the wave.
(a) 4 cm
(b) 6 cm
(c) 1 cm
(d) 3 cm
(e) 2 cm

17-05

Question 11
A transverse sinusoidal wave traveling in the negative x direction has an amplitude of 10.0 cm, a wavelength of 20.0 cm, and a frequency of 8.00 Hz. Write the expression for y as a function of x(in meters) and t(in seconds)if y(0,0) = 10.0 cm.
(a) y = (0.1 m) sin[20.0*x-8.00*t-(2*pi)]
(b) y = (0.1 m) sin[20.0*x+8.00*t+(2*pi)]
(c) y = (0.1 m) sin[31.4*x+50.3*t+(pi/2)]
(d) y = (0.1 m) sin[31.4*x+50.3*t+pi]
(e) y = (0.1 m) sin[31.4*x-50.3*t-(pi/2)]

17-05

Question 12
Ocean waves, with a wavelength of 12 m, are coming in at a rate of 20 crests per minute. What is their speed?
(a) 30 m/s
(b) 8.0 m/s
(c) 16 m/s
(d) 24 m/s
(e) 4.0 m/s

17-05
0.19-21%

Question 13
The equation of a transverse wave traveling along a stretched string is given by:
y(x,t) = (2.0 mm) sin(20x-600t)
where x is in meter and t in sec. What is the transverse speed at x = 1 m and t = 0.5 seconds?
(a) 1.1 m/s
(b) - 0.43 m/s
(c) zero
(d) 0.52 m/s
(e) - 0.21 m/s

17-05

Question 14
A sinusoidal wave is described as:
y = (0.1 m) * sin[10*pi*(x/5 +t-3/2)],
where x is in meters and t is in seconds. What are the values of its frequency(f), and its velocity(v)?
(a) f=2 Hz, v = 1 m/s moving in -x-direction.
(b) f=2 Hz, v = 1 m/s moving in +x-direction.
(c) f=2 Hz, v = 5 m/s moving in -x-direction.
(d) f=5 Hz, v = 5 m/s moving in -x-direction.
(e) f=5 Hz, v = 5 m/s moving in +x-direction.

17-05
0.34-74%

Question 15
A stretched string has a mass per unit length of 0.500 kg/m and is under a tension of 10.0 N. A sinusoidal wave on this string has an amplitude of 0.120 mm, a frequency of 100 Hz, and is traveling in the negative x direction. What is the equation of the wave ?
(a) y = (0.120 mm) sin(444*x - 628*t)
(b) y = (0.120 mm) sin(444*x + 628*t)
(c) y = (0.120 mm) sin(140*x + 628*t)
(d) y = (0.120 mm) sin(140*x - 628*t)
(e) y = (0.060 mm) sin(140*x + 628*t)

17-05

Question 16

A sinusoidal wave is given by the equation:

$y(x,t) = 7.0 \cos(-kx-wt+Phi)$.

Which of the following statements is true about this wave:

(a) The wave is a standing wave.
(b) The wave is moving to the positive x-axis.
(c) The wave is moving with speed k/w.
(d) The wave is moving to the negative x-axis.
(e) The wave is moving with speed kw.

17-05

Question 17 0.53-36%

In a vibrating string waves travel a distance of 45 cm in 3.0 s. If the distance between two successive crests is 3.0 cm, what is the frequency of the vibrator causing the waves?

(a) 5.0 Hz.
(b) 20.0 Hz.
(c) 11.5 Hz.
(d) 15.0 Hz.
(e) 7.5 Hz.

17-05

Question 18 0.44-31%

A water wave is described by the equation:

$y(x,t) = 0.40 \cos[0.10(x + 3t)]$

where x and y are in meters and t is in seconds. The maximum transverse speed of the water molecules is

(a) 0.12 m/s.
(b) 4.11 m/s.
(c) 0.04 m/s.
(d) 0.22 m/s.
(e) 1.20 m/s.

17-05

Question 19 0.43-28%

A sinusoidal traveling wave is generated on a string. The speed of the wave is 0.050 m/s, and it is traveling to the right along the x-axis. Figure 1 shows the displacement of the particle of the string, at x=0, as a function of time. What is the equation of the wave? [y is given in meters]

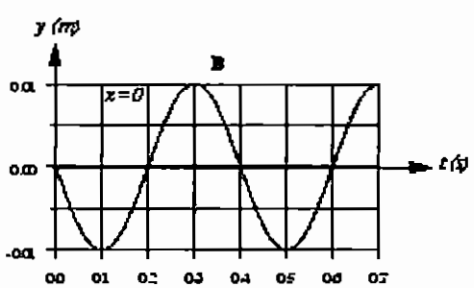


Figure 1

(a) $y(x,t) = 0.01*\sin[2*Pi(50x - 2.5t)]$
(b) $y(x,t) = 0.02*\sin[2*Pi(50x - 8.0t)]$
(c) $y(x,t) = 0.01*\sin[2*Pi(50x + 2.5t)]$
(d) $y(x,t) = 0.01*\sin[2*Pi(50x + 8.0t)]$
(e) $y(x,t) = 0.01*\sin[2*Pi(50x - 8.0t)]$

17-05
0.26-69%

Question 20
Any point on a string carrying a sinusoidal traveling wave is moving with its maximum transverse speed when:
(a) the magnitude of its displacement is half the amplitude.
(b) the magnitude of its displacement is one fourth the amplitude.
(c) the magnitude of its displacement is zero.
(d) the magnitude of its acceleration is a maximum.
(e) the magnitude of its displacement is a maximum.

17-05
0.28-81%

Question 21
A wave in a string, is given by the equation:
$y(x,t) = 0.24*\sin(3.0*x-24*t)$,
where x and y are in meters and t is in seconds. Calculate the magnitude of the transverse speed at x = 2.0 m and t = 1.0 s.
(a) 1.8 m/s.
(b) 5.5 m/s.
(c) 3.8 m/s.
(d) 2.1 m/s.
(e) 8.0 m/s.

17-05
0.56-44%

Question 22
A transverse sinusoidal wave of frequency 100 Hz is traveling along a stretched string with a speed of 20.0 m/s. What is the shortest distance between a crest and a point of zero transverse acceleration?
(a) 1.20 m.
(b) 0.15 m.
(c) 0.05 m.
(d) 0.10 m.
(e) 0.20 m.

17-6 Wave Speed on a Stretched String

17-06

Question 23
A 100-Hz oscillator is used to generate a sinusoidal wave, on a string, of wavelength 10 cm. When the tension in the string is doubled, the oscillator produces a wave with a frequency and wavelength of:
(a) 50 Hz and 14 cm.
(b) 200 Hz and 20 cm.
(c) 100 Hz and 20 cm.
(d) 200 Hz and 14 cm.
(e) 100 Hz and 14 cm.

17-06

Question 24
The linear density of a vibrating string is 1 g/m. A transverse wave is propagating on the string and is given by the equation:
$y(x,t) = 2.0*\sin(x - 40*t)$,
where x and y are in meters and t is in seconds. What is the tension in the string?
(a) 1.6 N.
(b) 1.9 N.
(c) 0.9 N.
(d) 2.1 N.
(e) 5.2 N.

17-06

Quest on 25

Figure (1) shows two different wires, joined together end to end, and are driven by a vibrator of frequency 120 Hz. Wire(2) has a linear density four times that of wire(1). If a wave has a wavelength of 1 m in wire(1), what is the wavelength of the wave in wire(2)?

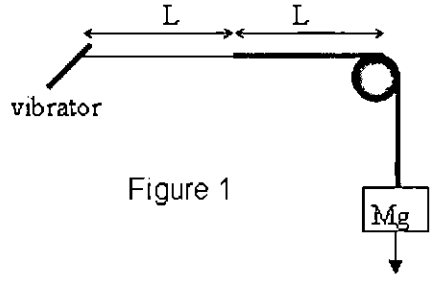


Figure 1

(a) 2.0 m.
(b) 0.5 m.
(c) 0.3 m.
(d) 1.5 m.
(e) 4.0 m.

17-06
0.46-22%

Question 26

The equation for a transverse wave on a string is:

$y(x,t) = 0.025*[\sin(25*x-500*t)]$

where x and y are in meters and t is in seconds. The tension in the string is 20 N. Find the linear density of this string.

(a) 0.02 kg/m
(b) 0.13 kg/m
(c) 0.05 kg/m
(d) 0.50 kg/m
(e) 0.25 kg/m

17-06
0.40-42%

Question 27

If a sinusoidal transverse wave is traveling on a string, then any point on the string

(a) moves in the same direction as the wave.
(b) moves in uniform circular motion with a different angular speed than that of the wave.
(c) moves in simple harmonic motion with the same frequency as that of the wave.
(d) moves in simple harmonic motion with a different frequency than that of the wave.
(e) moves in uniform circular motion with the same angular speed as that of the wave.

17-06

Question 28

A wave in a string, of linear density 0.13 g/m, is given by the equation:

$y(x,t) = 0.018 \sin(3.0x-24.0t)$,

where x and y are in meters and t is in seconds. the tension in the string is:

(a) 3.32*10**(-3) N.
(b) 3.90*10**(-3) N.
(c) 3.12*10**(-2) N.
(d) 2.34*10**(-4) N.
(e) 2.43*10**(-5) N.

17-06

Question 29 0.43-28%

A string 180 cm long has a fundamental frequency of vibration of 300 Hz. What length of the same string, under the same tension, will have a fundamental frequency of 200 Hz?

(a) 147 cm.
(b) 900 cm.
(c) 270 cm.
(d) 220 cm.
(e) 120 cm.

17-06

Question 30 0.57-57%

A steel wire of mass 0.400 kg and length 0.640 m supports a 102-kg block (see figure 2). The wire is struck exactly at the midpoint generating a pulse on the wire. How long does it take the peak of the pulse to reach the top of the wire?

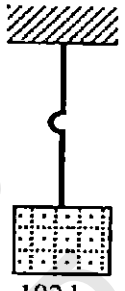


Figure 2

(a) 2.00*10**-3 s
(b) 8.00*10**-3 s
(c) 1.60*10**-2 s
(d) 6.00*10**-3 s
(e) 4.00*10**-3 s

17-06

Question 31 0.36-34%

In figure 2, two equivalent pulses, Pulse 1 and Pulse 2, are sent from points A and B at the same time, respectively. Which pulse reaches point C first?

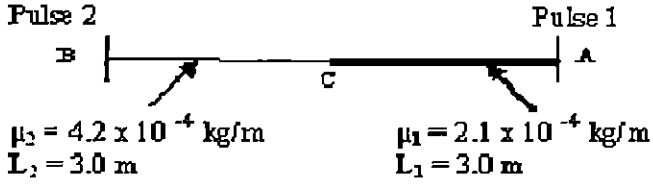


Figure 2

(a) Not enough information.
(b) Pulse 1.
(c) 312 Hz.
(d) Both at the same time.
(e) Pulse 2.

17-06
Question 32 0.33-42%
The tension in a 60 m telephone wire is 800 N. A pulse initiated at one end of the wire is found to reach the other end in 1.5 s. What is the mass of the wire?
(a) 15 kg.
(b) 50 kg.
(c) 30 kg.
(d) 60 kg.
(e) 40 kg.

17-06
Question 33 0.34-17%
The equation of a transverse wave on an 80 cm long stretched string is given by:
$y(x, t) = 2.0 \sin [10*x-50*t]$
where x and y are in meters and t is in seconds. If the mass of the string is 160 g, find the tension in the string.
(a) 5.0 N.
(b) 3.5 N.
(c) 25 N.
(d) 55 N.
(e) 15 N.

17-7 Energy and Power of a Traveling String Wave

Question 34
A wave of wavelength 0.6 m is sent along a horizontal rope of linear density 13 g/cm, under a tension of 750 N. If the amplitude of the wave is 5.2 cm, then the average power transmitted along the rope is given by:
(a) 2.7 kW.
(b) 9.5 kW.
(c) 5.2 kW.
(d) 4.6 kW.
(e) 1.3 kW.

17-07
Question 35 0.41-38%
A transverse wave in a 3.0 m long string is given by the harmonic wave equation: $y = 0.4*\cos[\pi*(x/4 + 6t)]$ (SI units). If the string is kept under a constant tension of 70 N, find the power transmitted to the wave.
(a) 44 W
(b) 25 W
(c) 72 W
(d) 83 W
(e) 58 W

17-07
Question 36 0.45-37%
Any point on a string carrying a sinusoidal wave will move with its maximum speed when the magnitude of its:
(a) displacement is maximum
(b) displacement is twice the amplitude
(c) displacement is minimum
(d) acceleration is maximum
(e) displacement is half the amplitude

17-07

Question 37
A transverse sinusoidal wave travels along a string of linear mass density 5.00 g/m. The amplitude of the wave is 2.00 cm, its frequency is 60.0 Hz, and the tension in the string is 20.0 N. What is the power transmitted by this wave?
(a) 8.99 W
(b) 90.0 W
(c) 512 W
(d) 2.54 W
(e) 285 W

17-07
0.38-31%

Question 38
The speed of a transverse wave on a string is 170 m/s when the tension in the string is 120 N. What must be the tension to produce waves with a speed of 180 m/s if the amplitude is doubled?
(a) 240 N
(b) 540 N
(c) 127 N
(d) 270 N
(e) 135 N

17-07
0.32-43%

Question 39
A harmonic wave is traveling in a string of mass density 10 g/m. The amplitude of the wave is 1 milli-m, its frequency is 100 Hz, and the tension in the string is 20 N. What is the average power required to maintain the vibration?
(a) 88 milli-W
(b) 8.8 milli-W
(c) 4.4 milli-W
(d) 44 milli-W
(e) 17 milli-W

17-07

Question 40
Transverse waves are being generated on a rope under constant tension. By what factor does the required power change if the length of the rope is doubled?
(a) 1/2.
(b) 1.
(c) 2.
(d) 4.
(e) 1/4.

17-07

Question 41
The power transmitted by a sinusoidal wave on a string does not depend on:
(a) the amplitude of the wave.
(b) the length of the string.
(c) the frequency of the wave.
(d) the tension in the string.
(e) the wavelength of the wave.

17-07

Question 42 0.50-32%

A string under a tension of 15 N, is set into vibration to produce a wave of speed 20 m/s, and a maximum transverse speed of 8 m/s. For this wave, the average power is:

(a) 44 W.
(b) 30 W.
(c) 24 W.
(d) 15 W.
(e) 11 W.

17-07

Question 43

A string has a linear mass density of 0.10 kg/m and it is under tension of 10.0 N. What must be the frequency of traveling waves of amplitude 10.0 mm for the average power to be 0.5 W?

(a) 32 Hz
(b) 0.01 Hz
(c) 16 Hz
(d) 100 Hz
(e) 10 Hz

17-07

Question 44 0.36-76%

Sinusoidal waves are generated on a string under constant tension by a source vibrating at a constant frequency. If the power delivered by the vibrating source is reduced to one half of the initial value, what is the ratio of the final amplitude to the initial amplitude?

(a) 1.0
(b) 2.0
(c) 0.50
(d) 0.71
(e) 1.4

17-07

Question 45

A sinusoidal wave, given by the equation:

$y(x,t) = 0.07 \cos(6.0x-30t)$

where x and y are in meters and t is in seconds, is moving in a string of linear density = 1.2 g/m At what rate is the energy transferred by the wave?

(a) 1.32*10**(-2) W.
(b) No enough information is given to solve this question.
(c) 3.02*10**(-2) W.
(d) 1.05*10**(-2) W.
(e) 2.21*10**(-2) W.

17-07

Question 46 0.61-34%

A sinusoidal wave travels along a string whose mass per unit length is 5.00 g/m. The amplitude of the wave is 2.00 cm, its wavelength is 105 cm, and the tension in the string is 20.0 N. What is the average power transported by this wave?

(a) 9.06 W
(b) 4.5 W
(c) 7.26 W
(d) 3.01 W
(e) 8.1 W

17-07

Question 47 0.47-58%

Figure 1 shows the snap shot of part of a transverse wave traveling along a string. Which statement about the motion of elements of the string is correct? For the element at

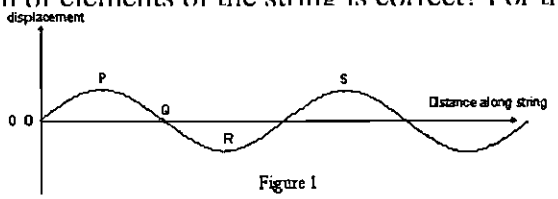


Figure 1

(a) Q, its displacement is a maximum.
(b) Q, its speed is zero.
(c) S, the magnitude of its acceleration is a maximum.
(d) P, its speed is a maximum.
(e) S, the magnitude of its acceleration is zero.

17-9 Interference of Waves

Question 48 0.51-28%

Two harmonic waves are described by y1 = 0.02*sin[pi*(2x-120t)] and y2 = 0.02*sin[pi*(2x-120t-0.5)](SI units). What is the amplitude of the resultant wave?

(a) 28 mm
(b) 0 mm
(c) 20 mm
(d) 10 mm
(e) 50 mm

17-09

Question 49

Fully DESTRUCTIVE interference between two sinusoidal waves of the same frequency and amplitude occurs only if they:

(a) travel in the same direction and are 90 degrees out of phase
(b) travel in opposite directions and are in phase
(c) travel in the same direction and are 180 degrees out of phase
(d) travel in the same direction and are in phase
(e) travel in opposite directions and are 90 degrees out of phase

17-09

Question 50

The path difference between two waves is 5 m. If the wavelength of the waves emitted by the two sources is 4 m, what is the phase difference (in degrees)?

(a) 75
(b) 45
(c) 320
(d) 180
(e) 450

17-09

Question 51 0.29-35%

Two harmonic waves traveling in the same medium are described by

y1 = 12 sin (3*pi*x-5*pi*t)
y2 = 12 sin (3*pi*x-5*pi*t - 4)

where x and y are in meters and t is in seconds. What is the displacement of the resultant wave at x= 1.0 m and t= 1.0 s?

(a) -10 m
(b) 1.4 m
(c) 9.1 m
(d) -1.6 m
(e) -3.2 m

17-09

Question 52
Two waves are described as follows:
y1(x,t) = 4 (x-v*t)
y2(x,t) = 4 (x+v*t)
At what position and time do these two waves cancel?
(a) At x = 0 and at t = 0 only.
(b) They always cancel because v has opposite signs.
(c) They never cancel (they always add up).
(d) At t = 0 and at any position x.
(e) At x = 0 and at any time t.

17-09

Question 53
A transverse harmonic wave in a string is described by:
y(x,t) = (3.0 m) * sin(0.3x-8t-Phi),
where x is in meters and t is in seconds. At t = 0 and x = 0, a point on the string has a positive displacement and has velocity of 0. The phase constant (Phi) is:
(a) 135 degrees.
(b) 270 degrees.
(c) 90 degrees.
(d) 45 degrees.
(e) 180 degrees.

17-09

Question 54
Two harmonic waves are described by:
y1(x,t) = 4 sin(8x-300t),
y2(x,t) = 4 sin(8x-300t-2),
where x is in centimeters and t is in seconds. What is the frequency of the resultant wave?
(a) 24 Hz.
(b) 38 Hz.
(c) 48 Hz.
(d) 33 Hz.
(e) 75 Hz.

17-09
0.37-31%

Question 55
The resultant wave, of two interfering waves, moving in the same direction is given by:
y(x,t) = 10.0*cos(Pi/6)*sin(3.0*x + 20*Pi*t + Pi/6).
One of the two originally interfering waves could be:
(a) y(x,t) = 5.0 sin(3.0*x + 20*Pi*t + Pi/3).
(b) y(x,t) = 10.0 sin(3.0*x + 20*Pi*t + Pi/3).
(c) y(x,t) = 5.0 sin(3.0*x + 20*Pi*t + Pi/6).
(d) y(x,t) = 10.0 sin(3.0*x - 20*Pi*t).
(e) y(x,t) = 10.0 sin(3.0*x + 20*Pi*t).

17-09
0.54-41%

Question 56
A sinusoidal wave of frequency 400 Hz has a speed of 330 m/s. How far apart are two points that differ in phase by Pi/2 ?
(a) .21 m
(b) 0.032 m
(c) 0.137 m
(d) 0.206 m
(e) 0.825 m

17-09
Question 57).63-49%
Two identical sinusoidal traveling waves are moving in the same direction along a stretched string. The amplitude of the resultant wave is 1.80 times that of the common amplitude of the two combining waves. What is the phase difference between the two waves ?
(a) 25.8 degrees
(b) 51.7 degrees
(c) 90.0 degrees
(d) 180 degrees
(e) 18.0 degrees

17-09
Question 58 0.40-28%
The equation for a transverse wave on a string is:
y(x,t) = 10.0*sin(0.157*x-50.3*t)
where x and y are in centimeters and t is in seconds. At a given time, how far apart are two points that differ in phase by Pi/2 radians ?
(a) 10.0 cm
(b) 5.00 cm
(c) 0.120 cm
(d) 18.0 cm
(e) 40.0 cm

17-09
Question 59 0.59-53%
Two sinusoidal waves having the same amplitude (A), frequency and wavelength, travel in the same direction and have a phase difference Phi. Which one of the following statements is TRUE ?
(a) Their interference will be constructive if Phi = 100 Pi.
(b) Their interference will be constructive if Phi = Pi.
(c) For certain values of Phi, the amplitude of the resultant reaches 4A.
(d) The frequency of the resultant wave is twice the original frequency.
(e) The resultant wave will be a standing wave for Phi = 0.

17-09
Question 60
Two identical sinusoidal waves, are out of phase with each other, travel in the same direction. They interfere and produce a resultant wave given by the equation:
y(x,t)= 8.0*10**(-4) sin(4.0x-8.0t+1.57 rad),
where x and y are in meters and t is in seconds. What is the amplitude of the two interfering waves?
(a) 1.0 m.
(b) 4.0 m.
(c) 0.5 m.
(d) 2.5 m.
(e) 0.2 m.

17-09
Question 61 0.44-34%
Two identical waves, moving in the same direction, have a phase difference of Pi/2. The amplitude of each of the two waves is 0.10 m. If they interfere, then the amplitude of the resultant wave is:
(a) 1.12 m.
(b) 0.05 m.
(c) 0.14 m.
(d) 0.21 m.
(e) Not enough information is given to solve this question.

17-09

Question 62 0.44-24%

Two identical sinusoidal waves are traveling along a stretched string, both moving in the negative x direction. The two waves are out of phase by Pi radians. The amplitude of each wave is 1.00 cm and their frequency is 100 Hz. What is the displacement of the string at x=0 when t=10.0 s?

(a) 2.00 cm
(b) 1.41 cm
(c) 0.71 cm
(d) 1.00 cm
(e) zero

17-09

Question 63 0.35-18%

A transverse sinusoidal wave is traveling on a string with a speed of 300 m/s. If the wave has a frequency of 100 Hz, what is the phase difference between two particles on the string that are 85 cm apart?

(a) 0.6 radians.
(b) 4.1 radians.
(c) 1.8 radians.
(d) 3.4 radians.
(e) 5.6 radians.

17-09

Question 64 0.31-66%

Figure 2 shows the displacements at the same instant for two waves, P and Q, of equal frequency and having amplitude Y and 2*Y, respectively. If the two waves move along the positive x-direction, what is the amplitude of the resultant wave, and the phase difference between the resultant wave and the wave P?

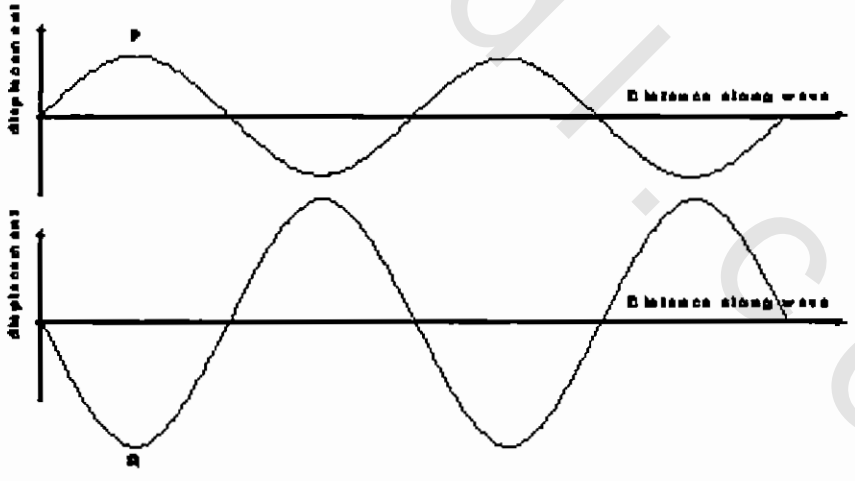


Figure 2

(a) Resultant amplitude is Y, and the phase difference is Pi.
(b) Resultant amplitude is 2*Y, and the phase difference is Pi.
(c) Resultant amplitude is 3*Y, and the phase difference is Pi.
(d) Resultant amplitude is Y, and the phase difference is zero.
(e) Resultant amplitude is 2*Y, and the phase difference is zero.

17-11 Standing Waves

17-11

Question 65
The equation for a standing wave is given by:
y = 4.00*10**(-3) sin(2.09 x) cos(60.0 t) (in Sl units).
What is the distance between two consecutive antinodes?
(a) 0.560 m
(b) 1.50 m
(c) 5.00 m
(d) 3.00 m
(e) 2.20 m

17-11
Question 66).19-27%
Two harmonic waves traveling in opposite directions interfere to produce a standing wave described by: y (x,t) = (0.3 m) sin(0.25*x) cos(120*pi*t). The speed of the two interfering waves is
(a) 1203 m/s
(b) 6527 m/s
(c) 1508 m/s
(d) 94.25 m/s
(e) 753.0 m/s

17-11

Question 67
The maximum amplitude of a standing wave on a string, with linear density = 3.00 grams/m and tension of 15.0 N, is 0.20 cm. If the distance between adjacent nodes is 12.0 cm, what will be the wave function y(x,t) of the standing wave? (Note that x is in centimeters and t is in seconds.)
(a) y(x,t) = 0.20 sin(0.262 x) cos(2.20*10**3 t).
(b) y(x,t) = 0.20 sin(0.421 x) cos(1.85*10**3 t).
(c) y(x,t) = 0.20 sin(0.262 x) cos(1.85*10**3 t).
(d) y(x,t) = 0.40 sin(0.262 x) cos(1.11*10**3 t).
(e) y(x,t) = 0.40 sin(0.421 x) cos(1.85*10**3 t).

17-11

Question 68
The equation for a standing wave is given by: y = 4.00*10**(-3) sin(2.09 x) cos(60.0 t) (SI units). What is the distance between two consecutive antinodes?
(a) 0.56 m.
(b) 3.00 m.
(c) 2.20 m.
(d) 1.50 m.
(e) 5.00 m.

17-11
Question 69 0.5-43%
A traveling wave is given by:
y(x,t) = 6.0*cos[0.63*x + 25.1*t)],
where x and y are in cm and t is in seconds. It interferes with a similar wave propagating in the opposite direction to produce a standing wave. The distance between the node and the consecutive antinode is:
(a) 1.0 cm.
(b) 2.5 cm.
(c) 0.5 cm.
(d) 5.0 cm.
(e) 7.9 cm.

17-11
Question 70 0.26-49%
A wave on a string is reflected from a fixed end. The reflected wave:
(a) is in phase with the original wave at the fixed end.
(b) has a larger amplitude than the original wave.
(c) is 180 degrees out of phase with the original wave at the fixed end.
(d) cannot be transverse.
(e) has a larger speed than the original wave.

17-11
Question 71 0.54-32%
The wave function for a standing wave on a string is
y(x,t) = 2.0*sin(0.25*Pi*x)*cos(120*Pi*t)
where x and y are in centimeters and t is in seconds. What is the distance between two adjacent nodes ?
(a) 4.0 cm
(b) 6.0 cm
(c) 8.0 cm
(d) 2.0 cm
(e) 1.0 cm

17-11
Question 72 0.43-23%
A wave of speed 20 m/s on a string, fixed at both ends, has an equation for a standing wave given by:
y(x,t) = 0.05 sin(kx) cos(30t),
where x and y are in meters and t is in seconds. What is the distance between two consecutive nodes?
(a) 5.0 m.
(b) 0.1 m.
(c) 2.1 m.
(d) 3.2 m.
(e) 1.1 m.

17-11
Question 73 0.44-54%
A 200-cm string is fixed at both ends. The mass per unit length of the string is 0.0150 g/cm. The tension in the string is 600 N. If the string vibrates in three equal segments, what is its fundamental frequency?
(a) 950 Hz
(b) 632 Hz
(c) 475 Hz
(d) 158 Hz
(e) 1330 Hz

17-12 Standing Waves and Resonance

17-12
Question 74 0.46-28%
Consider a string fixed at both ends. It has consecutive standing wave modes with frequencies of 480 Hz and 600 Hz. The tension in the string is kept constant. Find the fundamental frequency.
(a) 480 Hz
(b) 300 Hz
(c) 150 Hz
(d) 120 Hz
(e) 500 Hz

17-12
0.51-46%

Question 75
A stretched string, fixed at both ends, vibrates in its fundamental frequency. To double the fundamental frequency of the same string, one can change the tension in the string by a factor of:
(a) SQRT(2)
(b) 1/(SQRT(2))
(c) 2
(d) 1/2
(e) 4

17-12
0.34-37%

Question 76
A string, 30.0 cm long, with a linear density of 0.65 g/m is set into vibration. It is found that normal modes of vibration are present ONLY at the frequencies of 880 Hz and 1320 Hz as the frequency of the source is varied over the range 500 Hz to 1500 Hz. What is the tension in the string?
(a) 56.4 N
(b) 50.4 N
(c) 45.3 N
(d) 36.5 N
(e) 78.2 N

17-12
0.38-37%

Question 77
A string of length L, mass per unit length mu, and tension F is vibrating at its fundamental frequency. What is the effect on the fundamental frequency if the length of the string is doubled and the tension is quadrupled?
(a) The fundamental frequency is doubled.
(b) The fundamental frequency is quadrupled.
(c) The fundamental frequency is halved
(d) The fundamental frequency does not change.
(e) The fundamental frequency is tripled.

17-12

Question 78
A standing wave is established in a 3.0-m-long string fixed at both ends. The string vibrates in three segments with an amplitude of 1.0 cm. If the wave speed is 100 m/s, what is the frequency?
(a) 25 Hz
(b) 100 Hz
(c) 50 Hz
(d) 10 Hz
(e) 33 Hz

17-12

Question 79
A stretched wire vibrates in its fundamental mode at 300 Hz. What would be the fundamental frequency if the wire were one third the original length, with twice the diameter and with four times the tension?
(a) 900 Hz.
(b) 150 Hz.
(c) 450 Hz.
(d) 300 Hz.
(e) 800 Hz.

17-12

Question 80
The lowest resonant frequency, in a certain string clamped at both ends, is 50 Hz. When the string is clamped at its midpoint, the lowest resonant frequency is:
(a) 50 Hz.
(b) 150 Hz.
(c) 100 Hz.
(d) 200 Hz.
(e) 250 Hz.

17-12
0.39-42%

Question 81
Standing waves are produced in a string at the two consecutive resonant frequencies 155 and 195 Hz. If the mass of the string is 5.00 g and its length is 0.80 m, then the tension applied to the string should be:
(a) 17.2 N.
(b) 6.4 N.
(c) 28.5 N.
(d) 19.0 N.
(e) 25.6 N.

17-12

Question 82
A standing wave pattern is established on a string as shown in Figure 1. The wavelength of the component traveling wave is

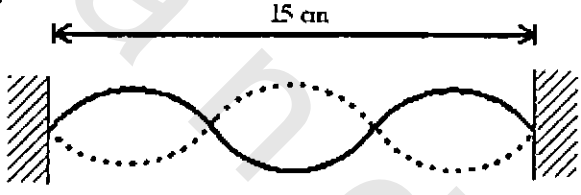


Fig. (1)

(a) 0.4 cm
(b) 15 cm
(c) 0.2 cm
(d) 5.0 cm
(e) 10 cm

17-12

Question 83
A string that is stretched between two supports separated by 1.0 m has resonant frequencies of 500 Hz and 450 Hz, with no intermediate resonant frequencies, what is the wave speed in the string?
(a) 200 m/s
(b) 50 m/s
(c) 350 m/s
(d) 500 m/s
(e) 450 m/s

17-12
0.55-37%

Question 84
A string fixed at both ends vibrates in three loops. The string has a length of 1.0 m, a mass of 8.0 g and is under a tension of 15 N. What is the frequency?
(a) 150 Hz
(b) 130 Hz
(c) 29 Hz
(d) 55 Hz
(e) 36 Hz

17-12
Question 85 0.52-22%
A string having a mass per unit length of 10.0 g/m is under a tension of 160 N. This string resonates in the mode shown in figure 1. If the length of this string is 90.0 cm, find the frequency of oscillation.

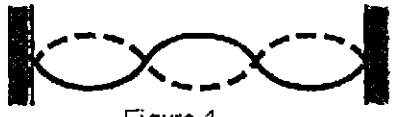


Figure 1

(a) 60.0 Hz
(b) 211 Hz
(c) 120 Hz
(d) zero
(e) 310 Hz

17-12
Question 86 0.38-35%
When a certain string is clamped at both ends, the lowest four resonant frequencies are 50, 100, 150 and 200 Hz. When the string is also clamped at its midpoint (without changing the tension), then the lowest four resonant frequencies are
(a) 50, 100, 150 and 200 Hz.
(b) 35, 50 , 75 and 100 Hz.
(c) 75, 150, 225 and 300 Hz.
(d) 50, 150, 250 and 300 Hz.
(e) 100, 200, 300 and 400 Hz.

17-12
Question 87
A string has linear density = 5.1 g/m and is under a tension of 120 N. If the vibrating length of the string is 60 cm, What is the lowest resonant frequency?
(a) 225 Hz.
(b) 128 Hz.
(c) 312 Hz.
(d) Not enough information.
(e) 158 Hz.

17-12
Question 88 0.53-44%
A 40 cm string of linear mass density 8.0 g/m is fixed at both ends. The string is driven by a variable frequency audio oscillator ranged from 300 Hz to 800 Hz. It was found that the string is set in oscillation only at the frequencies 440 Hz and 660 Hz. What is the tension in the string?
(a) 125 N.
(b) 496 N.
(c) 500 N.
(d) 322 N.
(e) 248 N.

17-12
Question 89 0.24-13%
A certain string, fixed at both ends, vibrates in seven segments at a frequency of 240 Hz. What frequency will cause it to vibrate in four segments?
(a) 411 Hz
(b) 89 Hz
(c) 137 Hz
(d) 274 Hz
(e) 420 Hz

17-12
0.52-35%

Question 90

Vibrations with frequency 600 Hz are set up on a 1.33-m length of a string that is clamped at both ends. The speed of waves on the string is 400 m/s. How far from either end of the string does the first node occur?

(a) 0.33 m
(b) 0.49 m
(c) 0.75 m
(d) 0.17 m
(e) 0.66 m

17-12
0.57-42%

Question 91

A point source emits sound waves which are reflected from a metal plate with air in between, as shown in figure 3. Standing waves are produced in between the source and the plate. If the points R, S and T are three successive nodes, what is the frequency of the wave? [Speed of sound in air is 342 m/s].

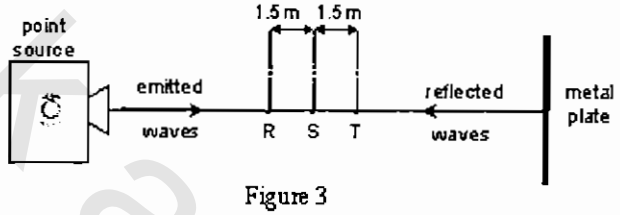


Figure 3

(a) 312 Hz.
(b) 158 Hz.
(c) Not enough information.
(d) 225 Hz.
(e) 114 Hz.

17-12
0.40-24%

Question 92

A 50 cm long string with a mass of 0.01 kg is stretched with a tension of 18 N between two fixed supports. What is the resonant frequency of the longest wavelength on this string?

(a) 50 Hz.
(b) 312 Hz.
(c) 30 Hz.
(d) 9.8 Hz.
(e) 150 Hz.

17 All sections

17

Question 93

Transverse waves, with fixed amplitude, are being generated on a rope under constant tension. When the frequency of the wave is increased, which one of the following statements is correct

(a) The wavelength increases and the transmitted power is the same
(b) Both the wavelength and the linear mass density decrease
(c) Both the wavelength and the maximum transverse speed increase
(d) The wavelength decreases and the transmitted power increases
(e) The maximum transverse speed is the same and the transmitted power increases

Chapter 18 Waves-11

18-1 sound Waves

18-01

Question 94
When a sound wave travels from air into steel,
(a) it changes from a longitudinal wave into transverse wave.
(b) it's velocity decreases.
(c) it's frequency increases.
(d) it's wavelength increases.
(e) it becomes more intense.

18-01

Question 95
A man strikes a long steel rod at one end. Another man, at the other end with his ear close to the rod, hears the sound of the of the blow twice (one through air and once through the rod), with a 0.1 seconds interval between. How long is the rod? [For the steel, the bulk modu us = 2.1*10**11 Pa, and the density = 7.0*10**3 kg/m**3. Speed of sound in air = 340 m/s.]
(a) 42 m.
(b) 34 m.
(c) 36 m.
(d) 40 m.
(e) 44 m.

18-01
0.42-41%

Question 96
Sound waves
(a) are matter waves.
(b) travel at the same speed in all media.
(c) are mechanical waves.
(d) are transverse waves.
(e) are electromagnetic waves.

18-01
0.46-39%

Question 97
Sound waves are not:
(a) pressure waves.
(b) mechanical waves.
(c) compression waves.
(d) transverse waves.
(e) longitudinal waves.

18-01
0.23-12%

Question 98
In figure 3, the two observers at A and B are hearing the sound emitted by the point source S. What is the time difference between hearing the sound at the two locations? Use 345 m/s as the speed of sound.

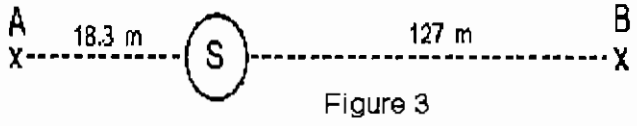


Figure 3

(a) 3.17 s
(b) 0.053 s
(c) 0.315 s
(d) 0.368 s
(e) 1.89 s

18-2 The Speed of sound

18-02

Question 99
The volume of a certain solid shrinks by 2 parts in 10**6 when it is subject to an external hydrostatic pressure of 1 atm. The density of the solid is 8.0 g/cm**3. What is the speed of a longitudinal wave through this material?
(a) 3.4*10**3 m/s.
(b) 1.5*10**3 m/s.
(c) 2.5*10**2 m/s.
(d) 2.5*10**3 m/s.
(e) 3.4*10**2 m/s.

18-02
0.31-59%

Question 100
A sound wave travels from air to water, then
(a) its speed decreases.
(b) its frequency decreases.
(c) its frequency increases.
(d) its speed increases.
(e) its wavelength will remain unchanged.

18-02
0.29-10%

Question 101
In a liquid having density 1.30*10**3 kg/m**3, longitudinal waves with frequency of 400 Hz are found to have a wavelength of 8.0 m. Calculate the bulk modulus of the liquid.
(a) 6.64*10**12 Pa.
(b) 1.33*10**10 Pa.
(c) 9.62*10**7 Pa.
(d) 3.12*10**6 Pa.
(e) 1.20*10**11 Pa.

18-3 Traveling Sound waves

18-03
0.25-25%

Question 102
If two sound waves, one in air and the other in water, are of equal intensity. What is the ratio of the pressure amplitude of the wave in water to that of the wave in air? (rho(air)= 1.21 kg/m**3, v(air)= 343 m/s, rho(water)= 1*10**3 kg/m**3, v(water)= 1482 m/s)
(a) 78.2
(b) 35.7
(c) 99.2
(d) 82.3
(e) 59.8

18-03
0.38-23%

Question 103
The maximum pressure amplitude that the human ear can tolerate in loud sounds is 28 Pa. What is the displacement amplitude for such a sound in air of density 1.21 kg/m**3 at a frequency of 5.0*10**3 Hz? [speed of sound in air = 343 m/s].
(a) 4.15*10**(-6) m.
(b) 50.5*10**(-6) m.
(c) 11.0*10**(-6) m.
(d) 2.15*10**(-6) m.
(e) 8.30*10**(-6) m.

18-03

Question 104
A sinusoidal sound wave is described by the displacement
S (x,t) = 2*10**(-8) cos [1.25 x - 1850 t],
where x is in meters and t is seconds. What is the pressure amplitude of this wave if it is traveling in a material with a bulk modulus of 2.1*10**9 N/m**2 ?
(a) 53 Pa
(b) 77 Pa
(c) 66 Pa
(d) 82 Pa
(e) 44 Pa

18-4 Interference

18-04
Question 105 (.43-37%
Two identical speakers, facing each other are driven by a common oscillator of frequency 600 Hz. A man, at the midpoint between the speakers, start moving toward one of them. He reaches the first minimum sound when he is 1 m from one of the speakers. Find the distance between the speakers. (Speed of sound = 343 m/s.)
(a) 6.1 m
(b) 4.0 m
(c) 2.3 m
(d) 5.6 m
(e) 4.5 m

18-04
Question 106
Two speakers are driven by a common oscillator and face each other at a distance of 1.500 m. A man is standing at 0.700 m from one of the speakers along the line joining the two speakers. What is the highest frequency of the oscillator, within the audible range (20.0 Hz to 20.0 kHz), so that the man hears a minimum sound? (Speed of sound = 343 m/s).
(a) 19.9 kHz
(b) 18.9 kHz
(c) 12.6 kHz
(d) 15.9 kHz
(e) 10.3 kHz

18-04
Question 107).44-36%
Two sound waves, from two different sources with the same frequency, 660 Hz, travel at a speed of 330 m/s. The sources are in phase. What is the phase difference of the waves at a point that is 5.0 m from one source and 4.0 m from the other? (The waves are traveling in the same direction.)
(a) 1 Pi.
(b) 2 Pi.
(c) 4 Pi.
(d) 3 Pi.
(e) 5 Pi.

18-04

Question 108 0.13-83%

A sound wave of 50.0 cm wavelength enters the tube shown in figure(1) at the source end. What must be the smallest radius(r) (other than zero) such that a maximum sound will be heard at the detector end?

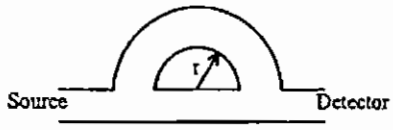


Figure (1)

(a) 15.9 cm.
(b) 21.3 cm.
(c) 33.0 cm.
(d) 17.5 cm.
(e) 43.8 cm.

18-04

Question 109

Two point sources S1 and S2 are placed on the y-axis as shown in figure 1. The two sources are in phase and emit identical sound waves with frequency 860 Hz. An observer starts at point A and moves to point B along a straight line parallel to the y-axis. How many points of maximum intensity (constructive interference) will he observe? (speed of sound in air = 344 m/s).

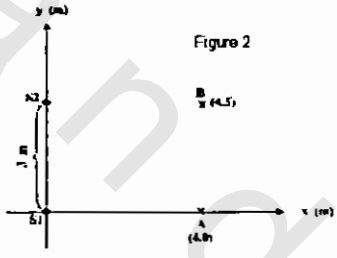


Figure 2

(a) 1
(b) 4
(c) 0
(d) 5
(e) 3

18-04

Question 110 0.70-40%

Two small identical speakers are in phase(see figure 2). The speakers are 3.0 m apart. An observer stands at point X, 4.0 m in front of one of the speakers. The sound he hears will be a maximum if the wavelength is

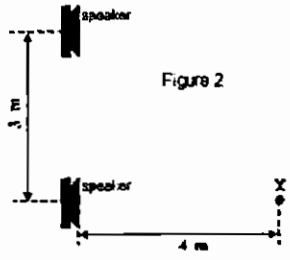


Figure 2

(a) 2.0 m.
(b) 3.0 m.
(c) 1.5 m.
(d) 1.0 m.
(e) 2.5 m.

18-04
0.31-41%

Question 111

Two speakers face each other and emit sound waves in air with a frequency of 500 Hz, as shown in figure 1. The phase difference between the sound waves emitted by the two speakers at point A is 2.35 radians. What is the distance between A and S2 ? The speed of sound in air is 343 m/s.

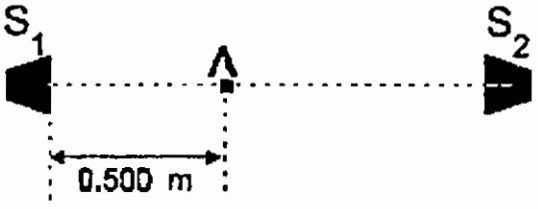


FIGURE 1

(a) 0.256 m
(b) 1.05 m
(c) 3.17 m
(d) 0.756 m
(e) 0.500 m

18-04
0.21-75%

Question 112

Two speakers A and B are driven by a common oscillator at 256 Hz and face each other at a distance of 10.0 m (see figure 2). A small detector is located midway between the two speakers (at point O). Find the distance that the detector has to move towards A along the line joining A and B to detect the first minimum in the sound intensity. [speed of sound in air = 343 m/s].

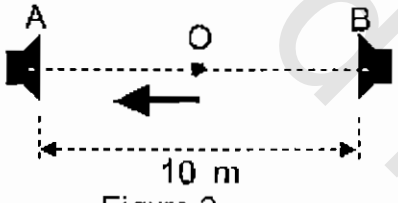


Figure 2

(a) 0.670 m
(b) 0.172 m
(c) 0.335 m
(d) 1.00 m
(e) 0.195 m

18-04

Question 113

A listener hears two sound waves from two loud-speakers that are in phase. At the listeners location a phase difference of 450 degrees is detected. What is the path difference if the wavelength of the waves is 4 m.

(a) 10 m.
(b) 5 m.
(c) 99 m.
(d) 1 m.
(e) zero.

18-04
0.48-47%

Question 114

Two transmitters, S1 and S2 shown in figure (1), emit identical sound waves of wavelength lambda. The transmitters are separated by a distance lambda/2. Consider a big circle of radius R with its center halfway between these transmitters. How many interference maxima are there on this big circle?

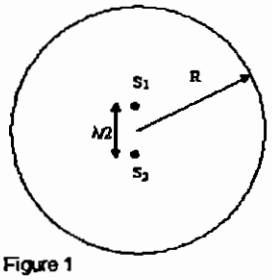


Figure 1

(a) 2.
(b) 5.
(c) 1.
(d) 6.
(e) 8.

18-04
0.33-70%

Question 115

Two loudspeakers, S1 and S2, emit sound waves of identical wavelength and amplitude. They are situated as shown in figure 4. The two speakers are in phase. A listener starts to walk from point D toward S2 along a line perpendicular to the line joining S1 and S2. How many times will he hear a minimum in sound intensity as he moves from D to S2?

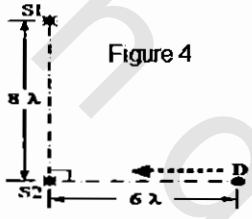


Figure 4

(a) 5
(b) 2
(c) 1
(d) 4
(e) 3

18-04
0.35-66%

Question 116

In figure 4, two small identical speakers are connected (in phase) to the same source. The speakers are 4.10 m apart and at ear level. An observer stands at X, 8.00 m in front of one speaker. In the frequency range 200 Hz-500 Hz, the sound he hears will be most intense if the frequency is: [speed of sound in air is 343 m/s]

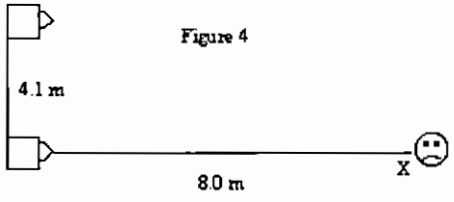


Figure 4

(a) 600 Hz.
(b) 346 Hz.
(c) 500 Hz.
(d) 210 Hz.
(e) 422 Hz.

18-04
0.19-59%

Question 117
In figure 1, two speakers, A and B, are driven by the same oscillator at a frequency of 170 Hz and face each other at a distance of 2.0 m. What is the number of minima along the line joining the two sources? [Consider only the nodes between the two sources.] [Take the speed of sound in air = 340 m/s]

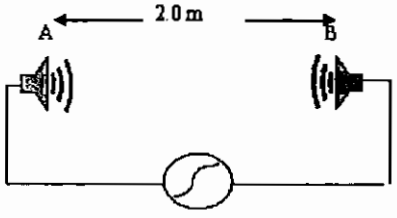


Figure 1

(a) 2
(b) 4
(c) 1
(d) 5
(e) zero

18-04
0.41-71%

Question 118
Two equal waves, of wavelength 4 m and amplitude A, are produced by two sources S1 and S2 as shown in figure 1. S1 is at a distance of 3 m from point P and S2 is at a distance of 5 m from P. When the sources are operated in phase, what is the amplitude of oscillation at P?

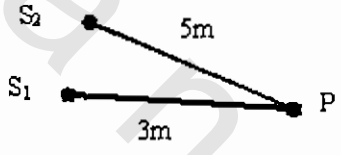


Figure 1

(a) 3*A/2.
(b) zero.
(c) A/2.
(d) 2*A.
(e) A.

18-5 Intensity and Sound Level

18-05

Question 119
Find the ratio of the intensities of two sound waves if the difference in their intensity levels is 7 dB.
(a) 3.
(b) 7.
(c) 5.
(d) 1.
(e) 9.

18-05

Question 120
A tone has a frequency of 1800 Hz and intensity level of 110 dB in air. What is the amplitude of oscillation of air molecules. [Density of air = 1.21 kg/m**3, speed of sound in air = 343 m/s].
(a) 3.54*10**-8 m.
(b) 1.81*10**-10 m.
(c) 2.03*10**-12 m.
(d) 2.57*10**-9 m.
(e) 1.94*10**-6 m.

18-05

Question 121 0.42-39%

The intensity of sound waves at 5 m from a speaker vibrating at 1000 Hz is 0.5 W/m**2. Determine the dislacement amplitude of the particles in the wave at that location (5 m away from the speaker). (The density of air = 1.3 kg/m**3 and the speed of sound in air = 340 m/s).

(a) 2.3*10**(-7) m
(b) 1.2*10**(-5) m
(c) 6.5*10**(-6) m
(d) 7.6*10**(-6) m
(e) 9.5*10**(-7) m

18-05

Question 122

A source of sound (1000 Hz) emits uniformly in all directions. An observer 3.0 m from the source measures a sound level of 40 dB. Calculate the average power output of the source.

(a) 2.87 micro-W
(b) 0.34 micro-W
(c) 10.5 micro-W
(d) 5.23 micro-W
(e) 1.13 micro-W

18-05

Question 123

Consider two sound waves A and B propagating in the same medium. Find the ratio of the intensity of the sound wave A to the intensity of the sound wave B if the sound level of wave A is 20 dB greater than the sound level of wave B.

(a) 20
(b) 15
(c) 5
(d) 10
(e) 100

18-05

Question 124 0.31-44%

A certain sound level is increased by 30 dB. By what factor is the intensity increased?

(a) 900
(b) 2700
(c) 300
(d) 1000
(e) 30

18-05

Question 125

Determine the intensity of a harmonic longitudinal wave with a pressure amplitude of 8.0*10**(-3) N/m**2 propagating inside a tube filled with helium. (For helium: density = 0.179 kg/m**3 and speed of sound waves = 972 m/s.).

(a) 1.8*10**(-7) W/m**2.
(b) 9.2*10**(-8) W/m**2.
(c) 1.5*10**(-6) W/m**2.
(d) 3.7*10**(-7) W/m**2.
(e) 4.6*10**(-8) W/m**2.

18-05

Question 126
A group of students, in a class room, produce a sound level of 53 dB. A single students speaking normally produces a sound level of 40 dB. How many students are in the room? (Assume each student in the group speaks at the same level as did the single person.)
(a) 13.
(b) 20.
(c) 30.
(d) 10.
(e) 5.

18-05

Question 127
If the distance from a source of sound increases by 1 meter, the sound level is decreased by 2 dB. Assume the loudspeaker that is emitting this sound emits sound in all directions. The original distance from the sound source is:
(a) 12.0 m.
(b) 3.86 m.
(c) 7.72 m.
(d) 1.93 m.
(e) 9.93 m.

18-05

Question 128 0.52-41%
A 1.5*10**(-6) W point source emits sound waves isotropically. What is the sound level 2.5 m from the source?
(a) 30 dB.
(b) 55 dB.
(c) 39 dB.
(d) 43 dB.
(e) 16 dB.

18-05

Question 129
A sound source located at the origin emits sound with an average power of 0.04 W. Two detectors are located on the positive x-axis. Detector A is at x = 3.0 m and detector B is at 5.0 m. What is the difference in sound level between A and B?
(a) 2.2 dB
(b) 3.3 dB
(c) 4.4 dB
(d) 5.5 dB
(e) 1.1 dB

18-05

Question 130
You are standing at a distance D from a point source of sound wave. You walk 30.0 m toward the source and observe that the intensity of these waves has doubled. Calculate the distance D.
(a) 15 m.
(b) 102 m.
(c) 493 m.
(d) 232 m.
(e) 300 m.

18-05

Question 131 0.26-20%

Which of the following statements is CORRECT ?

(a) The power transmitted by a sinusoidal wave on a string decreases with increasing frequency of the wave.
(b) The speed of sound is the same in all media.
(c) Sound waves can travel in vacuum.
(d) The power intercepted by a sound detector does not depend on the area of the detector.
(e) Electromagnetic waves can travel in vacuum.

18-05

Question 132 0.44-26%

A point source of a sound wave has a power of 0.50 W. At what distance from the source will the sound level be 90 dB ?

(a) 34 m
(b) 8.9 m
(c) 80 m
(d) 6.3 m
(e) 40 m

18-05

Question 133 0.42-26%

The intensity of sound wave A is 100 times that of sound wave B. What is the difference between their sound levels ?

(a) 20 dB
(b) 10 dB
(c) 2 dB
(d) 100 dB
(e) 3 dB

18-05

Question 134

If an observers distance from a point source is doubled, the sound intensity level will be

(a) increased by 6 dB.
(b) decreased by 4 dB.
(c) decreased by 6 dB.
(d) decreased by 36 dB.
(e) increased by 36 dB.

18-05

Question 135

Two waves are given by the equations:

$y1(x,t) = 5.0 \sin(0.25 x + 75 t)$
$y2(x,t) = 10.0 \sin(0.50 x + 150 t)$

where x and y are in meters and t is in seconds. The intensity ratio of I1/I2 of the two waves is:

(a) 1/16.
(b) 1/2.
(c) 1/3.
(d) 4.
(e) 1/4.

18-05
Question 136 0.48-40%
The ratio of the intensities of two sound waves is 5. Find the difference in their intensity levels.
(a) 1 dB.
(b) 4 dB.
(c) 7 dB.
(d) 6 dB.
(e) 2 dB.

18-05
Question 137 0.43-29%
A person closes his windows to reduce the street noise from 10**(-4) W/m**2 to 10**(-8) W/m**2. What is the change in the intensity level in dB?
(a) - 60.
(b) - 20.
(c) - 40.
(d) 40.
(e) 20.

18-05
Question 138 0.33-72%
A point source emits 30 W of sound. A small microphone has an area of 0.75 cm**2 is placed 10 m from the point source. What power does the microphone receive?
(a) 30 micro-W.
(b) 0.1 micro-W.
(c) 9.3 micro-W.
(d) 1.8 micro-W.
(e) 3.6 micro-W.

18-05
Question 139 0.62-44%
At a distance of 5.0 m from a point source, the sound level is 110 dB. At what distance is the sound level 95 dB?
(a) 7.1 m
(b) 5.0 m
(c) 14 m
(d) 28 m
(e) 42 m

18-05
Question 140 0.50-50%
A point source emits sound isotropically. At a distance of 3.00 m from the source, the sound level is 90.0 dB. What is the average power of the source?
(a) 12.6 mW
(b) 56.5 mW
(c) 28.3 mW
(d) 113 mW
(e) 315 mW

18-05
Question 141 0.59-41%
The intensity of sound wave A is 800 times that of sound wave B at a fixed point from both sources. If the sound level of sound A is 110 dB. What is the sound level of wave B:
(a) 690 dB.
(b) 555 dB.
(c) 7.3 dB.
(d) 50 dB.
(e) 81 dB.

18-05
0.22-85%

Question 142
The intensity level of sound from 10 persons each of intensity level 60 dB is
(a) 12 dB.
(b) 120 dB.
(c) 600 dB.
(d) 70 dB.
(e) 300 dB.

18-05
0.60-33%

Question 143
A person is hearing a sound level of 70 dB at a distance of 3.0 m from a point source. Assuming that the sound is emitted isotropically, find the power of the source.
(a) 8.6*10**(-6) W.
(b) 2.3*10**(-4) W.
(c) 2.9*10**(-5) W.
(d) 1.1*10**(-3) W.
(e) 7.7*10**(-3) W.

18-6 Sources of Musical Sound

18-06

Question 144
An air column 2 m in length is open at both ends. The frequency of a certain harmonic is 410 Hz, and the frequency of the next higher harmonic is 492 Hz. Determine the speed of sound in the air column.
(a) 317 m/s.
(b) 320 m/s.
(c) 328 m/s.
(d) 342 m/s.
(e) 305 m/s.

18-06

Question 145
An air column 2 m in length is open at one end and closed at the other end. The frequency of a certain harmonic is 369 Hz, and the frequency of the next higher harmonic is 451 Hz. Determine the speed of sound in the air column.
(a) 328 m/s.
(b) 342 m/s.
(c) 325 m/s.
(d) 323 m/s.
(e) 320 m/s.

18-06
0.46-32%

Question 146
The second harmonic of a string, fixed at both ends, of length 0.6 m and linear density 1.1*10**-3 kg/m, has the same frequency as the fifth harmonic (n=5) of a pipe closed at one end of length 1.0 m. Find the tension in the string. (Speed of sound = 343 m/s).
(a) 90 N
(b) 38 N
(c) 50 N
(d) 73 N
(e) 18 N

18-06

Question 147

During a time equal to the period of a certain vibrating fork, the emitted sound wave travels a distance:

(a) proportional to the frequency of the wave.
(b) of one wavelength.
(c) of about 331 meters.
(d) directly proportional to the frequency of the fork.
(e) equal to the length of the fork.

18-06

Question 148

If two successive frequencies of a pipe, closed at one end and filled by air, are 500 Hz and 700 Hz, the length of the pipe is: [speed of sound in air = 340 m/s].

(a) 0.85 m.
(b) 3.40 m.
(c) 1.70 m.
(d) 0.43 m.
(e) 0.18 m.

18-06

Question 149

Which of the following statements are CORRECT:

1. Waves carry energy and momentum.
2. Mechanical waves need a medium to propagate.
3. Sound waves are transverse waves.
4. A Wave on a stretched string is a longitudinal wave.
5. For a tube closed at one end, only odd harmonics are present.

(a) 3 and 5.
(b) 2 and 4.
(c) 1, 2 and 3.
(d) 1, 2, and 5.
(e) 1 and 4.

18-06

Question 150 0.44-55%

A tube 1.5 m long is closed at one end. A stretched wire is placed near the open end, see Fig. (1). The wire is 0.33 m long and has a mass of 9.8 g. It is fixed at both ends and vibrates in its fundamental mode. By resonance, it sets the air column in the tube into oscillation at that column's fundamental frequency. Find the tension in the wire. [Speed of sound in air = 343 m/s].

fig.(1)

(a) 98 N.
(b) 64 N.
(c) 77 N.
(d) 42 N.
(e) 30 N.

18-06

Question 151
Pipe A, which is 1.8 m long and open at both ends, oscillates at its third lowest harmonic frequency. Pipe B, which is closed at one end, oscillates at its second lowest harmonic frequency. The frequencies of pipes A and B match. They are both filled with air for which the speed of sound is 344 m/s. How long is pipe B?
(a) 0.9 m
(b) 1.0 m
(c) 0.6 m
(c) 3.6 m
(e) 1.8 m

18-06

Question 152
A 1024 Hz tuning fork is used to obtain a series of resonance levels in a gas column of variable length, with one end closed and the other open. The length of the column changes by 20 cm from one resonance to the next resonance. From this data, the speed of sound in this gas is:
(a) 20 m/s.
(b) 102 m/s.
(c) 51 m/s.
(d) 410 m/s.
(e) 205 m/s.

18-06
0.34-18%

Question 153
Tube A (open at both ends) is twice as long as tube B (open at one end) as shown in figure 3. The ratio of their fundamental frequencies (f1A/f1B) is:

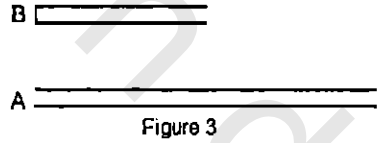


Figure 3

(a) 4
(b) 0.25
(c) 2
(d) 1
(e) 0.5

18-06
0.34-23%

Question 154
A pipe is closed at one end and open at the other end. The length of the pipe is 1.00 m. The air column in the pipe can resonate with a sound source of frequency: [speed of sound in air = 343 m/s]
(a) 257 Hz
(b) 450 Hz
(c) 320 Hz
(d) 200 Hz
(e) 160 Hz

18-06

Question 155
In an air pipe, closed at one end, the three successive resonance frequencies are 425 Hz, 595 Hz, and 765 Hz. If the speed of sound in air is 340 m/s, the length of the pipe is:
(a) 1.5 m.
(b) 1.0 m.
(c) 0.5 m.
(d) 2.0 m.
(e) 2.5 m.

18-06
Question 156 0.45-35%
A tuning fork, of frequency of 512 Hz, is used to generate the fundamental resonance in an open, at both ends, air tube of length 30 cm. The frequency of the fork that used to generate the fundamental resonance in the same air column when one of its ends is closed is:
(a) 128 HZ.
(b) 1024 HZ.
(c) 512 HZ.
(d) 64 Hz.
(e) 256 Hz.

18-06
Question 157 0.37-32%
Organ pipe A, with both ends open, has a fundamental frequency of 340 Hz and length 0.4 m. The third harmonic of organ pipe B, with one end open, has the same frequency as the second harmonic of pipe A. How long is pipe B?
(a) 2.0 m.
(b) 0.1 m.
(c) 1.5 m.
(d) 0.4 m.
(e) 0.3 m.

18-06
Question 158 0 54-65%
A pipe is closed at one end and open at the other, and has a length of 0.500 m. The pipe is filled with air. What is the resonant frequency corresponding to the mode shown in figure 5? Use 344 m/s as the speed of sound in air.

Figure 5

(a) 172 Hz
(b) 429 Hz
(c) 344 Hz
(d) 515 Hz
(e) 860 Hz

18-06
Question 159 0.11-68%
Two pipes have the same length L. Pipe B open at one end and closed at the other, while pipe A open both ends. Which harmonic of pipe B matches the second harmonic of pipe A?
(a) Never match.
(b) The fundamental.
(c) The fourth.
(d) One needs to know the exact length.
(e) The second.

18-06
Question 160 0.33-17%
The frequency of the fundamental mode of a sound wave in a 30.0-cm long tube closed at one end is 256 Hz. When the tube length is shortened to 12.0-cm, what is the new fundamental frequency?
(a) 640 Hz.
(b) 162 Hz.
(c) 256 Hz.
(d) 416 Hz.
(e) 102 Hz.

18-8 The Doppler Effect

18-08

Question 161

A driver of a racing car hears a frequency of 1.0*10**4 Hz while moving with a speed of 0.25 v (v is the speed of sound in air) towards a stationary source. Find the frequency of the source.

(a) 0.8*10**4 Hz.
(b) 0.9*10**4 Hz.
(c) 1.2*10**4 Hz.
(d) 1.0*10**4 Hz.
(e) 0.7*10**4 Hz.

18-08

Question 162 0.45-32%

Which of the following statements is CORRECT?

(a) For the Doppler effect, the observed frequency is always less than the actual frequency of the source.
(b) The power of sound emitted is always inversely proportional to the distance from the source.
(c) Sound waves are transverse.
(d) For spherical sound waves, the displacement amplitude decreases linearly with increasing distance from the source.
(e) The intensity of sound waves is independent of the distance from the source.

18-08

Question 163 0.53-32%

A stationary device generates sound waves of unknown frequency. An observer hears a frequency of 825 Hz as he approaches the device with a speed of 16 m/s. He hears a frequency of 750 Hz as he moves away from the device with the same speed. Find the speed of sound from the above information.

(a) 331 m/s
(b) 345 m/s
(c) 336 m/s
(d) 350 m/s
(e) 340 m/s

18-08

Question 164

An ambulance siren emits a sound of frequency 1.60 kHz. A person running with a speed of 2.50 m/s hears a frequency of 1.70 kHz as the ambulance approaches him from the back. How fast is the ambulance moving? (speed of sound is 340 m/s).

(a) 17.7 m/s
(b) 22.4 m/s
(c) 2.50 m/s
(d) 12.2 m/s
(e) 25.6 m/s

18-08

Question 165 0.38-31%

A train passes a train station at a constant speed of 40 m/s. The train whisle is sounded at a frequency of 320 Hz. An observer at the station hears a frequency f1 while the train is approaching and a frequency f2 while the train is moving away from the station. What change in frequency (f1-f2) does the observer notice? (v(air)= 343 m/s.)

(a) 62 Hz
(b) 320 Hz
(c) 40 Hz
(d) 76 Hz
(e) 25 Hz

18-08

Question 166

A train approaches a mountain at a speed of 75 km/hr. The train's engineer sounds a whistle that emits a frequency of 420 Hz. What will be the frequency of the echo that the engineer hears reflected off the mountain? (The speed of sound in air = 343 m/s).

(a) 420 Hz
(b) 400 Hz
(c) 446 Hz
(d) 430 Hz
(e) 474 Hz

18-08

Question 167

An ambulance siren emits a sound of frequency 1.60 kHz. A person running with a speed of 2.50 m/s hears a frequency of 1.70 kHz as the ambulance approaches him from the back. How fast is the ambulance moving? (speed of sound is 340 m/s).

(a) 25.6 m/s.
(b) 2.50 m/s.
(c) 17.7 m/s.
(d) 22.4 m/s.
(e) 12.2 m/s.

18-08

Question 168).23-14%

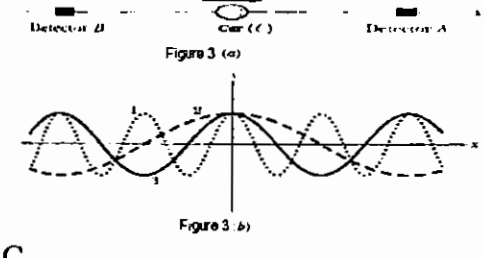
A police car is approaching a stationary observer at 34.0 m/s with its siren emitting a frequency of 450 Hz. What is the frequency heard by the observer? [Speed of sound in air = 343 m/s].

(a) 525 Hz.
(b) 475 Hz.
(c) 485 Hz.
(d) 500 Hz.
(e) 405 Hz.

18-08

Question 169

A car emitting a sound wave at a certain frequency moves along an x-axis (figure 2 a). The car moves directly toward detector A and directly away from detector B. The superimposed three plots of figure 2 b indicate the displacement function s (x) at some time t of the sound wave as measured by detector A, by detector B, and by someone in C. Which plot corresponds to which measurement?



(a) 1 to A , 3 to B , 2 to C
(b) 2 to A , 3 to B , 1 to C
(c) 2 to A , 1 to B , 3 to C
(d) 1 to A , 2 to B , 3 to C
(e) 3 to A , 2 to B , 1 to C

18-08
0.50-26%

Question 170

A police car moves at a speed of 50.00 m/s behind a truck that has a speed of 25.00 m/s as in figure 1. The police siren has a frequency of 1200 Hz. What is the frequency as heard by the truck driver ?

Figure 1

(a) 975.0 Hz
(b) 1408 Hz
(c) 1200 Hz
(d) 1302 Hz
(e) 1125 Hz

18-08
0.25-80%

Question 171

A stationary source emits a sound wave of frequency f. A man travels toward the source at half the speed of sound. The frequency as detected by the man is:

(a) 3f
(b) 3f/2
(c) 2f/3
(d) f
(e) 2f

18-08
0.29-17%

Question 172

Two trucks are moving toward each other. Truck A moves at a speed of 13.8 m/s and truck B moves at a speed of 22.2 m/s. Truck A sounds its horn with a frequency of 500 Hz. What will be the frequency heard by truck B ? [speed of sound in air = 343 m/s].

(a) 451 Hz
(b) 512 Hz
(c) 532 Hz
(d) 521 Hz
(e) 555 Hz

18-08
0.30-17%

Question 173

Consider a sound source S and a sound detector D. Which of the following situations may result in the detector observing the same frequency as that of the source ?

(a) S is stationary and D moves away from S.
(b) S moves toward D and D moves away from S with the same speed.
(c) Both S and D move away from each other with the same speed.
(d) D is stationary and S moves away from D.
(e) S moves toward D and D moves toward S with the same speed.

18-08

Question 174

A bat is moving toward a wall with a velocity of 30 m/s. The bat is emitting a sound with frequency 40.0 kHz. The frequency of the reflected sound as heard by the bat is: [take the speed of sound in air = 340 m/s]

(a) 43.9 kHz.
(b) 33.5 kHz.
(c) 43.5 kHz.
(d) 47.7 kHz.
(e) 40.0 kHz.

18-08
Question 175 0.22-14%
The whistle on a train generates a tone of 440 Hz as the train approaches a station at 30.0 m/s. Find the frequency that a stationary observer standing at the station will hear. (assume the speed of sound = 330 m/s.)
(a) 472 Hz.
(b) 493 Hz.
(c) 440 Hz.
(d) 528 Hz.
(e) 484 Hz.

18-08
Question 176 0.49-33%
A stationary observer hears a frequency of 760 Hz of a whistle of a train moving at a speed of 40 m/s towards him. If the train is moving away with the same speed, then the frequency detected by the observer will be: [Take the speed of sound in air = 340 m/s].
(a) 600 Hz.
(b) 540 Hz.
(c) 700 Hz.
(d) 500 Hz.
(e) 963 Hz.

18-08
Question 177 0.30-15%
Two cars are traveling in opposite directions toward each other with the same speed. One of the cars sounds the horn, which has a frequency of 544 Hz. The other car hears the frequency as 563 Hz. What is the speed of the cars? Use 344 m/s as the speed of sound in air.
(a) 8.19 m/s
(b) 11.6 m/s
(c) 10.0 m/s
(d) 5.90 m/s
(e) 7.24 m/s

18-08
Question 178 0.27-41%
An ambulance travels along a highway at a speed of 33.5 m/s. Its siren emits sound at a frequency of 1000 Hz. A car is traveling in the opposite direction at a speed of 24.5 m/s What frequency is heard by a passenger in the car as the car moves away from the ambulance? (speed of sound in air = 343 m/s)
(a) 1180 Hz
(b) 976 Hz
(c) 842 Hz
(d) 846 Hz
(e) 1187 Hz

18-08
Question 179 0.32-22%
An ambulance emits sound with a frequency of 2600 Hz. After passing a motorist driving (in the same direction of the ambulance) with a speed of 5 m/s, the motorist receives the sound with frequency of 2424 Hz. Calculate the speed of the ambulance. [speed of sound in air is 340 m/s]
(a) 50.0 m/s.
(b) 1.0 m/s.
(c) 15.0 m/s.
(d) 30.0 m/s.
(e) 5.0 m/s.

18-08
0.27-12%

Question 180

An ambulance emits sound of frequency 300 Hz and is moving with a speed of 45.0 m/s away from a moving car. If the car is moving towards the ambulance with a speed of 15.0 m/s, what frequency does a person in the car hear? [The speed of sound in air is 343 m/s].

(a) 250 Hz.
(b) 277 Hz.
(c) 300 Hz.
(d) 333 Hz.
(e) 370 Hz.

Chapter 19 Temperature, Heat, and the First Law of Thermodynamics

19-2 The Zeroth Law of Thermodynamics

19-02

Question 181
The condition of thermal equilibrium between two objects is that the two objects
(a) have the same temperature.
(b) have the same volume.
(c) have the same area.
(d) have the same pressure.
(e) be of the same material.

19-02

Question 182
Body A is at a higher temperature than Body B. When they are placed in contact, heat will flow from A to B
(a) only if the thermal conductivity of A is greater than that of B
(b) only if A has the greater internal energy content
(c) only if the specific heat of A is larger that that of B
(d) only if the volume of A is larger than that of B
(e) until both have the same temperature

19-3 Measuring Temperature

19-03

Question 183
In a constant-volume gas thermometer, the pressure is 0.019 atm at 100 degrees Celsius. Find the temperature when the pressure is 0.027 atm.
(a) 132 degrees Celsius
(b) 340 degrees Celsius
(c) 257 degrees Celsius
(d) 531 degrees Celsius
(e) 321 degrees Celsius

19-03

Question 184
Which one of the following statements is wrong?
(a) Most solid materials contract when cooled
(b) Generally liquids expand more than solids for the same temperature change
(c) If two bodies are in thermal equilibrium than they must have the same temperature
(d) The density of most substances decreases when they are heated
(e) Two bodies can be in thermal contact for a very long time without being in thermal equilibrium

19-4 The Celsius and Fahrenheit Scales

19-04

Question 185
Specify the WRONG statement:
(a) Celsius, Fahrenheit and Kelvin are three temperature scales.
(b) If two bodies are in thermal contact, they can have initially different temperatures.
(c) Two bodies in thermal equilibrium with a third, are in thermal equilibrium with each other.
(d) A thermometer is an instrument that measures temperature.
(e) Two bodies are in thermal equilibrium with each other if their temperatures are different.

19-04

Question 186
Fahrenheit and Kelvin scales agree at a reading of:
(a) 574.
(b) 273.
(c) -40.
(d) Zero.
(e) 301.

19-04

Question 187 0.20-27%
A new temperature scale is called Z. On that scale, the boiling point of water is 150 degree Z and the freezing point is - 10 degree Z. Find the corresponding 70 degree Z in degree C.
(a) 50 degree C.
(b) 70 degree C.
(c) 80 degree C.
(d) 90 degree C.
(e) 150 degree C.

19-04

Question 188 0.40-33%
It is recommended to use a new temperature scale called Z. On Z scale, the boiling point of water is 65.0 degrees Z and the freezing point is -15.0 degrees Z. To what temperature on the Fahrenheit scale would a temperature of -100 degrees Z correspond? [Note: both scales are linear]
(a) -15 Degrees Fahrenheit.
(b) -159 Degrees Fahrenheit.
(c) +15 Degrees Fahrenheit.
(d) -110 Degrees Fahrenheit.
(e) -100 Degrees Fahrenheit.

19-04

Question 189 0.19-18%
The temperature difference of 45 Celsius degrees is equivalent to
(a) 11 Fahrenheit degrees.
(b) 81 Fahrenheit degrees.
(c) 25 Kelvin.
(d) 81 Kelvin.
(e) 25 Fahrenheit degrees.

19-04

Question 190 0.48-45%
A bottle of soft drink is placed in a refrigerator and left there until its temperature drops by 15 K from its original value. What is the corresponding change in temperature on the Fahrenheit scale?
(a) -31 Fahrenheit degrees.
(b) 59 Fahrenheit degrees.
(c) 27 Fahrenheit degrees.
(d) 3.3 Fahrenheit degrees.
(e) 258 Fahrenheit degrees.

19-5 Thermal Expansion

19-05

Question 191
A certain rod has a length of 25.0000 cm when measured at a room temperature of 22 degrees C. When the length of the rod is measured at 26 degree C it was found to be 25.0024 cm. The linear expansion coefficient of the rod material must be
(a) 3.6*10**-5 (C degree)**-1.
(b) 3.9*10**-5 (C degree)**-1.
(c) 8.2*10**-5 (C degree)**-1.
(d) 2.4*10**-5 (C degree)**-1.
(e) 1.7*10**-5 (C degree)**-1.

19-05
0.53-37%

Question 192
Consider a steel plate with area 2.0 m**2 at 20 degrees Celsius. What is magnitude of the change in its area when the temperature is lowered to -20 degrees Celsius? The coefficient of linear expansion of steel (alpha) = 11.7*10**-6 /Celsius degrees.
(a) 1.2*10**-3 m**2
(b) 1.9*10**-6 m**2
(c) 2.3*10**-5 m**2
(d) 1.9*10**-3 m**2
(e) 1.2*10**-6 m**2

19-05
0.46-46%

Question 193
Calculate the change in the length of a 2.0 m aluminum thin wire if its temperature is changed by 54 F-degrees. (the coefficient of thermal expansion for aluminum is equal to 23*10**(-6) /C-degrees).
(a) 1.2 mm
(b) 2.5 mm
(c) 4.5 mm
(d) 1.4 mm
(e) 9.6 mm

19-05

Question 194
The volume expansion coefficient of benzene is 1.24*10**(-4) / C-degree. If a 100 cm**3 steel container is filled with benzene when the temperature is 20.0 degrees-C, how much benzene will spill over when the temperature is raised to 50.0 degrees-C? (neglect the thermal expansion of the steel container.)
(a) 0.436 cm**3
(b) 0.236 cm**3
(c) 0.372 cm**3
(d) 0.865 cm**3
(e) 0.124 cm**3

19-05

Question 195
A gold ring has a diameter of 2.168 cm at a temperature of 15 degree-C. Determine its diameter when the temperature is 215 degree-C.(alpha of gold = 1.42*10**(-5) /C-degree.)
(a) 3.185 cm
(b) 50.16 cm
(c) 3.514 cm
(d) 2.397 cm
(e) 2.174 cm

19-05

Question 196 0.31-37%

Find the change in volume of an aluminum sphere, with initial radius of 0.1 m, when it is heated from 0.0 degrees-C to 100 degrees-C.(Coefficient of linear expansion of aluminum (alpha)is 23*10**(-6)/C-degrees)

(a) 29 cm**3
(b) 34 cm**3
(c) 64 cm**3
(d) 78 cm**3
(e) 50 cm**3

19-05

Question 197

A bridge is made with segments of concrete 50 m long. If the linear expansion coefficient of concrete is 12.0*10**-6 (Celsius degree)**-1, how much spacing is needed to allow for expansion for an extreme change in temperature of 150 degrees Fahrenheit? (Assume that the linear expansion coefficient is not a temperature dependent)

(a) 7.5 cm.
(b) 9.5 cm.
(c) 5.0 cm.
(d) 10 cm.
(e) 2.5 cm.

19-05

Question 198

An iron ball has a diameter of 6.0 cm and is 0.01 mm too large to pass through a hole in a brass ring when both are at a temperature of 30 degrees Celsius. To what temperature should the brass ring be heated so that the ball just passes through the hole? [The coefficient of volume expansion of iron = 3.6*10**(-5) K**-1 and of brass = 5.7*10**(-5) K**-1]

(a) 52 degrees Celsius.
(b) 59 degrees Celsius.
(c) 47 degrees Celsius.
(d) 32 degrees Celsius.
(e) 39 degrees Celsius.

19-05

Question 199 0.22-67%

The coefficient of linear expansion of gold is 14.20*10**(-6)/K. If the density of gold is 19.30 g/cm**3 at 20 degrees Celsius, the density of gold at 90 degrees Celsius will be:

(a) 19.28 g/cm**3.
(b) 19.00 g/cm**3.
(c) 19.24 g/cm**3.
(d) 19.38 g/cm**3.
(e) 19.34 g/cm**3.

19-05

Question 200 0.43-44%

An ordinary glass cup is filled to the top with 0.3 Liters of water at 10 degree C. If the temperature is now increased to 40 degree C, how much water (if any) will spill from the glass? Coefficient of volume expansion of water is 21*10**(-5) K**(-1) and for glass is 27*10**(-6) K**(-1)].

(a) 1.65*10**(-3) Liters.
(b) 0.12*10**(-3) Liters.
(c) 3.44*10**(-3) Liters.
(d) 6.67*10**(-3) Liters.
(e) zero Liters.

19-05

Question 201

A steel washer (ring) has an inner diameter of 4.000 cm and an outer diameter of 4.500 cm at 20 deg C. To what temperature must the washer be heated to just fit over a rod that is 4.010 cm in diameter? (Coefficient of linear expansinon of steel, alpha, = 11*10**-6 per C deg)

(a) -40 deg C
(b) 509 deg C
(c) 247 deg C
(d) 100 deg C
(e) 315 deg C

19-05

Question 202 0.52-66%

A metal rod has a length of 10.000 cm at 20 degrees-C, and a length of 10.025 cm at the boiling point of water. What is the temperature if the length of the rod is 10.015 cm ?

(a) 74 degrees-C
(b) 56 degress-C
(c) 70 degrees-C
(d) 50 degrees-C
(e) 68 degrees-C

19-05

Question 203 0.54-69%

A cylindrical glass beaker of radius 1.5 cm contains 20 mL of water at 5.0 degrees-C. What is the change in the water level when the temperature rises to 90 degrees-C. Ignore the change in the volume of the glass beaker. [The coefficient of volume expansion of water is 2.1*10**-4 (degrees-C)**-1 and 1 mL = 1 cm**3].

(a) 360 mm
(b) 0.11 mm
(c) 0.51 mm
(d) 16 mm
(e) 0.35 mm

19-05

Question 204

When the temperature of a sphere is raised by 75 degrees Celsius the spheres volume increases by 6.9*10**(-5) m**3.If the original volume is 1.8*10**(-2) m**3, find the coefficient of linear expansion of the sphere.

(a) 9.0*10**(-5) (Celsius degrees)**(-1).
(b) 1.7*10**(-5) (Celsius degrees)**(-1).
(c) 2.8*10**(-5) (Celsius degrees)**(-1).
(d) 5.1*10**(-5) (Celsius degrees)**(-1).
(e) 3.4*10**(-5) (Celsius degrees)**(-1).

19-05

Question 205 0.32-28%

A certain metal rod has a length of 10.00 m at 100.00 degree-C and a length of 10.04 m at 773 K. Find its length at zero degree-C.

(a) 9.99 m.
(b) 10.01 m.
(c) 9.00 m.
(d) 9.83 m.
(e) 10.03 m.

19-05
0.45-60%

Question 206
A steel gas tank of volume 0.0700 m**3 is filled completely with gasoline. The temperature of the tank increased from 20 to 50 degrees-C. How much gasoline has spilled out of the tank? For steel, the coefficient of linear expansion is 12.0*10**(-6)/degree-C. For gasoline, the coefficient of volume expansion is 9.50*10**(-4)/degree-C.
(a) 2.52*10**(-5) m**3
(b) 2.00*10**(-3) m**3
(c) 7.56*10**(-5) m**3
(d) 1.92*10**(-3) m**3
(e) 1.69*10**(-3) m**3

19-05
0.52-28%

Question 207
An iron ball has a diameter of 6.00 cm and is 0.01 cm larger than the diameter of a brass ring. Both are at a temperature of 20 degrees Celsius. To what temperature should the brass ring be heated so that the ball just passes through the hole? [The coefficient of linear expansion of brass = 1.9*10**(-5) K**-1]
(a) 32 degrees Celsius.
(b) 165 degrees Celsius.
(c) 108 degrees Celsius.
(d) 430 degrees Celsius.
(e) 590 degrees Celsius.

19-6 Temperature and Heat

19-06
0.22-13%

Question 208
Which of the following statements is True:
(a) When the temperature of an object increases by one degree-C it means that it has increased by less than one degree-F.
(b) 272 Kelvin is warmer than zero degree-C.
(c) If two objects are in thermal equilibrium they must have the same temperature
(d) if an object (A) is warmer than a second object (B) in the Fahrenheit scale then object (B) must be warmer than object (A) in the Celsius scale.
(e) The coefficient of linear expansion is the same for all materials.

19-7 The Absorption of Heat by Solids and Liquids

19-07

Question 209
A 20-g ice cube at 0 degree C is heated until 15 g has become water at 100 degree C and 5.0 g has been converted to steam. How much heat is added to do this? (L(melting)=80 cal/g, L(vaporization) = 540 cal/g, c(water) = 1 cal/g/C).
(a) 3.3*10**3 cal.
(b) 6.3*10**3 cal.
(c) 5.2*10**3 cal.
(d) 9.0*10**3 cal.
(e) 2.3*10**3 cal.

19-07
0.57-47%

Question 210
Copper pellets, each of mass 1.0 g, are heated to 100 degrees Celsius. How many pellets must be added to 500 g of water initially at 20 degrees Celsius to make the final equilibrium temperature 30 degrees Celsius? (neglect the heat capacity of the container) Specific heat of copper = 0.0924 cal/g degree Celsius and specific heat of water = 1.0 cal/g degree Celsius.
(a) 773
(b) 120
(c) 250
(d) 680
(e) 924

19-07
0.52-42%

Question 211
How much heat is needed to convert 80 g of ice initially at -10 degrees-C to steam at 100 degrees-C? (C(water) = 1.0 cal/g*degree C, L(f) = 80 cal/g, C(ice) = 0.5 cal/g*degree C, L(v) = 540 cal/g).
(a) 22 kcal
(b) 65 kcal
(c) 58 kcal
(d) 16 kcal
(e) 75 kcal

19-07

Question 212
How much ice at -20 degrees-C must be mixed with 0.25 kg of water, initially at 20 degrees-C, in order for the final temperature to be 0 degrees-C with the ice all melted? (neglect the heat capacity of the container.) C(water) = 4186 J/Kg C-degrees, C(ice) = 2000 J/kg C-degrees Lf(ice) = 33.4*10**4 J/kg.
(a) 75 g
(b) 12 g
(c) 63 g
(d) 85 g
(e) 56 g

19-07
0.09-34%

Question 213
What mass of steam (T = 100 degrees-C) is required to melt 200 g of ice and produce water at 25 degrees-C? (c(water)= 1 cal/g*degrees-C, Lf=79.7 cal/g, Lv=539 cal/g.)
(a) 34.1 g
(b) 22.5 g
(c) 121 g
(d) 254 g
(e) 125 g

19-07

Question 214
A lead bullet,travelling at 200 m/s, strikes a tree and comes to rest. If half the heat produced is retained by the bullet. The temperature of the bullet will be change by: (Specific heat of lead = 0.125*10**3 J/(kg*Celsius degree) (Assume that all the kinetic energy is converted to heat energy.)
(a) 160 Celsius degree.
(b) -80 Celsius degree.
(c) 20 Celsius degree.
(d) 80 Celsius degree.
(e) 40 Celsius degree.

19-07

Question 215

A 5-kg block of lead having a temperature of 80 degrees Celsius is added to 0.5 kg of water having a temperature of 20 degrees Celsius. What is the final equilibrium temperature of the system? (Specific heat of lead = 0.03 cal/g*C and for water = 1 cal/g*C.)

(a) 26 degrees Celsius.
(b) 20 degrees Celsius.
(c) 54 degrees Celsius.
(d) 79 degrees Celsius.
(e) 34 degrees Celsius.

19-07

Question 216

A 100 g of water at 100 degrees Celsius is added to a 20-g aluminum cup containing 50 g of water at 20 degrees Celsius. What is the equilibrium temperature of the system? The specific heat of aluminum is 900 J/(kg*K) and the specific heat of water is 4186 J/(kg*K).

(a) 63 degrees Celsius.
(b) 14 degrees Celsius.
(c) 72 degrees Celsius.
(d) 55 degrees Celsius.
(e) 95 degrees Celsius.

19-07

Question 217 0.30-50%

A thermometer, of mass 0.06 kg and specific heat 836 J/(kg K), reads 15 degrees Celsius. It is then completely immersed in 0.15 kg of water of specific heat 4180 J/(kg K). The final temperature reading of the thermometer in the water is 45 degrees Celsius. Assuming no heat losses from the system to the surrounding, the initial temperature of the water was:

(a) 35.1 degrees Celsius.
(b) 47.4 degrees Celsius.
(c) 42.6 degrees Celsius.
(d) 15.4 degrees Celsius.
(e) 50.4 degrees Celsius.

19-07

Question 218

How much heat is required to melt ice of mass 500 g at -10 deg C to water at 0 deg C? (specific heat of ice, c, = 2220 J/(kg.K); heat of fusion of ice, Lf, = 333*10*3 J/kg)

(a) 8.45*10**5 J
(b) 9.05*10**5 J
(c) 1.78*10**5 J
(d) 2.05*10**5 J
(e) 3.01*10**5 J

19-07

Question 219

The temperature of a 0.5 kg sample in a glass cup increases by 20 C-degrees when 2.8*10**4 J of heat are added. The cup absorbs 9.0*10**3 J of the heat added. What is the specific heat of the sample?

(a) 275 J/(kg*K).
(b) 1475 J/(kg*K).
(c) 226 J/(kg*K).
(d) 1900 J/(kg*K).
(e) 475 J/(kg*K).

19-07
Question 220 0.52-50%
A 200-g copper piece was initially at a temperature of 325 degrees-C. It is then dropped nto 2000 g of water at a temperature of 5 degrees-C. Assuming that the copper-water system is an isolated system, and the water does not vaporize, find the heat gained by water. The specific heat of copper is 0.0923 cal/g.K The specific heat of water is 1.00 cal/g.K.
(a) 16000 calories
(b) 4600 calories
(c) 5850 calories
(d) 9500 calories
(e) 12200 calories

19-07
Question 221 (.66-59%
What is the minimum amount of heat required to completely melt 120 g of aluminum in tially at 20 degrees-C. For aluminum, c = 900 J/kg.K, Lf = 3.97*10**5 J/kg, and its melting point is 660 degrees-C.
(a) 3.75*10**5 J
(b) 4.76*10**5 J
(c) 2.15*10**5 J
(d) 6.91*10**5 J
(e) 1.17*10**5 J

19-07
Question 222).36-66%
In an insulated container, 250 grams of ice at 0 degrees-C are added to 500 grams of water at 18 degrees-C. How much ice remains when the system reaches equilibrium ? [The latert heat of fusion of water = 333 kJ/kg and the specific heat of water = 4190 J/kg.K].
(a) 250 g
(b) 113 g
(c) 137 g
(d) 300 g
(e) 79.0 g

19-07
Question 223 0.54-71%
One kilogram of water is initially at a temperature of 30.0 degrees-C. How much ice, ir itially at a temperature of zero degrees-C, must be added to the water to make a mixture whose equilibrium temperature is 10.0 degrees-C ? [The specific heat of water is 4190 J/kg.K and the heat of fusion is 333 kJ/kg.]
(a) 252 g
(b) 224 g
(c) 452 g
(d) 200 g
(e) 476 g

19-07
Question 224
Calculate the amount of energy, in Joules, required to completely melt 130 g of lead initially at temperature of 15.0 degrees Celsius. Melting point of lead = 328 degrees Celsius, latent heat of fusion of lead = 2.32*10**4 J/kg and the specific heat of lead = 128 J/kg/K.
(a) 1.31*10**4.
(b) 5.21*10**3.
(c) 8.22*10**3.
(d) 8.25*10**7.
(e) 3.02*10**3.

19-07

Question 225

Liqu d nitrogen boils at temperature of -196 degrees Celsius when the pressure is one atmosphere. A silver coin of mass 1.5*10**(-2) Kg and temperature 25 degrees Celsius is dropped into the liquid. What mass of nitrogen boils off as the coin cools to 196 degrees Celsius. [Take the specific heat of silver = 235 J/Kg/K and latent heat of vaporization for liquid nitrogen is 2.0*10**5 J/Kg.

(a) 8.10 g.
(b) 89.0 g.
(c) 20.1 g.
(d) 112 g.
(e) 3.90 g.

19-07

Question 226 0.43-29%

Two cubes, one silver and one iron, have the same mass and temperature. A quantity Q of heat is removed from each cube. Which one of the following causes the final temperature of the cubes to be different?

(a) latent heat of vaporization
(b) density
(c) coefficient of volume expansion
(d) volume
(e) specific heat

19-07

Quest on 227 0.55-27%

An ice cube has a mass of 30.0 g and is at zero degrees-C. Calculate the amount of heat needed to convert the cube into water at 20 degrees-C. Latent heat of fusion of water = 333 kJ/kg Latent heat of vaporization of water = 2256 kJ/kg Specific heat of water = 4.19 kJ/kg.K

(a) 70.2 kJ
(b) 12.5 kJ
(c) 7.5 kJ
(d) 10.0 kJ
(e) 2.5 kJ

19-07

Question 228 0.30-56%

A 2.00-kg sample of steam at 100 degrees-C loses 2.26 kJ of heat. What is the final temperature of the sample? Latent heat of vaporization of water = 2256 kJ/kg Latent heat of fusion of water = 333 kJ/kg specific heat of water = 4.19 kJ/kg.K

(a) 96.2 degrees-C
(b) 100 degrees-C
(c) 94.6 degrees-C
(d) 86.4 degrees-C
(e) 99.5 degrees-C

19-07

Question 229 0.43-68%

Fifty grams of ice at zero degrees Celsius is placed in a thermos bottle containing 100 grams of water at 6.0 degrees Celsius. How many grams of ice will melt?

(a) 2.0 grams.
(b) 17 grams.
(c) 7.5 grams.
(d) 3.5 grams.
(e) 50 grams.

19-07
Question 230 0 68-43%
A person wants to cool 0.3-kg of water that is initially at 30 degrees Celsius by adding ice initially at -25 degrees Celsius. How much ice should he add so that the final temperature will be 0 degrees Celsius with all the ice melted? [For ice, use the specific heat = 2.1*10**3 J/(kg*K), and heat of fusion = 3.3*10**5 J/kg].
(a) 11 g.
(b) 1.2 g.
(c) 22 g.
(d) 43 g.
(e) 99 g.

19-07
Question 231 C.44-40%
A metallic bullet, of mass m and specific heat c, hits a steel plate with a speed v. During the impact, 50% of the bullet's initial kinctic energy is converted to thermal energy in the bullet. What is the rise in temperature of the bullet?
(a) v**2/(2*c).
(b) v**2/(4*c).
(c) v/(4*c).
(d) v/(2*c).
(e) v**2/(c).

19-8 A Closer Look at Heat and Work

19-08
Question 232
The work done in the expansion of a gas from an initial to a final state
(a) always equals P*(Vf - Vi).
(b) depends only on the end points.
(c) is the slope of a PV curve.
(d) is the area under the curve of a PV diagram.
(e) is negative.

19-08
Question 233 (.39-58%
One mole of an ideal gas is taken through the cyclic process ABCA as shown in Fig. (2). What is the net heat absorbed, or lost, by the gas?

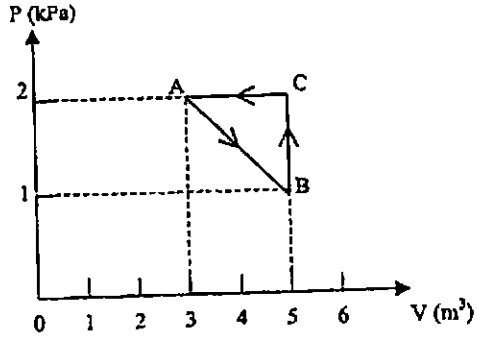


fig.(2)

(a) -2.0*10*3 J.
(b) -1.0*10*3 J.
(c) 1.0*10*3 J.
(d) 2.0*10*3 J.
(e) 5.0*10*3 J.

19-08
0.36-65%

Question 234
A system of an ideal gas undergoes the cyclic process shown in figure 5. Calculate the work done by the system along the path XY.

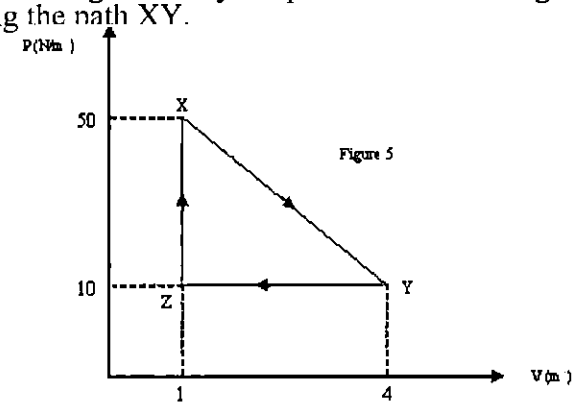


Figure 5

(a) -60 J.
(b) zero
(c) 60 J.
(d) 90 J.
(e) -90 J.

19-08
0.40-26%

Question 235
In a PV diagram, a system of an ideal gas goes through the process shown in Figure 3. How much heat is absorbed after the system goes through this cycle 10 times. [Take P= 1.0 Pa and V= 1.0 m**3].

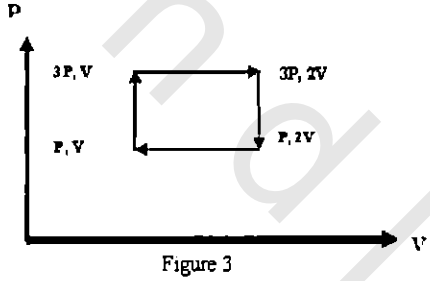


Figure 3

(a) 15 Joules.
(b) 20 Joules.
(c) 5 Joules.
(d) 25 Joules.
(e) 2 Joules.

19-9 The first Law of Thermodynamics

19-09
0.32-26%

Question 236
Which of the following statements are CORRECT:
1. The first law of thermodynamics represents the conservation of energy.
2. Room temperature is about 20 degrees on the Kelvin scale.
3. A caloric is approximately 4.2 J.
4. Heat has the same units as work.
5. Heat is a temperature difference.

(a) 1, 3, and 4.
(b) 3 and 5.
(c) 1 and 5.
(d) 1, 2 and 3.
(e) 2 and 4.

19-09
Question 237 (.30-72%
In this question use: W = work, Q = heat, S = Entropy. Which of the following are state functions, i.e. path independent? 1. W 2. Q-W 3. S 4. Q 5. Q-2*W
(a) Only 2.
(b) 3 and 4.
(c) 1, 2 and 4.
(d) 2 and 5.
(e) 2, 3.

19-10 Some Special Cases of the First Law of Thermodynamics

19-10
Question 238 .46-27%
Nitrogen gas (m = 1.00 kg) is confined in a cylinder with a movable piston at a pressure of 1 atm. A quantity of heat of 25 kcal is added to the gas in an isobaric process, and its internal energy increases by 8 kcal. What is the change in the volume of the gas?
(a) 1.4 m**3
(b) 1.2 m**3
(c) 0.4 m**3
(d) 0.2 m**3
(e) 0.7 m**3

19-10
Question 239
Which one of the following statements is true?
(a) In an adiabatic process, the heat flow is positive
(b) In an isovolumetric process, the work done is positive
(c) The internal energy of a system is not a state function
(d) In a cyclic process, the change in internal energy is zero
(e) In an isobaric process, the change in internal energy is always zero

19-10
Question 240
One gram of water is heated from 0 degree-C to 80 degree-C at a constant pressure of 1 atm. Determine the change in internal energy of the water. Neglect the change in volume of the water. (Cwater = 4186 J/kg*K.)
(a) 50 cal
(b) 80 cal
(c) 100 cal
(d) 250 cal
(e) 180 cal

19-10
Question 241
Assume an ideal gas expands adiabatically. Which one of the following statements is TRUE.
(a) the temperature of the gas increases.
(b) the pressure of the gas increases.
(c) the internal energy of the gas remains constant.
(d) the temperature of the gas decreases.
(e) the pressure of the gas remains constant.

19-10
Question 242 0.13-43%
In a certain process a gas ends in its original thermodynamic state. Of the following statements, which is possible as the net result of the process?
(a) The gas absorbs 50 J of heat and 50 J of work is done on it.
(b) The gas does no work but rejects 50 J of heat.
(c) The gas does no work but absorbs 50 J of heat.
(d) The gas absorbs 50 J of heat and does 50 J of work.
(e) The gas rejects 50 J of heat and does 50 J of work.

19-10

Question 243 0.36-34%

One gram of water is cooled from 100 degrees-C to zero degrees-C and becomes all ice. Determine the change in internal energy during this process. (Neglect any change in the volume of the water.) (For water: C= 4186 J/kg degrees-C and Lf= 3.33*10**5 J/kg.)

(a) 752 J
(b) -752 J
(c) -100 J
(d) 419 J
(e) -419 J

19-10

Question 244

Two kilograms of water, at 100 degree Celsius, occupy a volume of 2.0*10**-3 m**3. When this amount of water is boiled, at atmospheric pressure, it becomes 3.3 m**3 of steam. Find the change in the inernal energy.

(a) 3.4*10**4 J.
(b) 4.2*10**6 J.
(c) - 4.2*10**6 J.
(d) 2.1*10**6 J.
(e) - 2.1*10**6 J.

19-10

Question 245

3.00-kg of water at 100 degrees Celsius is converted to steam at 100 degrees Celsius by boiling at one atmospheric pressure. For one kg of water, the volume changes from an initial value of 1.0*10**(-3) m**3 as a liquid to 1.671 m**3 as steam. The work done by the water in this process is:

(a) 5.07*10**5 J.
(b) 1.23*10**5 J.
(c) 1.69*10**5 J.
(d) 2.45*10**5 J.
(e) 3.01*10**5 J.

19-10

Question 246 0.37-31%

Which of the following statements is CORRECT for a gas undergoing an adiabatic process:

(a) The pressure of the gas remains constant.
(b) The temperature of the gas remains constant.
(c) The volume of the gas remains constant.
(d) There is no heat exchange between the gas and its environment.
(e) The internal energy of the gas is always zero.

19-10

Question 247 0.45-51%

A system undergoes an adiabatic process in which its internal energy increases by 20 J. Which of the following correctly describes changes in the system ?

(a) Heat: 40 J added, Work: 20 J by the system
(b) Heat: 20 J added, Work: none
(c) Heat: none, Work: 20 J by the system
(d) Heat: 20 J removed, Work: none
(e) Heat: none, Work: 20 J on the system

19-10
0.57-47%

Question 248

A gas is compressed at a constant pressure of 0.800 atm from a volume of 9.00 L to a volume of 2.00 L. In the process, 400 J of heat flows out of the gas. What is the change in the internal energy of the gas ?

(a) - 966 J
(b) - 566 J
(c) 566 J
(d) - 166 J
(e) 166 J

19-10
0.39-40%

Question 249

An ideal gas is taken through the cycle ABCA, shown in figure 4. The work done along the paths AB, BC and CA, are respectively:

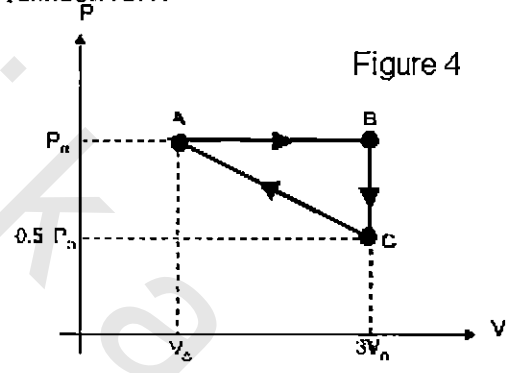


Figure 4

(a) 2*Po*Vo, zero , +1.5*Po*Vo
(b) 2*Po*Vo, zero , -2*Po*Vo
(c) 2*Po*Vo, zero , -1.5*Po*Vo
(d) 2*Po*Vo, Po*Vo, -1.5*Po*Vo
(e) 2*Po*Vo, zero , -Po*Vo

19-10

Question 250

Gas within a closed chamber undergocs the cycle shown in Fig. 2. Calculate the net heat added to the system in a complete cycle.

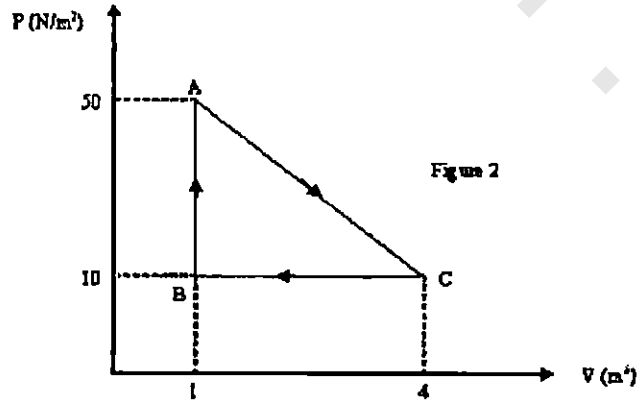


Figure 2

(a) 10 J.
(b) 73 J.
(c) 14 J.
(d) 31 J.
(e) 60 J.

19-10
0.43-25%

Question 251

In a P-V diagram, a system of an ideal gas goes through the process shown in figure 2. How much heat is absorbed after the system goes 100 times through the cycle?

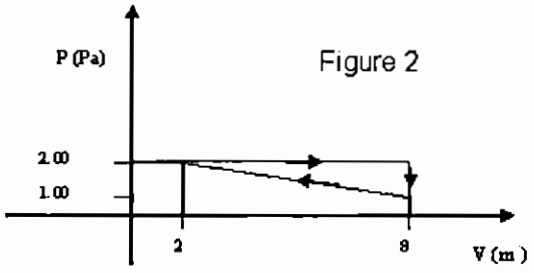


Figure 2

(a) 500 J.
(b) 300 J.
(c) zero.
(d) 730 J.
(e) 355 J.

19-10
0.14-77%

Question 252

A cylinder with a frictionless piston contains 0.2 kg of water at 100 degrees Celsius. What is the change in internal energy of water when it is converted to steam at 100 degrees Celsius at constant pressure of 1 atm. [Density of steam = 0.6 kg/m**3, water = 10**3 kg/m**3]

(a) 418 kJ.
(b) 452 kJ.
(c) 226 kJ.
(d) 113 kJ.
(e) 333 kJ.

19-10
0.22-85%

Question 253

Air is injected from a cylinder of compressed air into a spherical balloon of initial volume V, causing its diameter to double. What is the work done at constant pressure P?

(a) 7.0*P*V.
(b) 4.0*P*V.
(c) 3.0*P*V.
(d) 8.0*P*V.
(e) 1.0*P*V.

19-11 Heat Transfer Mechanisms

19-11

Question 254

Calculate the rate of heat flow through a glass window, 2.0 m * 1.5 m in area and 3.3 mm in thickness, if the temperature of the outer and inner surfaces are 5.0 degrees C and -5.0 degrees C, respectively. [Thermal conductivity of glass = 0.84 J/(s.m. K]

(a) 3006 W.
(b) 0303 W.
(c) 1071 W.
(d) 7636 W.
(e) 8930 W.

19-11

Question 255
A glass window has an area of 0.50 m**2 and a thickness of 0.60 cm. If the rate of heat flow between the faces is 500 kJ/hour, find the temperature difference between the window's faces. K(glass) = 0.80 W/m C-degrees.
(a) 3.5 C-degrees
(b) 2.1 C-degrees
(c) 1.2 C-degrees
(d) 45 C-degrees
(e) 12 C-degrees

19-11
0.50-43%

Question 256
An insulated aluminum rod has a length of 2.0 m and a diameter of 2.0 cm. The ends of the rod are maintained at a temperature difference of 200 degrees-C. Find the heat transferred along the rod in one minute.(Thermal conductivity of Al= 238 W/m*K.)
(a) 1062 J
(b) 732 J
(c) 160 J
(d) 1796 J
(e) 449 J

19-11

Question 257
What is the outside temperature if 4.0*10**6 cal of heat is lost through 4.0 m**2 window of 0.3 cm thick glass in one hour from a house kept at 20 degrees Celsius? (For glass k = 0.2 cal/s*m*C.)
(a) 13 degrees Celsius.
(b) 8 degrees Celsius.
(c) 16 degrees Celsius.
(d) 32 degrees Celsius.
(e) 24 degrees Celsius.

19-11

Question 258
A solid aluminum rod, of length 1.60 m and cross-sectional area of 3.14*10**(-4) m**2, has one end in boiling water and the other end in ice. How much ice melts in one minute? [The thermal conductivity of aluminum is 205 Watts/(m*K) and the heat of fusion of water is 3.35*10**5 J/kg.] (neglect any heat loss, by the system, to the surrounding)
(a) 3.2*10**(-3) kg.
(b) 7.2*10**(-4) kg.
(c) 5.8*10**(-4) kg.
(d) 6.3*10**(-4) kg.
(e) 7.9*10**(-2) kg.

19-11
.28-68%

Question 259
By what factor does the rate of radiant emission of heat, from a heating element, increases when the temperature of a heating element increases from 27 degrees Celsius to 327 degrees Celsius?
(a) 2.
(b) 8.
(c) 64.
(d) 4.
(e) 16.

19-11

Question 260 0.18-76%

A closed cubical box (60 cm on edge and 5 cm on thickness) contains ice at zero degrees Celsius. When the outside temperature is 20 degrees Celsius, it is found that 250 grams of ice melt each hour. What is the value of the thermal conductivity of the walls of the box?

(a) 0.01 Watts/(m*K).
(b) 3.21 Watts/(m*K).
(c) 0.03 Watts/(m*K).
(d) 0.07 Watts/(m*K).
(e) 1.02 Watts/(m*K).

19-11

Question 261

A cylindrical copper rod of length 1.5 m and cross section 6.5 cm2 is insulated to prevent heat loss through its surface. The ends are maintained at a temperature difference of 100 C deg by having one end in a water-ice mixture and the other in boiling water and steam. How much ice is melted per hour at the cold end? (thermal conductivity of copper, kappa, = 401 W/(m_K); heat of fusion of ice, Lf, = 333*10*3 J/kg)

(a) 281 g
(b) 980 g
(c) 469 g
(d) 188 g
(e) 330 g

19-11

Question 262 0.59-33%

A room has a window made of two layers of glass separated by an air layer as in figure 4. Each of the 3 layers has a thickness of 0.50 mm and an area of 1.0 square meter. The temperature outside the room is - 20 degrees-C, while the temperature inside the room is + 20 degrees-C. What is the rate of heat transfer by conduction through the window ? Assume steady state.

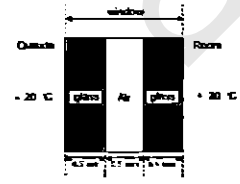


Figure 4

(a) 1.2 kW
(b) 2.0 kW
(c) 1.4 kW
(d) 0.90 kW
(e) 1.0 kW

19-11

Question 263 0.26-33%

On a cold winter day, metallic objects generally feel cooler to the touch than wooden objects. This is because:

(a) heat tends to flow from metal to wood.
(b) the mass density of wood is less than the mass density of metals.
(c) metals conduct heat better than wood.
(d) the equilibrium temperature of metal is lower than that of wood.
(e) a given mass of wood contains more heat than the same mass of metal.

19-11

Question 264 0 51-54%

An aluminum rod and an iron rod, each of length 20.0 cm and radius 1.00 cm, are placed end to end, as in figure 3. The sides of the rods are insulated. The outer end of iron is at 80.0 degrees-C and that of aluminum is at 20.0 degrees-C. In steady state, what is the temperature at the junction of the two rods ? [The thermal conductivity of aluminum = 235 W/m.K ar d the thermal conductivity of iron = 14.0 W/m.K].

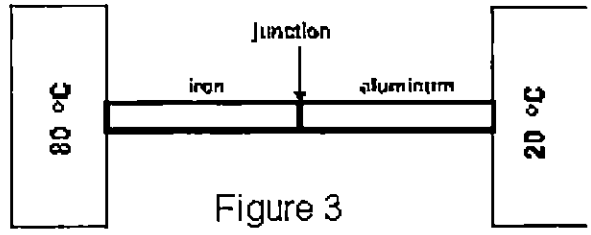


Figure 3

(a) 15.7 degrees-C
(b) 50.0 degrees-C
(c) 85.6 degrees-C
(d) 76.6 degrees-C
(e) 23.4 degrees-C

19-11

Question 265

A rod is made of two different metals, one piece has length L and thermal conductivity K and the other piece has a length 2 L and thermal conductivity 3 K. The rod is situated between two heat reservoirs as shown in Fig. 1. What is the steady state temperature at the interface of the two pieces?

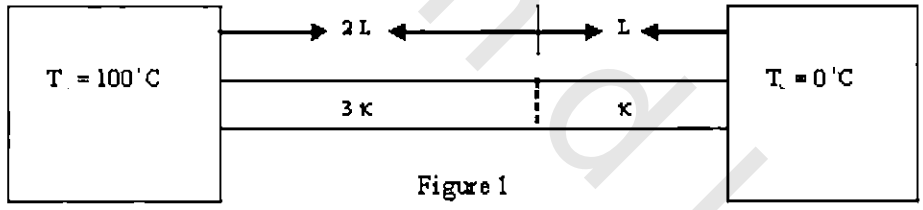


Figure 1

(a) 0 Kelvin.
(b) 60 Kelvin.
(c) 35 Kelvin.
(d) 68 Kelvin.
(e) 333 Kelvin.

19-11

Question 266 0.34-18%

Consider a copper slab of thickness L and area of 5.0 m**2. If the conduction rate through the copper slab is 1.2*10**6 J/s and the temperature on the left of the slab is 102 degree-C while on the right of the slab it is -12.0 degree-C, what must be the thickness of the slab? [Take the coefficient of thermal conductivity of copper as 400 W/(m K)].

(a) 32 cm.
(b) 29 cm.
(c) 19 cm.
(d) 15 cm.
(e) 25 cm.

19-11

Question 267 0.32-18%

Heat is conducted by two cylindrical rods with identical cross sectional area and length (see figure 6). The temperature difference between the ends of each rod is the same. One of the rods is made of carbon, while the other is made of silver. What is the ratio of the conduction rate of the silver rod to the conduction rate of the carbon rod? Thermal conductivity of silver = 435 W/m.K. Thermal conductivity of carbon = 1100 W/m.K.

Figure 6

(a) 2.5
(b) 0.40
(c) 0.48
(d) 1.5
(e) 0.67

19-11

Question 268 0.26-68%

The wall of a home is 0.2 m thick, 2.0 m high, 10 m wide and has a thermal conductivity of 0.4 watt/m/K. If the inside temperature is 15 degrees Celsius and the outside temperature is -5.0 degrees Celsius, how much energy is lost in 12 hours?

(a) 4.5*10**6 J.
(b) 4.5*10**5 J.
(c) 4.5*10**6 J.
(d) 2.7*10**7 J.
(e) 3.4*10**7 J.

19-11

Question 269 0.49-31%

A box has a total surface area of 1.2 m**2 and a wall thickness of 4.0 cm and is made of an insulating material. A 10-W electric heater inside the box maintains the inside temperature steady at 45 degrees Celsius. If the outside temperature is 30 degrees Celsius, find the thermal conductivity of the insulating material.

(a) 3.1*10**(-4) W/(m*K).
(b) 4.5*10**(-2) W/(m*K).
(c) 3.6*10**(-3) W/(m*K).
(d) 2.2*10**(-2) W/(m*K).
(e) 1.7*10**(-3) W/(m*K).

Chapter 20 The Kinetic Theory of Gases

20-2 Avogadro's Number

20-02
0.39-49%

Question 270
A sample of an ideal gas exerts a pressure of 60 Pa when its temperature is 400 K and the number of molecules present per unit volume is n. A second sample of the same gas exerts a pressure of 30 Pa when its temperature is 300 K. How many molecules are present per unit volume of the second sample?
(a) n/3
(b) 5*n/3
(c) 2*n/3
(d) n/2
(e) 3*n/2

20-3 Ideal Gases

20-03

Question 271
Which one of the graphs in Figure (1) best represents the variation of pressure with the volume of an ideal gas at constant temperature (isothermal process)?

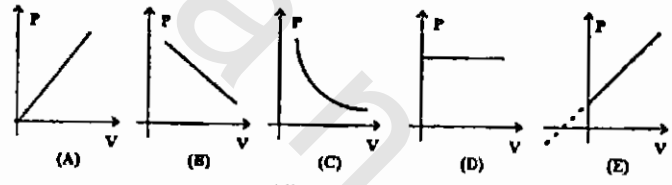


Figure # 1

(a) A.
(b) B.
(c) E.
(d) C.
(e) D.

20-03

Question 272
One mole of an ideal monatomic gas at temperature of 290 K expands isothermally and reversibly from a pressure of 10 atmospheres to a final pressure of 2 atmospheres. What is the work done by the gas on the surroundings?
(a) 89 J.
(b) 6720 J.
(c) 2740 J.
(d) 951 J.
(e) 3880 J.

20-03
0.41-31%

Question 273
Calculate the number of molecules of an ideal gas occupying a volume of 1 cm**3 at 27 degree Celsius and at a pressure of 1*10**-10 Pa.
(a) 2.4*10**10 molecules
(b) 8.4*10**6 molecules
(c) 1.2*10**4 molecules
(d) 2.4*10**4 molecules
(e) 6.2*10**5 molecules

20-03
0.54-30%

Question 274
An ideal gas is taken through the cyclic process shown in Figure 1. How much heat is added or removed from the gas?

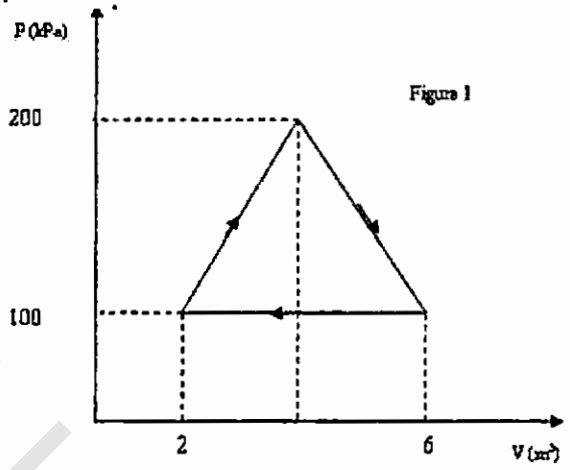


Figure 1

(a) - 400 kJ
(b) - 800 kJ
(c) 600 kJ
(d) 100 kJ
(e) 200 kJ

20-03
0.38-47%

Question 275
How much work is required to compress five moles of an ideal gas at 20 degrees-C and 1.0 atmosphere to half of its initial volume during an isothermal process?
(a) Zero
(b) -2.1 kJ
(c) +2.1 kJ
(d) −8.4 kJ
(e) -8.4 kJ

20-03

Question 276
A steel vessel contains 5 moles of an ideal gas at 0 degree-C and a pressure of 1 atm. It is heated at constant volume until its temperature is 100 degrees-C. How many moles of gas should be removed from the container to keep the pressure of the gas constant at 1 atm?
(a) 1.34 moles
(b) 3 moles
(c) 3.66 moles
(d) 4.32 moles
(e) 2.45 moles

20-03

Question 277
Consider an isothermal compression of 0.1 moles of an ideal gas at a temperature of 0 degree-C. The initial pressure of the gas is 1 atm and the final volume is 1/5 the initial volume. Find the thermal energy transfer for this process.
(a) 565 J gained by the gas
(b) [illegible] J
(c) 565 J lost by the gas
(d) 1124 J lost by the gas
(e) 1124 J gained by the gas

20-03

Question 278 0.16-36%

Compute the number of molecules in 1.00 cm**3 of an ideal gas at a pressure of 100 Pa and temperature of 20 degrees-C.

(a) 4.34*10**16 molecules
(b) 2.47*10**16 molecules
(c) 43.0*10**21 molecules
(d) 6.02*10**23 molecules
(e) 3.62*10**17 molecules

20-03

Question 279 0.03-34%

Air that occupies 0.14 m**3 at 2.04*10**5 Pa is expanded isothermally to atmospheric pressure. The work done by the gas, in calories, is

(a) 3500 cal
(b) 9200 cal
(c) 2100 cal
(d) 1400 cal
(e) 4800 cal

20-03

Question 280 0.46-40%

A helium-filled balloon has a volume of 2 m**3. As it rises in the earth's atmosphere, its volume expands. What will its new volume be if its original temperature and pressure are 20 degrees-C and 1 atm., and its final temperature and pressure are -40 degrees-C and 0.1 atm.?

(a) 25 m**3
(b) 8 m**3
(c) 4 m**3
(d) 10 m**3
(e) 16 m**3

20-03

Question 281

One mole of an ideal gas has a temperature of 25 degree Celsius. If the volume is held constant and the pressure is doubled, the final temperature will be:

(a) 50 degree Celsius.
(b) 174 degree Celsius.
(c) 596 degree Celsius.
(d) 25 degree Celsius.
(e) 323 degree Celsius.

20-03

Question 282

Five moles of an ideal gas expands isothermally at 100 degree Celsius to five times its initial volume. Find the heat flow into the system.

(a) 6.7*10**4 J
(b) 7.0*10**4 J
(c) 3.1*10**4 J
(d) 1.1*10**4 J
(e) 2.5*10**4 J

20-03

Question 283

An ideal gas occupies a volume V1 at a temperature of 100 degrees Celsius. If the pressure of the gas is held constant, by what factor does the volume change when the Celsius temperature is tripled?

(a) 1.54.
(b) 0.33.
(c) 3.55.
(d) 3.00.
(e) 6.00.

20-03

Question 284

One mole of an ideal gas undergoes the thermodynamic process shown in figure (2). If the process BC is an isothermal, how much work is done by the gas in this isothermal process?

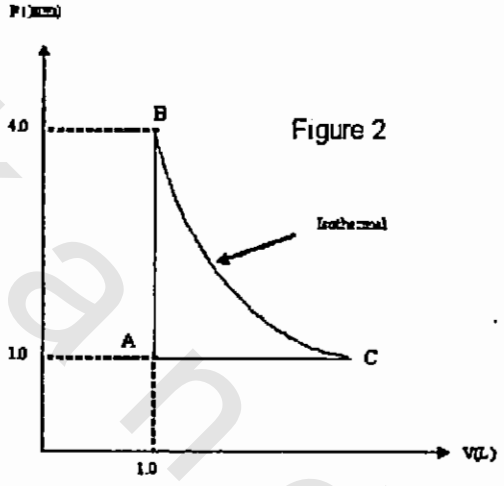


Figure 2

(a) 1.69*10**3 J.
(b) 0.92*10**3 J.
(c) 5.29*10**4 J.
(d) 1.30*10**3 J.
(e) 0.56*10**3 J.

20-03

Question 285

0.58-45%

Two moles of an ideal gas, initially at 20 degrees Celsius, are taken through an isothermal process in which the volume of the gas doubles. The work done by the gas during this process is:

(a) 230 J.
(b) -3375 J.
(c) 3375 J.
(d) Zero.
(e) -230 J.

20-03

Question 286

Two moles of a monatomic ideal gas at a temperature of 300 K and pressure of 0.20 atm is compressed isothermally (constant temperature) to a pressure of 0.80 atm. Find the work done by the gas.

(a) -18000 J
(b) 0 J
(c) +18000 J
(d) -6900 J
(e) +6900 J

20-03

Question 287
An ideal gas undergoes an isothermal process starting with a pressure of 2*10**5 Pa and a volume of 6 cm3. Which of the following might be the pressure and volume of the final state?
(a) 4*10**5 Pa and 4 cm**3
(b) 6*10**5 Pa and 2 cm**3
(c) 3*10**5 Pa and 6 cm**3
(d) 1*10**5 Pa and 10 cm**3
(e) 8*10**5 Pa and 2 cm**3

20-03
Question 288 0.63-42%
An ideal gas containing 5.00 moles expands isothermally at 127 degrees-C to four times its initial volume. Find the heat flow during this expansion.
(a) 23.0 kJ out of the system
(b) 7.32 kJ into the system
(c) 7.32 kJ out of the system
(d) 23.0 kJ into the system
(e) 34.5 kJ out of the system

20-03
Question 289 0.57-66%
An ideal gas occupies a volume of 12 L at 20 degrees-C and a pressure of 1.0 atm. Its temperature is now raised to 100 degrees-C and its pressure increases to 3.0 atm. The new volume is:
(a) 25 L.
(b) 5.1 L.
(c) 0.20 L.
(d) 21 L.
(e) 14 L.

20-03
Question 290 0.52-56%
Which of the following statements is CORRECT ?
(a) Heat is a temperature difference.
(b) The internal energy of an ideal gas depends on the temperature and pressure only.
(c) A standing wave must be transverse.
(d) The rms speed of gas molecules decreases in an isotherml process.
(e) For a given medium, the frequency of a wave is inversely proportional to wavelength.

20-03
Question 291 0.54-42%
An ideal gas, initially occupies a volume of 0.380 m**3 at a pressure of 2.04*10**5 Pa, expands isothermally to a pressure of 1.01*10**5 Pa. Calculate the work done by the gas.
(a) 27.0 kJ
(b) 32.1 kJ
(c) 539 kJ
(d) 321 kJ
(e) 54.5 kJ

20-03
0.2-66%

Question 292
The volume of an oxygen container is 50.0 L. As oxygen leaks from the container, the pressure inside the container drops from 21.0 to 9.00 atm, and its temperature drops from 303 to 283 K. The number of moles that leaks from the container is:
(a) 22.8 mol.
(b) 11.1 mol.
(c) 19.4 mol.
(d) 65.3 mol.
(e) 42.2 mol.

20-03
0.48-32%

Question 293
One mole of oxygen molecule (M = 32 g/mol) occupies a cubic vessel of side length 10 cm at a temperature of 27 degree-C. Calculate the pressure of the gas on the walls.
(a) 3.33*10**4 Pa.
(b) 7.52*10**6 Pa.
(c) 2.49*10**6 Pa.
(d) 1.14*10**4 Pa.
(e) 5.01*10**6 Pa.

20-03
0.33-66%

Question 294
The equation of state of a certain gas is given as P*V**2 = K, where P is the pressure, V is the volume and K is a constant. Find the work done by the gas if its volume increases from Vi = 2.0 m**3 to a final volume Vf = 4.0 m**3.
(a) 2*K**2.
(b) K/2.
(c) K**2.
(d) K/4.
(e) 4*K.

20-03
0.44-40%

Question 295
Which one of the following statements is correct?
(a) In an isothermal process, the work done on the gas is always positive.
(b) In an adiabatic process, the work is always zero.
(c) All real gases approach the ideal gas state at low temperatures.
(d) Two different ideal gas molecules of different mass will have the same average translational kinetic energy if they are at the same temperature.
(e) In an isobaric process, the energy is always constant.

20-03
0.73-44%

Question 296
A sample of a monatomic ideal gas is originally at 20 degrees-C. What is the final temperature of the gas if both the pressure and the volume are doubled?
(a) 353 K
(b) 293 K
(c) 278 K
(d) 1172 K
(e) 1200 K

20-03

Question 297 0.17-68%

One mole of a monatomic ideal gas at 410 K is compressed to half its original volume by an isobaric process. How much work is done in the process?

(a) 3.3 kJ done on the gas
(b) 1.7 kJ done on the gas
(c) 3.3 kJ done by the gas
(d) 8.3 kJ done on the gas
(e) 1.7 kJ done by the gas

20-03

Question 298 0.31-59%

A mass of an ideal gas of volume V at pressure P undergoes the cyclic process shown in figure 5. At which points is the gas coolest and hottest?

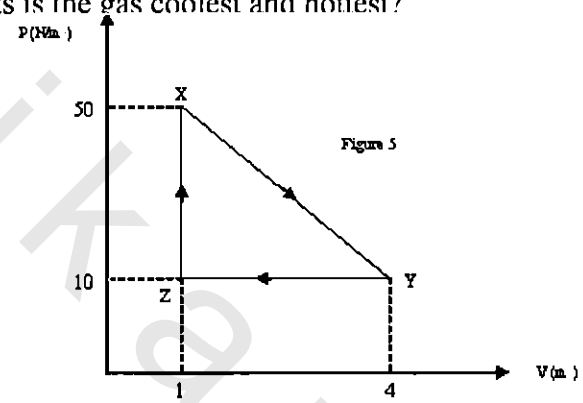


Figure 5

(a) Coolest at Z and hottest at X.
(b) Coolest at Z and hottest at Y.
(c) Coolest at X and hottest at Y.
(d) Coolest at Y and hottest at X.
(e) Coolest at Y and hottest at Z.

20-03

Question 299 0.56-47%

A system of monatomic ideal gas expands to twice its original volume, doing 300 J of work in the process. The heat added to the gas will be largest if the process is

(a) cyclic.
(b) done at constant volume.
(c) done adiabatically.
(d) done isothermaly.
(e) done at constant pressure.

20-03

Question 300 0.53-41%

Five moles of an ideal gas are kept at a constant temperature of 53.0 degrees Celsius while the pressure of the gas is increased from 1.00 atm to 3.00 atm. Find the work done in the process.

(a) zero.
(b) 2.42 kJ of work done on the gas.
(c) 14.9 kJ of work done on the gas.
(d) 14.9 kJ of work done by the gas.
(e) 2.42 kJ of work done by the gas.

20-4 Pressure, Temperature, and RMS Speed

20-04
0.55-36%

Question 301
Oxygen gas at 20 degrees Celsius is confined in a cube. What is the translational average kinetic energy per molecule?
(a) 9.1*10**-24 J
(b) 6.1*10**-21 J
(c) 4.1*10**-22 J
(d) 5.2*10**-21 J
(e) 2.1*10**-22 J

20-04
0.43-36%

Question 302
The mass of an oxygen molecule is 16 times that of a hydrogen molecule. At room temperature, the ratio of the rms speed of an oxygen molecule to that of a hydrogen molecule is:
(a) 1/4
(b) 16
(c) 1/16
(d) 1
(e) 4

20-04

Question 303
The mass of a hydrogen molecule is 3.3*10**(-27) kg. If 1.0*10**23 hydrogen molecules per second strike 2.0 cm**2 of wall at an angle of 55 degrees with the normal when moving with a speed of 1.0*10**3 m/s, what pressure do they exert on the wall?
(a) 0.9*10**3 Pa.
(b) 2.8*10**3 Pa.
(c) 8.6*10**3 Pa.
(d) 5.7*10**3 Pa.
(e) 1.9*10**3 Pa.

20-04

Question 304
Find the rms speed of nitrogen molecules (M=28 g/mole) at 0 degree-C.
(a) 1.7*10**2 m/s.
(b) 4.9*10**2 m/s.
(c) 3.9*10**2 m/s.
(d) 3.2*10**2 m/s.
(e) zero.

20-04
0.20-71%

Question 305
The average translation kinetic energy of an ideal gas of helium atoms at room temperature (300 Kelvin) is 5.54*10**(-21) J. The average translation kinetic energy of the ideal argon gas at room temperature is: [Atomic mass of helium = 2.0 Kg/Kmole, Atomic mass of argon = 8.0 Kg/Kmole]
(a) 1.40*10**(-21) J.
(b) 5.54*10**(-21) J.
(c) 2.21*10**(-20) J.
(d) 2.77*10**(-21) J.
(e) 1.11*10**(-20) J.

20-04
Question 306 ■.45-26%
A closed tank, at room temperature, has a mixture of hydrogen molecules and helium atoms. The ratio of rms speed of hydrogen molecules to that of helium is: [Note: The molar mass of the hydrogen molecule is 2.0 g/mol and the molar mass of the helium atom is 4.0 g/mol]
(a) 0.1
(b) 2.1
(c) 1.4
(d) 3.2
(e) 0.3

20-04
Question 307 0.51-22%
An ideal gas has an RMS speed of 254 m/s. If each gas particle has a mass of 6.62*10**(-26)kg, what is the temperature of the gas?
(a) 310 K
(b) 611 K
(c) 103 K
(d) 425 K
(e) 79 K

20-04
Question 308 0.28-15%
Two moles of a monatomic ideal gas with an RMS speed of 254 m/s are contained in a tank that has a volume of 0.15 m**3. If the molar mass of the gas is 0.39 kg/mole, what is the pressure of the gas?
(a) 2.3*10**5 Pa.
(b) 1.1*10**5 Pa.
(c) 2.2*10**4 Pa.
(d) 3.2*10**6 Pa.
(e) 6.8*10**4 Pa.

20-5 Translational Kinetic Energy

20-05
Question 309 0.50-40%
Which one of the following statements is WRONG?
(a) For the same increase in temperature, solids generally expand less than liquids.
(b) The number of molecules (N), the universal gas constant (R) and the absolute temperature (T) are all thermodynamic variables.
(c) As the temperature increases from zero degrees-C to 4 degrees-C, the water's density increases.
(d) Water, ice and water vapor can coexist in equilibrium.
(e) Two objects in thermal equilibrium must be at the same temperature.

20-05
Question 310
Two moles of nitrogen are in a 6.0 Liter container at a pressure of 5.0*10**5 Pa. Find the average transnational kinetic energy of a single molecule.
(a) 1.9*10**(-21) J.
(b) 9.3*10**(-22) J.
(c) 7.5*10**(-22) J.
(d) 1.2*10**(-21) J.
(e) 3.7*10**(-21) J.

20-05

Question 311 0.32-62%

Two identical containers, one has 2.0 moles of type 1 molecules, of mass m1, at 20 degrees Celsius. The other has 2.0 moles of type 2 molecules, of mass m2 = 2*m1, at 20 degrees Celsius. The ratio between the average translational kinetic energy of type 2 to that of type 1 is:

(a) 16.
(b) 2.
(c) 8.
(d) 4.
(e) 1.

20-05

Question 312

Two moles of nitrogen are in a 3-liter container at a pressure of 5.0*10**6 Pa. Find the average translational kinetic energy of a molecule.

(a) 1.9*10**(-20) J.
(b) 7.1*10**(-22) J.
(c) 1.0*10**(-24) J.
(d) 3.6*10**(-20) J.
(e) 1.1*10**(-23) J.

20-05

Question 313 0.28-64%

The average translational kinetic energy of the molecules of an ideal gas in a closed, rigid container is increased by a factor of 4. What happens to the pressure of the gas?

(a) it increases by a factor of 8.
(b) it increases by a factor of 4.
(c) it decreases by a factor of 8.
(d) it remains the same.
(e) it decreases by a factor of 4.

20-5 Mean Free Path

20-06

Question 314

Which one of the following statements is FALSE:

(a) For an ideal gas the specific heat at constant volume is less than the specific heat at constant pressure.
(b) At 400K, the specific heat at constant volume for Oxygen is equal to the specific heat at constant pressure for Helium.
(c) In an adiabatic compression there is no heat transfer between the system and its surroundings.
(d) The average energy per molecule of an ideal monatomic gas increases linearly with temperature.
(e) When an isolated ideal gas expands its temperature increases.

20-7 The Distribution of Molecular Speeds

20-07

Question 315).50-35%

5.00 kg of water is to be cooled from 100 to 0 degrees-C. The quantity of ice needed is: [For water: the specific heat = 4.19 kJ/(kg.K) and the latent heat of fusion = 333 kJ/kg.]

(a) 0.89 kg.
(b) 12.5 kg.
(c) 9.22 kg.
(d) 4.25 kg.
(e) 6.29 kg.

20-07

Question 316).32-81%

300 grams of water at 25 degree-C are added to 100 grams of ice at zero degree-C. The final temperature of the mixture is:

(a) 15 degree-C.
(b) 10 degree-C.
(c) 20 degree-C.
(d) zero degree-C.
(e) 5 degree-C.

20-8 The Molar Specific Heats of an Ideal Gas

20-08

Question 317

In a constant volume process, 209 J of heat is added to 1 mole of an ideal monatomic gas initially at 300 K. Find the final temperature of the gas.

(a) 329 K.
(b) 350 K.
(c) 317 K.
(d) 391 K.
(e) 373 K.

20-08

Question 318).36-30%

Two moles of helium (monoatomic) gas are heated from 100 degrees Celsius to 250 degrees Celsius. How much heat is transferred to the gas if the process is isobaric?

(a) 3.11 kJ
(b) 1.51 kJ
(c) 8.52 kJ
(d) 2.63 kJ
(e) 6.23 kJ

20-08

Question 319).46-40%

One mole of an ideal diatomic gas (Cp = 7R/2) is cooled at constant pressure from 420 K to 300 K. Calculate the change in internal energy of the gas in calories.

(a) +596 cal
(b) +285 cal
(c) +188 cal
(d) -285 cal
(e) -596 cal

20-08

Question 320

Consider 100 g of helium (He) gas at 77 K. How much heat energy must be supplied to the gas to increase its temperature to 24 degrees-C, if the process is isovolumetric? (M(He) = 4 g/mole and He is a monatomic gas.)

(a) 69 kJ
(b) 43 kJ
(c) 71 kJ
(d) 24 kJ
(e) 12 kJ

20-08

Question 321

Two moles of helium (monatomic) gas are heated from 100 degree Celsius to 250 degree Celsius. How much heat is transferred to the gas if the process is isobaric?

(a) 6.23*10**3 J
(b) 1.51*10**2 J
(c) 8.52*10**5 J
(d) 3.11*10**3 J
(e) 2.63*10**3 J

20-08

Question 322

Two moles of helium (monatomic) gas are heated from 100 degrees Celsius to 250 degrees Celsius. How much heat is transferred to the gas if the process is isobaric?

(a) 3.11 kJ.
(b) 8.52 kJ.
(c) 2.63 kJ.
(d) 1.51 kJ.
(e) 6.23 kJ.

20-08

Question 323 0.31-75%

A diatomic ideal gas, at a pressure of 1.0 atm, expands isobarically from a volume of 2.0 Liters to a volume of 5.0 Liters. Calculate the change in internal energy of the gas during the process.

(a) -9.0*10**3 J.
(b) 7.6*10**2 J.
(c) 1.1*10**3 J.
(d) 1.7*10**3 J.
(e) -3.1*10**2 J.

20-08

Question 324 0.27-66%

Five moles of an ideal monatomic gas are allowed to expand adiabatically to twice its volume. In the process the gas does 831 Joules of work. The temperature of the gas will:

(a) increases by 13.3 degree C.
(b) decreases by 20.2 degree C.
(c) increases by 20.2 degree C.
(d) decreases by 13.3 degree C.
(e) stays constant.

20-08

Question 325

Two moles of a monatomic ideal gas is compressed at a constant pressure of 1.5 atm from a volume of 70 liters to 35 liters. Calculate the change in internal energy of the gas.

(a) - 1.9*10**4 J
(b) - 3.5*10**4 J
(c) - 0.80*10**4 J
(d) 2.4*10**4 J
(e) - 0.87*10**4 J

20-08

Question 326

Figure (4) shows 5 paths traversed by a gas on a P-V diagram. For which of the 5 paths is the change in internal energy the greatest?

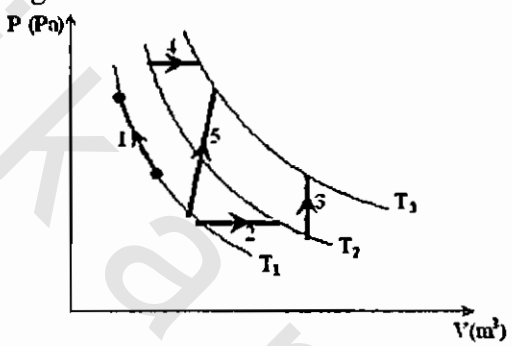


Fig. (4)

(a) 1 and 2
(b) 5
(c) 4
(d) 5 and 4
(e) 3

20-08

Question 327

One mole of an ideal monatomic gas is taken through the cyclic process shown in the figure. Calculate the net heat (lost or gained) by the gas during one complete cycle.

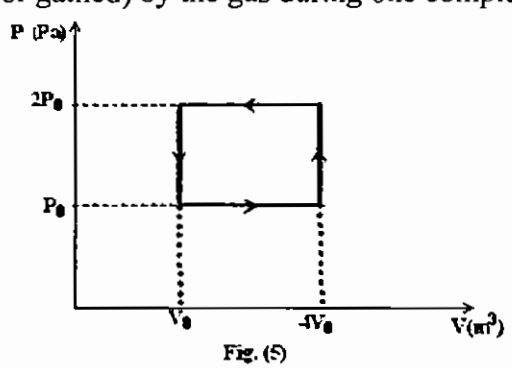


Fig. (5)

(a) 4*Po*Vo Joule (lost)
(b) 2*Po*Vo Joule (gained)
(c) 4*Po*Vo Joule (gained)
(d) 3*Po*Vo Joule (lost)
(e) 2*Po*Vo Joule (lost)

20-08
Question 328 0.49-28%
One mole of an ideal monatomic gas is taken from A to C along the diagonal path in figure 5. What is the change in the internal energy of the gas in this process ?

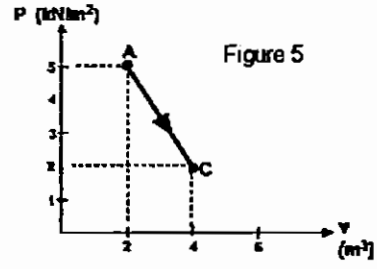


Figure 5

(a) + 5.0 kJ
(b) + 3.0 kJ
(c) - 3.0 kJ
(d) ZERO
(e) - 5.0 kJ

20-08
Question 329 0.32-34%
An ideal monatomic gas is compressed at a constant volume of 0.500 L from a pressure of 0.500 atm to a final pressure of 0.250 atm. What is the change in the internal energy of the gas ?
(a) + 0.188 J
(b) - 18.9 J
(c) zero
(d) + 18.9 J
(e) - 0.188 J

20-08
Question 330 0.24-41%
An ideal gas initially occupies a volume of 2.50 L at a pressure of 1.80 atm. It expands isothermally to three times its initial volume. How much work is done by the gas ?
(a) + 499 J
(b) - 4.94 J
(c) + 4.94 J
(d) - 499 J
(e) zero

20-08
Question 331 0.59-58%
One mole of an ideal monatomic gas is taken through the cycle of figure 5. Calculate the work done in a complete cycle.

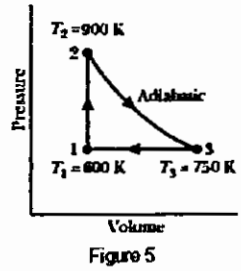


Figure 5

(a) + 895 J
(b) - 525 J
(c) + 325 J
(d) + 623 J
(e) zero

20-08

Question 332 0.40-42%

For a given temperature increase, a certain amount of an ideal gas requires 80 J of heat when heated at constant volume and 150 J of heat when heated at constant pressure. How much work is done by the gas in the second situation ?

(a) +80 J
(b) zero
(c) -70 J
(d) +70 J
(e) -80 J

20-08

Question 333 0.36-71%

Five moles of an ideal gas expands isothermally at a temperature of 127 degrees-C to one-fourth the initial pressure. How much heat is transferred in this process ?

(a) 23.0 kJ into the gas
(b) 23.0 kJ out of the gas
(c) 7.32 kJ into the gas
(d) zero
(e) 7.32 kJ out of the gas

20-08

Question 334

Two moles of helium (monatomic) gas are heated from 100 degrees Celsius to 250 degrees Celsius. How much heat is transferred to the gas if the process is done at constant pressure?

(a) 3.11 kJ.
(b) 2.63 kJ.
(c) 6.23 kJ.
(d) 1.51 kJ.
(e) 8.52 kJ.

20-08

Question 335

Five moles, of an ideal monatomic gas, expand at constant pressure of 1.0*10**2 Pascal from a volume of 1.0 m**3 to to a volume of 3.0 m**3. What is the change in the internal energy of the system?

(a) 100 J.
(b) 500 J.
(c) 600 J.
(d) 300 J.
(e) 1000 J.

20-08

Question 336 0.37-61%

Two moles of helium gas (monatomic) are initially at a temperature of 27.0 degrees-C and occupy a volume of 20.0 liters. The helium gas is expanded at constant pressure until its volume is doubled. Find the change in the internal energy.

(a) 5.4*10**6 J.
(b) 9.2*10**3 J.
(c) 7.5*10**3 J.
(d) 1.9*10**5 J.
(e) 1.3*10**3 J.

20-08
Quest on 337 0.53-55%
A diatomic ideal gas undergoes a constant pressure process in which its internal energy increases by 540 J. Find the heat added to the gas and the work done by the gas.
(a) Q = 0, W = 540 J.
(b) Q = 900 J, W = 360 J.
(c) Q = 230 J, W = 313 J.
(d) Q = 540 J, W = 0.
(e) Q = 756 J, W = 216 J.

20-08
Quest on 338 0.67-35%
A system containing an ideal gas at a constant pressure of 1.22*10**5 Pa gains 2140 J of heat. During the process, the internal energy of the system increases by 2320 J. What is the change in the volume of the gas?
(a) + 3.66*10**(-3) m**3
(b) - 3.66*10**(-3) m**3
(c) - 1.48*10**(-3) m**3
(d) zero
(e) + 1.48*10**(-3) m**3

20-08
Quest on 339 0.38-59%
The internal energy of a fixed mass of an ideal gas depends on
(a) pressure, but not volume or temperature.
(b) temperature, but not volume or pressure.
(c) volume, but not temperature or pressure.
(d) temperature and pressure, but not volume.
(e) temperature and volume, but not pressure.

20-08
Question 340 0.45-39%
The temperature of two moles of helium gas is raised from zero degrees Celsius to 100 degrees Celsius at constant pressure. Calculate the work done by the gas.
(a) 10.0 kJ.
(b) 6.00 kJ.
(c) 1.20 kJ.
(d) 1.00 kJ.
(e) 1.66 kJ.

20-08
Question 341 0.42-67%
A cylinder of volume 2.5 L contains 0.25 moles of helium [M = 4.0 grams/mole] at 2.0 atmospheric pressure. What is the internal energy of the gas?
(a) 1.20 kJ.
(b) 0.61 kJ.
(c) 0.76 kJ.
(d) 0.01 kJ.
(e) 1.60 kJ.

20-08

Question 342 0.35-78%

An ideal monatomic gas originally in state A is taken reversibly to state B along the straight line path shown in figure 4. What is the change in the internal energy of the gas for this process?

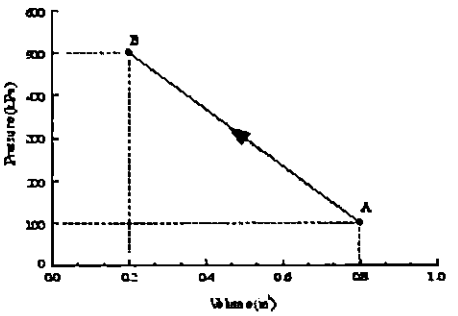


Figure 4

(a) -180 kJ.
(b) 180 kJ.
(c) 30 kJ.
(d) -30 kJ.
(e) -15 kJ.

20-11 The Adiabatic Expansion of an Ideal Gas

20-11

Question 343

Helium gas at 27 degrees C is compressed adiabatically to 1/2 of its initial volume. Find its temperature after compression. [gamma (helium) = 1.67]

(a) 152 degree C.
(b) 075 degree C.
(c) 520 degree C.
(d) 204 degree C.
(e) 307 degree C.

20-11

Question 344 0.69-35%

An ideal gas (gamma = 1.40) expands slowly and adiabatically. If the final temperature is one third the initial temperature, by what factor does the volume change?

(a) 12.5
(b) 10.0
(c) 18.0
(d) 15.6
(e) 14.0

20-11

Question 345

A cylinder contains 4 moles of a diatomic ideal gas (Cv = 5R/2) at a temperature of 27 degrees-C and a pressure of 1.5 atm. temperature reaches 127 degrees-C. How much work is done by the gas in this process?

(a) 986 calories
(b) 562 calories
(c) 418 calories
(d) 794 calories
(e) 150 calories

20-11

Question 346

The air in an automobile engine at 20 degree-C is compressed from an initial pressure of 1 atm and a volume of 200 cm**3 to a final volume of 20 cm**3. Find the final temperature if the air behaves like an ideal gas (gamma = 1.4) and the compression is adiabatic.

(a) 50 degree-C
(b) 10 degree-C
(c) 463 degree-C
(d) 20 degree-C
(e) 526 degree-C

20-11

Question 347 0.34-36%

An ideal gas (gamma = 1.3) is initially at V = V1, T = 273 K and P = 1.0 atm. The gas is compressed adiabatically to half its original volume. It is then cooled at a constant pressure to its original temperature. The ratio of the final volume to the initial volume is:

(a) 0.4
(b) 2.0
(c) 0.5
(d) 0.2
(e) 1.0

20-11

Question 348 0.41-31%

Which one of the following statements is TRUE? The temperature of an ideal gas decreases in an

(a) adiabatic compression.
(b) increase in pressure at constant volume.
(c) isobaric expansion.
(d) isothermal compression.
(e) adiabatic expansion.

20-11

Question 349

An ideal monatomic gas goes through the process in T-V diagram of figure (1). At Point A, the temperature is 400 K, and the volume is 2 liters. If the volume at point B is 10 liters, what is the temperature at point C be?

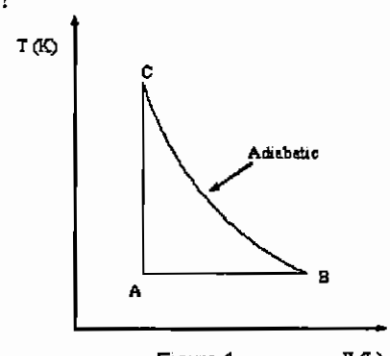


Figure 1

(a) 4.00*10**3 K
(b) 2.00*10**3 K
(c) 5.89*10**3 K
(d) 1.17*10**3 K
(e) 2.00*10**2 K

20-11

Question 350
An ideal diatomic gas, initially at a pressure Pi = 1.0 atm and volume Vi, is allowed to expand isothermally until its volume doubles. The gas is then compressed adiabatically until it reaches its original volume. The final pressure of the gas will be:
(a) 1.7 atm.
(b) 0.4 atm.
(c) 2.0 atm.
(d) 1.3 atm.
(e) 0.5 atm.

20-11

Question 351
In an adiabatic process, the temperature of one mole of an ideal monatomic gas is decreased from 500 K to 400 K. What is the work done during the process in calories?
(a) 300
(b) 400
(c) 500
(d) 200
(e) 100

20-11
).44-46%

Question 352
Initially, an ideal monatomic gas containing 10.0 moles occupies a volume of 30.0 L at a pressure of 5.00 atm. It is then compressed adiabatically to a final volume of 12.0 L. What is the final temperature of the gas ?
(a) 157 K
(b) 457 K
(c) 844 K
(d) 420 K
(e) 336 K

20-11
).48-55%

Question 353
One mole of an ideal monatomic gas is initially at 300 K and 1.0 atm. The gas is compressed adiabatically to 2.0 atm. What is the final volume of the gas ?
(a) 0.079 m**3
(b) 0.025 m**3
(c) 0.016 m**3
(d) 0.056 m**3
(e) 0.041 m**3

20-11

Question 354
An ideal diatomic gas, initially at a pressure Pi = 1.0 atm and volume Vi, is allowed to expand isothermally until its volume doubles. The gas is then compressed adiabatically until it reaches its original volume. The final pressure of the gas will be:
(a) 0.5 atm.
(b) 1.7 atm.
(c) 2.0 atm.
(d) 1.3 atm.
(e) 0.4 atm.

20-11

Question 355 0.44-54%

The air in an automobile engine at 20 degree-C is compressed adiabatically from an initial pressure of 1 atm and a volume of 200 cm**3 to a final volume of 20 cm**3. Find the final temperature if the air behaves like an ideal gas. [Take gamma = 1.4]

(a) 50 degree-C
(b) 20 degree-C
(c) 10 degree-C
(d) 463 degree-C
(e) 526 degree-C

20-11

Question 356 0.66-42%

Two moles of a gas, originally at atmospheric pressure, occupy a volume of 0.0500 m**3. The gas is compressed adiabatically to half its original volume. What is the final temperature of the gas? Use Cp/Cv = 1.4.

(a) 128 K
(b) 573 K
(c) 295 K
(d) 401 K
(e) 300 K

20-11

Question 357 0.52-30%

One mole of a monatomic ideal gas is initially at a temperature of 300 K and with a volume of 0.030 m**3. The gas is compressed adiabatically to a volume of 0.040 m**3. What is the final temperature?

(a) 100 K.
(b) 7.00 K.
(c) 522 K.
(d) 476 K.
(e) 999 K.

---

20 All Sections

20

Question 358 0.44-31%

A gas is taken through the cyclic process shown in Figure 1. Calculate the net thermal energy transferred to the gas during two cycles.

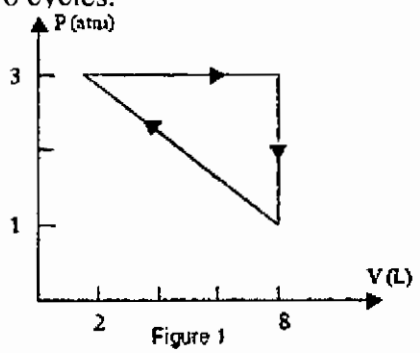


Figure 1

(a) 909 J
(b) zero
(c) 101 J
(d) 1212 J
(e) 2424 J

20

Question 359
5 moles of hydrogen gas occupy a balloon that is inflated to a volume of 0.3 m**3 and at 1.0 atmospheric pressure. What is the root-mean square velocity of the molecules inside the balloon? [The mass of hydrogen atom is 1.66*10**(-27) kg].
(a) 3.0*10**9 m/s.
(b) 3.4*10**2 m/s.
(c) 4.3*10**3 m/s.
(d) 2.2*10**3 m/s.
(e) 1.3*10**3 m/s.

20

Question 360
For an ideal gas, which of the following statements is FALSE:
(a) In an isothermal process, there is no change in the internal energy.
(b) In an adiabatic process, no heat enters or leaves the system.
(c) In an isothermal process, the work done is equal to heat energy.
(d) In a constant volume process, the work done by the gas is zero.
(e) In any cyclic process, the work done by the gas is zero.

20

Question 361
Helium gas is heated at constant pressure from 32 degrees Fahrenheit to 212 degrees Fahrenheit. If the gas does 20.0 Joules of work during the process, what is the number of moles?
(a) 0.050 moles.
(b) 0.013 moles.
(c) 0.200 moles.
(d) 0.024 moles.
(e) 0.111 moles.

20

Question 362
For an ideal gas, Which of the following statements are CORRECT: 1. Cp Cv = R/2. 2. In an isothermal process, the internal energy of the system does not change. 3. In an adiabatic process, no heat enters or leaves the system. 4. In a constant volume process, the work done by the system is positive.
(a) 2 and 4.
(b) 2 and 3.
(c) 3 and 4.
(d) 1, 2 and 4.
(e) 1 and 3.

20

Question 363 0.50-72%
The temperature of an ideal gas remains constant as its volume is decreased. Which one of the following statements is CORRECT?
(a) The pressure of the gas decreases in the process.
(b) The gas does positive work on its surroundings.
(c) The average kinetic energy of the gas molecules increases.
(d) Heat flows out of the gas into the surroundings.
(e) The process is adiabatic.

Chapter 21 Entropy and the Second Law of Thermodynamics

21-2 Change In Entropy

21-02

Question 364
One mole of an ideal monatomic gas is heated quasi-statically at constant volume from 100 K to 105 K. What is the change in entropy of the gas?
(a) 0.18 J/K.
(b) 0.26 J/K.
(c) 0.61 J/K.
(d) 1.03 J/K.
(e) 1.39 J/K.

21-02
0.47-52%

Question 365
Suppose that 10 kg of water at 50 degree-C is mixed with an equal amount of water at 10 degree-C. When thermal equilibrium is reached, what is the change in entropy of the mixture? The specific heat of water is 4186 J/kg*K.
(a) 250 J/K
(b) 130 J/K
(c) 246 J/K
(d) 551 J/K
(e) 183 J/K

21-02
0.41-53%

Question 366
Five moles of an ideal diatomic gas (Cp = 7R/2) is taken through an isovolumetric process. If the final pressure is five times the initial pressure, what is the change in entropy of the gas?
(a) 234 J/K
(b) -234 J/K
(c) -167 J/K
(d) 167 J/K
(e) -151 J/K

21-02
0.51-45%

Question 367
Find the change in entropy when 100 g of ice at 0 degree-C is heated slowly to 80 degrees-C. (C(water) = 1.0 cal/g*degree-C, L(f) = 80 cal/g).
(a) 85 cal/K
(b) 25 cal/K
(c) 62 cal/K
(d) 12 cal/K
(e) 55 cal/K

21-02

Question 368
The left-hand side of the container shown in Figure 2 contains 5 moles of nitrogen gas, in thermal equilibrium with the right hand side, which contains 3 moles of hydrogen gas. The two sides are separated by a partition, and the container is insulated. After the partition is broken, what is the change in entropy of the system?

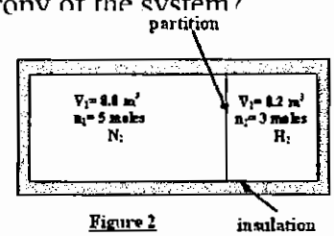


Figure 2

(a) 34 J/K
(b) 58 J/K
(c) zero
(d) 12 J/K
(e) 49 J/K

21-02

Question 369
A container holds 240 g of water at 8 degrees-C. The container is placed in a refrigerator maintained at - 5 degrees-C. Calculate the change in entropy of the water after it is in thermal equilibrium with the refrigerator. C(ice)=2090 J/kg*K,C(water)=4186 J/kg*K, Lf=3.33*10**(5) J/Kg.
(a) 331 J/K
(b) -331 J/K
(c) -254 J/K
(d) -172 J/K
(e) 254 J/K

21-02
0.24-43%

Question 370
Consider 5 moles of a isolated ideal gas initially at a pressure P1 and volume V1. The gas expands freely to a final pressure P2 and volume V2. If the entropy change during this process is 16.6 J/K, then the ratio of the final pressure to the initial pressure is:
(a) 0.67
(b) 3.0
(c) 0.33
(d) 0.50
(e) 1.5

21-02
0.29-30%

Question 371
When an ideal gas is subjected to a reversible adiabatic compression process, which one of the following statements is TRUE:
(a) The gas rejects heat.
(b) No work is done on the gas.
(c) The entropy of the gas does not change.
(d) The gas absorbs heat.
(e) The internal energy of the gas does not change.

21-02

Question 372
A 10 kg piece of ice at 0 degree Celsius is changed slowly and reversibly to water at 70 degrees Celsius. What is the change in entropy of the Ice?
(a) -2.2*10**4 J/K.
(b) 6.5*10**4 J/K.
(c) 2.2*10**4 J/K.
(d) -6.5*10**4 J/K.
(e) -3.4*10**4 J/K.

21-02

Question 373
What is the change in entropy of 200-g of water as its temperature increases from 0 degrees Celsius to 50 degrees Celsius. [For water: the specific heat = 4.19 kJ/(kg.K) and the latent heat of fusion = 333 kJ/kg.]
(a) 2.55*10**3 J/K.
(b) 1.41*10**2 J/K.
(c) 4.19*10**3 J/K.
(d) 0.35*10**3 J/K.
(e) 3.35*10**3 J/K.

21-02

Question 374 0.21-74%

An ideal monatomic gas is confined to a cylinder by a piston. The piston is slowly pushed in so that the gas temperature remains at 27 degree C. During the compression, 750 J of work is done on the gas. The change in the entropy of the gas is:

(a) 3.0 J/K.
(b) - 2.5 J/K.
(c) 2.5 J/K.
(d) Zero.
(e) - 3.0 J/K.

21-02

Question 375

240 grams of water at 8 degrees-C are cooled to ice at at - 5 degrees-C. Calculate the change in entropy of the water. c(ice)=2090 J/kg*K, c(water)=4186 J/kg*K, Lf=3.33*10**(5) J/Kg.

(a) -254 J/K.
(b) -172 J/K.
(c) 254 J/K.
(d) 331 J/K.
(e) -331 J/K.

21-02

Question 376 0.45-70%

50.0 g of water at 15.0 degrees-C are converted slowly into ice at - 15.0 degrees-C. What is the change of entropy of water ? specific heat of water = 4190 J/kg.K., specific heat of ice = 2220 J/kg.K., Lf = 333kJ/kg, Lv = 2256kJ/kg

(a) - 17.5 J/K
(b) + 83.4 J/K
(c) - 78.5 J/K
(d) + 78.5 J/K
(e) - 83.4 J/K

21-02

Question 377 0.24-28%

One mole of an ideal monatomic gas expands at constant pressure to three times its initial volume. What is the change of entropy of the gas in this process ?

(a) + 22.8 J/K
(b) + 9.13 J/K
(c) - 22.8 J/K
(d) - 13.7 J/K
(e) + 13.7 J/K

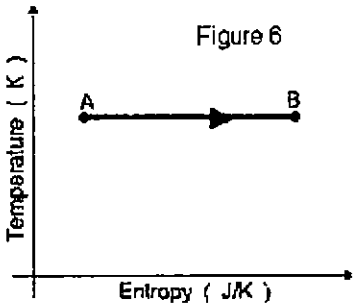
21-02

Question 378 0.20-79%

A 4.0-kg piece of iron at 800 K is dropped into a lake whose temperature is 280 K. Assume that the lake is so large that its temperature rise is negligible. Find the change in the entropy of the lake. [specific heat of iron = 0.11 kcal/kg.K].

(a) - 0.20 kcal/K
(b) + 0.20 kcal/K
(c) + 0.82 kcal/K
(d) zero
(e) - 0.82 kcal/K

21-02
Question 379 (.27-47%
A sample of an ideal monatomic gas undergoes the reversible process A to B displayed in the T-S diagram shown in figure 6. The process is :



(a) a change of phase.
(b) an isothermal compression.
(c) a constant-volume process.
(d) an isothermal expansion.
(e) a free expansion.

21-02
Question 380 (.21-74%
The change in entropy is zero for
(a) reversible processes during which no work is done.
(b) reversible isothermal processes.
(c) reversible isobaric processes.
(d) all adiabatic processes.
(e) reversible adiabatic processes.

21-02
Question 381 (.44-45%
Five moles of an ideal gas undergo a reversible isothermal compression from volume V to volume V/2 at temperature 30 degrees C. What is the change in the entropy of the gas?
(a) 29 J/K.
(b) -81 J/K.
(c) -29 J/K.
(d) -18 J/K.
(e) 18 J/K.

21-02
Question 382 N.26-83%
One mole of a monatomic ideal gas is taken from an initial state (i) to a final state (f) as shown in figure 1. Calculate the change in entropy of the gas for this process.

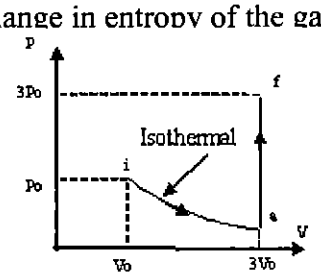


Figure 1

(a) 1.25 J/K.
(b) 36.5 J/K.
(c) 11.2 J/K.
(d) 22.5 J/K.
(e) 25.0 J/K.

21-02
Question 383 0.44-62%
You mix two samples of water, A and B. Sample A is 100 g at 20 degree-C and sample B is also 100 g but at 80 degree-C. Calculate the change in the entropy of sample B.
(a) 8.9 cal/K.
(b) 9.7 cal/K
(c) - 9.7 cal/K.
(d) zero.
(e) - 8.9 cal/K.

21-02
Question 384 0.26-45%
Which of the following statements is correct?
(a) For an adiabatic process the change in entropy is negative if it is done irreversibly.
(b) The efficiency of a Carnot engine is 100%.
(c) For an isothermal expansion the change in entropy of an ideal gas is zero.
(d) A Carnot engine does not reject any heat as waste.
(e) For an adiabatic process the change in entropy is zero if it is done reversibly.

21-02
Question 385 0.55-58%
Five moles of an ideal monatomic gas are allowed to expand isobarically. The initial volume is 20.0 cm**3 and the final volume is 100 cm**3. Find the change in entropy of the gas.
(a) 67.0 J/K
(b) 100 J/K
(c) 152 J/K
(d) 52.0 J/K
(e) 167 J/K

21-02
Question 386 0.42-66%
10.0 kg of water at zero degrees-C are mixed with 10.0 kg of water at 100 degrees-C. The specific heat of water is 4.19 kJ/kg.K. The change in entropy of the system is
(a) 1.02 kJ/K
(b) 6.03 kJ/K
(c) 7.05 kJ/K
(d) 13.1 kJ/K
(e) zero

21-02
Question 387 0.41-29%
One mole of an ideal gas undergoes an isothermal expansion in which its volume increases to five times its initial value. What is the change of entropy of the gas in this process?
(a) 12.5 J/K
(b) 4010 J/K
(c) 20.1 J/K
(d) 13.4 J/K
(e) zero

21-02
Question 388 0.28-60%
Two moles of an ideal gas undergo an adiabatic free expansion from an initial volume of 0.6 L to 1 3 L. Calculate the change in entropy of gas.
(a) -12.9 J/K.
(b) -5.3 J/K.
(c) 16.6 J/K.
(d) 12.9 J/K.
(e) zero.

21-02

Question 389 (.14-70%

System A (one kilogram of ice at zero degrees Celsius) is added to system B (one kilogram of water at 100 degrees Celsius) in an insulator container. Calculate the total change in entropy of system A.

(a) Infinite.
(b) 6.00 kJ/K.
(c) -1.41 kJ/K.
(d) 1.36 kJ/K.
(e) 1.20 kJ/K.

21-02

Question 390 .67-40%

A 5.00-kg block of copper is at 296 K. If it is heated such that its entropy increases by 1 07 kJ/K, what is the final temperature? [The specific heat of copper is 386 J/(kg*K)]

(a) 760 K.
(b) 273 K.
(c) 310 K.
(d) 515 K.
(e) 100 K.

21-3 The Second Law of Thermodynamics

21-03

Question 391

Which of the following statements are CORRECT:

1. Two objects are in thermal equilibrium if they have the same temperature.
2. In an isothermal process, the work done by an ideal gas is equal to the heat energy
3. In an adiabatic process, no heat enters or leaves the system.
4. The thermal efficiency of an ideal engine can be = 1.0.
5. For any process the change in entropy of a closed system < 0.

(a) 1, 2, and 3.
(b) 3 and 5.
(c) 4 and 5.
(d) 1, 2 and 5.
(e) 1 and 4.

21-03

Question 392 0.30-60%

Which of the following statements are WRONG:

1. The efficiency of the ideal engine is greater than one.
2. The change in entropy is zero for reversible isothermal processes.
3. In cyclic processes, the change in entropy is zero.
4. If steam is condensed, its entropy will decrease.
5. If ice is melted, its entropy will decrease.

(a) 1, 2 and 4.
(b) 1, 2 and 5.
(c) 2, 3 and 4.
(d) 1, 3 and 5.
(e) 1, 2 and 3.

21-03

Question 393

Which of the following statements are true?

(I) Temperatures that differ by 10 C-degrees must differ by 18 F-degrees.

(II) Zero degree-C is the lowest temperature that one can reach.

(III) Heat conduction refers to the transfer of thermal energy between objects in contact.

(IV) The entropy of a system never decreases.

(V) Heat is a form of energy.

(a) I, III, and V.
(b) II, III, and V.
(c) I, III, and IV.
(d) I, II, and IV.
(e) II, III, and IV.

21-4 Entropy In the Real World: Engines

21-04

Question 394 0.36-59%

An ideal heat pump is used to absorb heat from the outside air at -10 degree-C and transfers it into a house at a temperature of 30 degree-C. What is the heat energy transferred into the house if 5.0 kJ of work is done on the heat pump?

(a) 20 kJ
(b) 76 kJ
(c) 18 kJ
(d) 12 kJ
(e) 38 kJ

21-04

Question 395 0.33-37%

One mole of an ideal monoatomic gas (Cv = 3R/2)is taken through the cycle shown in Figure 1. If Ta = 590 K, Tb = 450 K and Tc = 300 K, calculate the efficiency of an engine operating in this cycle.

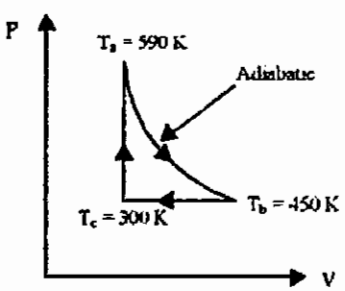


Figure 1

(a) 0.45
(b) 0.28
(c) 0.08
(d) 0.55
(e) 0.14

21-04

Question 396

A heat engine has a monatomic gas as the working substance and its operating cycle is shown by the P-V diagram in Figure 1. In one cycle, 18.2 kJ of heat energy is absorbed by the engine. Find the efficiency of the heat engine.

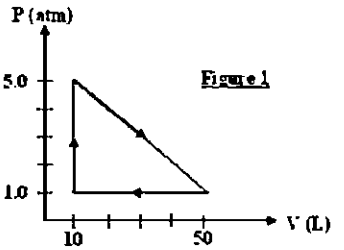


Figure 1

(a) 0.31
(b) 0.25
(c) 0.55
(d) 0.22
(e) 0.44

21-04

Question 397 0.45-43%

A Carnot engine whose low temperature reservoir is at 7 degrees-C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of the high temperature reservoir be increased while the cold reservoir remains at the same temperature?

(a) 742 K
(b) 560 K
(c) 373 K
(d) 280 K
(e) 434 K

21-04

Question 398 0.38-54%

Which one of the following statements is WRONG?

(a) The entropy of the universe remains constant in all processes.
(b) Perfect engines do not exist because they violate the second law of thermodynamics.
(c) No real engine is more efficient than Carnot engine.
(d) In an isolated system, the entropy increases for a irreversible process and remains constant for a reversible process.
(e) The change in entropy of a system depends only on the initial and final states.

21-04

Question 399

A heat engine absorbs 8.71*10**3 J per cycle from a hot reservoir with an efficiency of 25% and executes 3.15 cycles per second. What is the power output of the heat engine?

(a) 1.91*10**3 W.
(b) 1.58*10**5 W.
(c) 1.11*10**5 W.
(d) 3.15*10**3 W.
(e) 6.86*10**3 W.

21-04

Question 400

Specify the CORRECT statement:

(a) The entropy of the universe decreases in any process.
(b) To calculate the efficiency of ideal engine the temperature should be in Celsius.
(c) Heat engines can have efficiency higher than Carnot engine working between the same two temperatures.
(d) The efficiency of heat engines can be 100%.
(e) Isolated systems tend toward disorder and entropy is a measure of this disorder.

21-04

Question 401

An ideal engine absorbs heat at 527 degrees Celsius and rejects heat at 127 degrees Celsius. If it has to produce useful mechanical work at the rate of 750 Watts, it must absorb heat at the rate of

(a) 2250 Watts.
(b) 527 Watts.
(c) 750 Watts.
(d) 375 Watts.
(e) 1500 Watts.

21-04

Question 402

A heat engine has a monatomic gas as the working substance and its operating cycle is shown by the P-V diagram in Figure 1. In one cycle, 18.2 kJ of heat energy is absorbed by the engine. Find the efficiency of the heat engine.

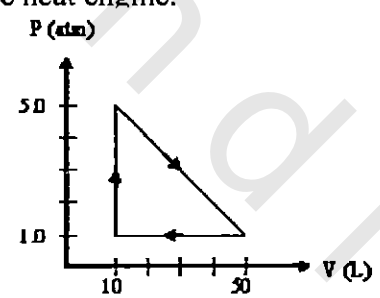


FIGURE 1

(a) 0.31
(b) 0.55
(c) 0.25
(d) 0.44
(e) 0.22

21-04

Question 403 0.49-39%

An ideal engine, whose low-temperature reservoir is at 27 degrees Celsius, has an efficiency of 20%. By how much should the temperature of the high-temperature reservoir be increased to increase the efficiency to 50%?

(a) 20 K.
(b) 225 K.
(c) 975 K.
(d) 88 K.
(e) 300 K.

21-04

Question 404

Five moles of an ideal monatomic gas are taken though the cycle shown in the Figure (1). Calculate the efficiency of the cycle.

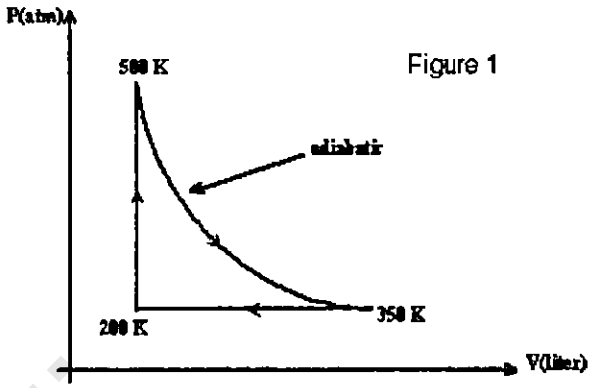


Figure 1

(a) 0.45.
(b) 0.28.
(c) 0.83.
(d) 0.06.
(e) 0.17.

21-04

Question 405

One mole of an ideal gas is taken through the cycle shown in the T-S diagram of figure (2). Calculate the efficiency of the cycle.

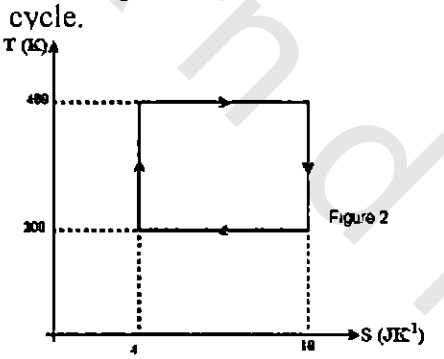


Figure 2

(a) 0.60.
(b) 0.82.
(c) 0.46.
(d) 0.20.
(e) 0.50.

21-04
0.41-24%

Question 406

A Carnot heat engine operates between two reservoirs whose temperatures are 27 degrees-C and 127 degrees-C. If we want to double the efficiency of the heat engine, what should be the temperature of the hot reservoir? Assume the temperature of the cold reservoir is kept constant.

(a) 600 K
(b) 1200 K
(c) 800 K
(d) 1500 K
(e) 900 K

21-04

Question 407 0.57-60%

One mole of an ideal gas is taken through the reversible cycle shown in figure 1, with Q1 = 6.0 kJ Q2 = 30 kJ, Q3 = 18 kJ and Q4 = 10 kJ. What is the efficiency of this cycle ?

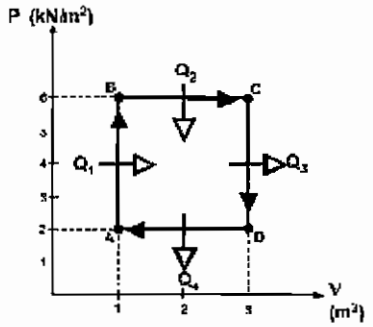


Figure 1

(a) 0.54
(b) 0.44
(c) 0.22
(d) 0.33
(e) 0.29

21-04

Question 408 0.45-57%

A Carnot heat engine absorbs 70.0 kJ as heat and expels 55.0 kJ as heat in each cycle. If the low-temperature reservoir is at 120 degrees-C, find the temperature of the high-temperature reservoir.

(a) 35.8 degrees-C
(b) 393 degrees-C
(c) 153 degrees-C
(d) 227 degrees-C
(e) 450 degrees-C

21-04

Question 409 0.36-42%

An automobile engine operates with an overall efficiency of 20%. How many gallons of gasoline is wasted for each 10 gallons burned?

(a) 10.
(b) 6.
(c) 12.
(d) 2.
(e) 8.

21-04

Question 410 0.19-77%

A heat engine operates between 600 K and 300 K. In each cycle it takes 100 J from the hot reservoir, loses 25 J to the cold reservoir, and does 75 J of work. This heat engine violates:

(a) The first law but not the second law of the thermodynamics.
(b) The second law but not the first law of thermodynamics.
(c) Neither the first law nor the second law.
(d) Conservation of energy.
(e) Both, the first law and the second law of thermodynamics.

21-04

Question 411 0.29-58%

An ideal heat engine has a power output of 200 W. The engine operates between two reservoirs at 300 K and 600 K. How much energy is absorbed per hour?

(a) 6.31*10**3 J.
(b) 1.44*10**6 J.
(c) 1.93*10**5 J.
(d) 1.92*10**6 J.
(e) 5.46*10**6 J.

21-04

Question 412 0.21-74%

One mole of a diatomic ideal gas is taken through the cycle shown in Figure 2. Process b->c is adiabatic, Pa = 0.3 atm, Pb = 3.0 atm, Vb = 1.0*10**(-3) m**3, and Vc = 4.0*Vb. What is the efficiency of the cycle?

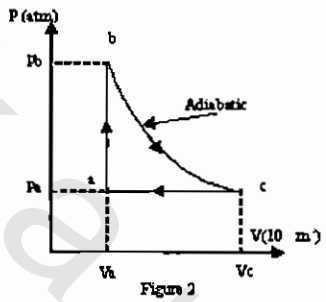


Figure 2

(a) 74%.
(b) 53%.
(c) 34%.
(d) 28%.
(e) 12%.

21-04

Question 413 0.31-18%

A Carnot engine has an efficiency of 20%. It operates between two constant-temperature reservoirs differing in temperature by 70.0 K. What is the temperature of the HOT reservoir?

(a) 350 K.
(b) 280 K.
(c) 400 K.
(d) 300 K.
(e) 70 K.

21-04

Question 414 0.42-40%

A heat engine operates in a Carnot cycle between reservoirs of temperatures 127 degrees-C and 727 degrees-C. It is found that 20 J of heat is expelled to the cold reservoir in every cycle. What is the work done per cycle?

(a) 40 J
(b) 20 J
(c) 50 J
(d) 30 J
(e) 10 J

21-04

Question 415 0.43-65%

An 8.0-MW electric power plant has an efficiency of 30 %. It loses its waste heat to the environment. How much heat is lost to the environment per second?

(a) 23 MJ
(b) 5.6 MJ
(c) 2.4 MJ
(d) 19 MJ
(e) 8.0 MJ

21-04

Question 416 0.34-67%

A heat engine has a thermal efficiency of 20%. It runs 2 revolutions per second and delivers 80 W. For each cycle find the heat discharged to the cold reservoir.

(a) 40 W.
(b) 61 W.
(c) 200 W.
(d) 121 W.
(e) 160 W.

21-04

Question 417 0.45-24%

A car engine delivers 8.6 kJ of work per cycle. If its efficiency is 30%, find the energy lost by the engine per cycle.

(a) 24 kJ.
(b) 20 kJ.
(c) 8.6 kJ.
(d) 26 kJ.
(e) 14 kJ.

21-5 Entropy In the Real World: Refrigerators

21-05

Question 418 0.49-53%

Which one of the following statements is WRONG?

(a) A refrigerator is a heat engine working in reverse.
(b) The most efficient cyclic process is the Carnot cycle.
(c) The total entropy decreases for any system that undergoes an irreversible process.
(d) Entropy is a quantity used to measure the degree of disorder in a system.
(e) It is impossible to construct a heat engine which does work without rejecting some heat to a cold reservoir.

21-05

Question 419

Which one of the following statements is WRONG?

(a) No heat engine has higher efficiency than Carnot efficiency.
(b) Thermal energy cannot be transferred spontaneously from a cold object to a hot object.
(c) After a system has gone through a reversible cyclic process, its total entropy does not change.
(d) A heat pump works like a heat engine in reverse.
(e) The total entropy of a system increases only if it absorbs heat.

21-05

Question 420 0.34-39%

An ideal freezer has a coefficient of performance (COP) of 5. If the temperature inside the freezer is - 20 degrees-C, what is the temperature at which heat is rejected?

(a) -20 degrees-C
(b) 31 degrees-C
(c) -45 degrees-C
(d) 20 degrees-C
(e) 36 degrees-C

21-05

Question 421

What is the coefficient of performance of a refrigerator that absorbs 40 cal/cycle at low temperature and expels 51 cal/cycle at high temperature?

(a) 4.6.
(b) 0.22.
(c) 2.3.
(d) 3.6.
(e) 0.28.

21-05

Question 422 0.50-53%

An ideal refrigerator has a coefficient of performance of 5. If the temperature inside the refrigerator is -20 degrees Celsius, what is the temperature at which it rejects heat?

(a) - 5 degrees Celsius.
(b) 31 degrees Celsius.
(c) 20 degrees Celsius.
(d) 27 degrees Celsius.
(e) 42 degrees Celsius.

21-05

Question 423

Which one of the following statements is WRONG?

(a) No heat engine has higher efficiency than Carnot efficiency.
(b) A refrigerator works like a heat engine in reverse.
(c) Thermal energy cannot be transferred spontaneously from a cold object to a hot object.
(d) The total entropy of a system increases only if it absorbs heat.
(e) After a system has gone through a reversible cyclic process, its total entropy does not change.

21-05

Question 424

A Carnot refrigerator has a coefficient of performance equal to 6. If the refrigerator expels 80 J of heat to a hot reservoir in each cycle, find the heat absorbed from the cold reservoir.

(a) 21 J.
(b) 15 J.
(c) 30 J.
(d) 5 J.
(e) 69 J.

21-05
Question 425 0.43-39%
A Carnot refrigerator has a coefficient of performance equal to 5. The refrigerator absorbs 120 J of heat from a cold reservoir in each cycle. How much heat is expelled to the hot reservoir ?
(a) 720 J
(b) 480 J
(c) 600 J
(d) 144 J
(e) 125 J

21-05
Question 426 0.32-67%
What mass of water at 0 degrees-C can a freezer make into ice cubes in one hour, if the coefficient of performance of the refrigerator is 3.0 and the power input is 0.2 Kilowatt?
(a) 0.4 kg.
(b) 1.9 kg.
(c) 3.0 kg.
(d) 9.2 kg.
(e) 6.5 kg.

21-05
Question 427 0.40-63%
What is the coefficient of performance of an ideal refrigerator if the temperatures of the two reservoirs are 10 degrees Celsius and 27 degrees Celsius.
(a) 7.1
(b) 1.5
(c) 0.5
(d) 8.0
(e) 6.5

21-05
Question 428 0.38-34%
During one cycle, a Carnot refrigerator does 200 J of work to remove 600 J from its cold compartment. How much energy per cycle is exhausted to the kitchen as heat?
(a) 800 J.
(b) 200 J.
(c) 225 J.
(d) 600 J.
(e) 450 J.

Chapter22 Electric Charge

22-4 Coulomb's Law

22-04

Question 429
Suppose that isolated charges Q and q attract each other with a force F. If the separation between these charges were made half as great, each charge would then experience a force
(a) 2F/3.
(b) F.
(c) Can not be determined unless we know the magnitude of Q and q.
(d) 4 F.
(e) F/2.

22-04
0.57-52%

Question 430
Three charges are located as shown in Figure 1. If a = 3.0 m, Q1 = 2.0 micro-C, and Q2 = Q3 = 8.0 micro-C, what is the magnitude of the electric force on charge Q1?

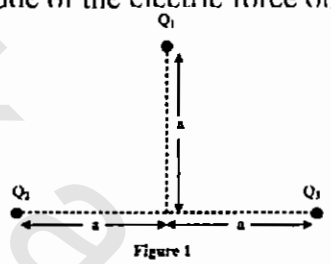


Figure 1

(a) 0.023 N
(b) 0.090 N
(c) 0.046 N
(d) 0.011 N
(e) 0.055 N

22-04
0.51-56%

Question 431
Three points charges are located on the x-y plane as follows: Q1 = -10 micro-C at (4 m, 0), Q2 = 20 micro-C at (0, 10 m), and Q3 at (4 m, 10 m). If the net force on Q1 points in the negative x-direction, find the charge Q3.
(a) -24 micro-C
(b) +16 micro-C
(c) 0 micro-C
(d) -16 micro-C
(e) +24 micro-C

22-04
0.34-40%

Question 432
A 0.2 g metallic ball hangs from an insulating string in a vertical electric field of 3000 N/C and directed upward as shown in Figure 1. If the tension in the string is 0.004 N, then the charge on the ball is:

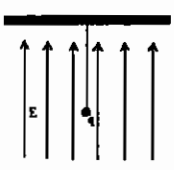


Figure 1

(a) -1.0 micro-C
(b) -0.7 micro-C
(c) 1.0 micro-C
(d) -2.0 micro-C
(e) 0.7 micro-C

22-04

Question 433 0.10-44%

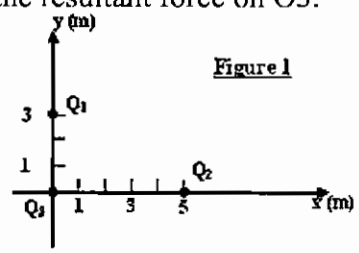
A charge +2q is placed at the origin and a charge -q is placed at x= 0.200 m on the x-axis. Where, on the x-axis, can a third charge +q be placed so that the force on it is zero?

(a) 0.327 m
(b) -0.740 m
(c) -0.440 m
(d) 0.112 m
(e) 0.683 m

22-04

Question 434 0.39-40%

Consider three point charges, Q1=Q2= 2 micro-C and Q3= 4 micro-C, located as shown in Figure 1. Find the magnitude of the resultant force on Q3.



(a) 10*10**(-3) N
(b) 2.9*10**(-3) N
(c) 6.0*10**(-3) N
(d) 8.5*10**(-3) N
(e) zero

22-04

Question 435

A negative charge is placed at the center of a square. Each corner of the square has a fixed charge of 1.00*10**(-6) C. If the resulting force acting on each charge is zero, the magnitude of the negative charge is:

(a) 9.60*10**(-6) C.
(b) 0.77*10**(-6) C.
(c) 0.69*10**(-6) C.
(d) 0.96*10**(-6) C.
(e) 6.92*10**(-6) C.

22-04

Question 436

Two neutral metal sphere are separated by 0.3 km. How much electric charge must be transferred from one sphere to the other so that their electrical attraction is 10**3 N?

(a) 0.2 C.
(b) 0.9 C.
(c) 0.4 C.
(d) 0.6 C.
(e) 0.1 C.

22-04

Question 437 0.43-57%

A charge of + 3.2*10**(-6) C is placed at the origin. A second charge (q2) is placed at x = 3.0 m. If a charge of 1.0*10**(-6) C experiences no force if placed at x = 4.0 m, then q2 is:

(a) + 0.2*10**(-6) C.
(b) - 3.3*10**(-6) C.
(c) - 0.2*10**(-6) C.
(d) + 2.1*10**(-6) C.
(e) - 2.1*10**(-6) C.

22-04

Question 438 0.37-35%

Two small charged objects repel each other with a force F when separated by a distance d. If the charge on each object is reduced to one-fourth of its original value and the distance between them is reduced to d/2 the force becomes:

(a) F.
(b) F/4.
(c) F/16.
(d) F/8.
(e) F/2.

22-04

Question 439

Two fixed particles, of charges q1 = + 1.0*10**(-6) C and q2= - 9.0*10**(-6) C, are 10 cm apart. How far from each should a third charge be located so that no net electrostatic force acts on it?

(a) 1.1 cm from q1 and 11.1 cm form q2.
(b) 5 cm from q1 and 15 cm from q2.
(c) 3 cm from q1 and 7 cm from q2.
(d) 1 cm from q1 and 11 cm from q2.
(e) 1 cm from q1 and 9 cm from q2.

22-04

Question 440

A mass with a charge "Q" is suspended in equilibrium from a beam balance. A point charge q = + 10 micro-C is then fixed at a distance d = 5.0 cm below "Q" and an extra mass m = 4.0 g has to be placed on the pan to obtain equilibrium, see figure (3). Find the value of the charge "Q".

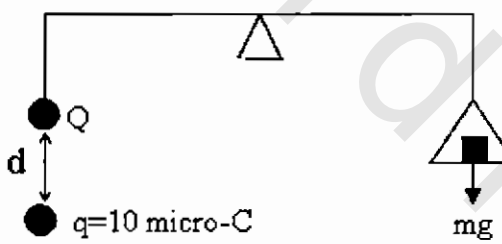


Figure 3

(a) + 6.2*10**(-9) C.
(b) - 1.1*10**(-9) C.
(c) + 3.3*10**(-9) C.
(d) + 1.1*10**(-9) C.
(e) - 3.3*10**(-9) C.

22-04

Question 441 0.49-55%

Charges q1 and q2 are on the x-axis. q1 is at x = a and q2 is at x = 2a. The net force on a third charge at the origin is zero. Which of the following is TRUE ?

(a) q2 = -4*q1
(b) q2 = 2*q1
(c) q2 = 4*q1
(d) q2 = -q1
(e) q2 = -2*q1

22-04
0.50-45%

Question 442
Two point charges q1 and q2 lie along the x-axis. q1 = + 16.0 micro-Coulombs is at x = 2.00 m and q2 = + 9.00 micro-Coulombs is at the origin. Where must a negative charge q3 be placed on the x-axis such that the net electrostatic force on it is zero ?
(a) x = + 0.857 m
(b) x = - 0.857 m
(c) x = + 1.14 m
(d) x = + 2.86 m
(e) x = - 1.14 m

22-04
0.39-76%

Question 443
As in figure (1), a charge Q is fixed at each of two opposite corners of a square. A charge q is fixed at each of the other two corners. If the resultant electrical force on Q is zero, then Q and q are related as:`

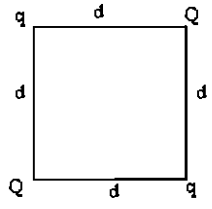


Figure (1)

(a) Q = - 2 Sqrt(2) q**2
(b) Q = - 2 Sqrt(2) q
(c) Q = q**2
(d) Q = q
(e) Q = - 4 q

22-04
0.48-70%

Question 444
Consider two identical conductor spheres, A and B. Initially, sphere A has a charge of -80 Q and Sphere B has a charge of +20 Q. If the spheres touched and then are separated by a distance of 0.3 m, what is the resultant force between them? [Take Q = 5.7*10**(-8) C]
(a) 0.3 N, repulsive.
(b) 0.4 N, attractive.
(c) 0.2 N, attractive.
(d) 0.2 N, repulsive.
(e) 0.3 N, attractive.

22-04
0.44-42%

Question 445
In figure 3, Q = 60 micro-C, q = 20 micro-C, a = 3.0 m, and b = 4.0 m. Calculate the total electric force on q. [i and j are the unit vectors in the positive direction of x-axis and y-axis, respectively].

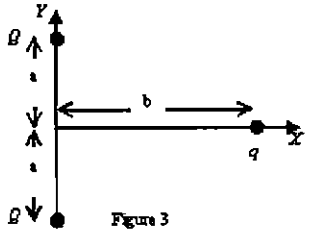


Figure 3

(a) 1.12 j (N).
(b) -0.34 i (N).
(c) -0.69 i (N).
(d) 0.34 i (N).
(e) 0.69 i (N).

22-04

Question 446).44-21°o

In figure (1), if Q = 30 micro-C, q = 5.0 micro-C and d = 0.3 m, find the net force on q. ¯i and j are the unit vectors in the positive direction of x-axis and y-axis, respectively].

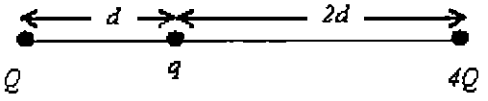


Figure 1

(a) -7.5 i (N).
(b) 7.5 i (N).
(c) 3.8 i (N).
(d) -3.8 j (N).
(e) zero.

22-04

Question 447).43-29°o

What is the electric force between two protons which are separated by 1.6*10**(-15) m

(a) zero.
(b) 90 N, attractive.
(c) 2.2 N, repulsive.
(d) 2.2 N, attractive.
(e) 90 N, repulsive.

22-04

Question 448).39-53°o

Two positive charges (+8.0 C and +2.0 C) are separated by 300 m. A third charge is placed a distance r from the +8.0 C charge so that the resultant electric force on the third charge due to the other two charges is zero. The distance r is

(a) 500 m.
(b) 100 m.
(c) 300 m.
(d) 200 m.
(e) 400 m.

22-04

Question 449 0.40-29°o

Two positively charged particles q1 and q2 (with q2>q1) are fixed in place on the x-axis at the positions shown in figure 1. A third charge q3 is to be placed somewhere on the x-axis such that the net electrostatic force on q3 is zero. Which one of the following statements is TRUE?

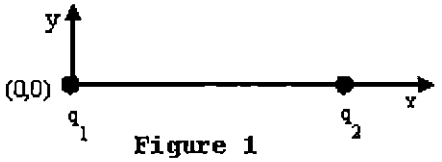


Figure 1

(a) q3 should be placed at a point between q1 and q2 but closer to q2.
(b) q3 should be placed to the left of q1.
(c) q3 should be placed to the right of q2.
(d) q3 should be placed at the mid point between q1 and q2.
(e) q3 should be placed at a point between q1 and q2 but closer to q1

23-3 Electric Field Lines

23-03

Question 450

Which one of the following statements is CORRECT?

(a) Electric charge is not quantized.
(b) Electric field lines are closer together when the electric field is weak, and are far apart when the electric field is strong.
(c) Halfway between two point charges of equal magnitude and opposite sign, the net electric field is zero.
(d) In a solid conductor, electrons do not move freely.
(e) The direction of an electric field does not change whether a positive or negative test charge is used in calculating the electric field.

23-03
0.34-36%

Question 451

The strength of the electric field shown in Figure 3

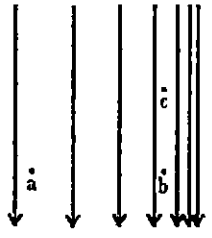


Figure 3

(a) increases as we go from point a to point b.
(b) increases as we go from point c to point b.
(c) increases as we go from point b to point a.
(d) is the same at points a, b and c.
(e) increases as we go from point b to point c.

23-4 The Electric field Due to a Point Charge

23-04
0.49-54%

Question 452

A 32 micro-C charge is positioned on the x-axis at x = 4.0 cm. Where should a -18 micro-C charge be placed (on the x-axis) so that the net electric field at the origin is zero?

(a) 1 cm
(b) 4 cm
(c) 5 cm
(d) 3 cm
(e) 7 cm

23-04

Question 453

A point charge of 4.0 nano-C is located at a point having coordinates (30.0 cm, 40.0 cm). At what point will the electric field be 72 N/C and pointing in the negative y-direction?

(a) (10.0, -89.9) cm
(b) (30.0, 49.9) cm
(c) (30.0, -30.7) cm
(d) (30.0, 70.7) cm
(e) (30.0, -49.9) cm

23-04

Question 454

A 40 micro-C charge is positioned on the x axis at x = 4.0 cm. In order to produce a net electric field of zero at the origin, where, on the x-axis, should a -60 micro-C charge be placed?

(a) 5.7 cm
(b) 4.9 cm
(c) -6.0 cm
(d) -5.3 cm
(e) 6.0 cm

23-04

Question 455 31-25%

Four charges are placed on the circumference of a circle of radius 1.0 m and centered at the origin as shown in Figure 2. What is the magnitude and direction of the electric field at the origin (0,0)?

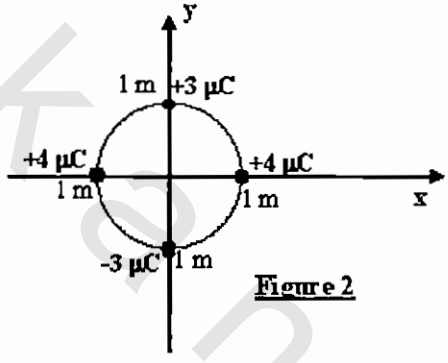


Figure 2

(a) 72000 N/C along the positive x-axis
(b) 54000 N/C along the negative y-axis
(c) 54000 N/C along the positive y-axis
(d) Zero
(e) 72000 N/C along the negative x-axis

23-04

Question 456

Four electric charges are arranged so that the total electric field at the origin is zero. Wh ch configuration in figure (1) would achieve this?

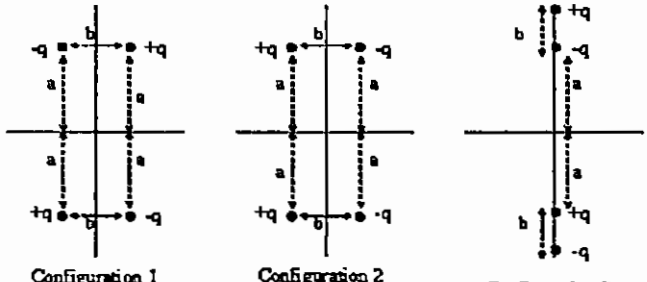


Figure 1

(a) All configurations.
(b) Configuration 1.
(c) Neither configuration.
(d) Configuration 3.
(e) Configurations 1 and 2.

23-04

Question 457
A charged particle has a mass of 2.0*10**(-4) kg. If it is held stationary by a downward 300 N/C electric field, the charge of the particle is:
(a) - 1.5*10**(-6) C.
(b) - 6.5*10**(-6) C.
(c) 6.5*10**(-6) C.
(d) 1.5*10**(-6) C.
(e) - 3.0*10**(-6) C.

23-04

Question 458
Two uniformly charged, concentric and hollow, spheres have radii r and 1.5*r. The charge of the inner sphere is q/2 and that on the outer sphere is 3*q/2. Find the electric field at a distance 2.0*r from the center of the spheres.
(a) 0.5*k*q/(r**2).
(b) 0.25*k*q/(r**2).
(c) 0.35*k*q/(r**2).
(d) Zero.
(e) 0.13*k*q/(r**2).

23-04
0.43-74%

Question 459
For the arrangement of charges shown in figure (1), the electric field at the point P is:

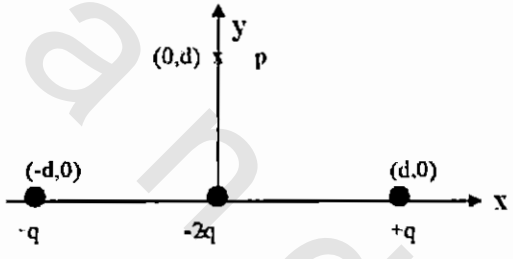


Figure 1

(a) Zero.
(b) 1.3*k*q/(d**2) in the positive y-direction.
(c) 2.0*k*q/(d**2) in the negative y-direction.
(d) 2.0*k*q/(d**2) in the positive y-direction.
(e) 1.3*k*q/(d**2) in the negative y-direction.

23-04

Question 460
In figure (4), what is the magnitude of the electric field at point P due to the four point charges shown?

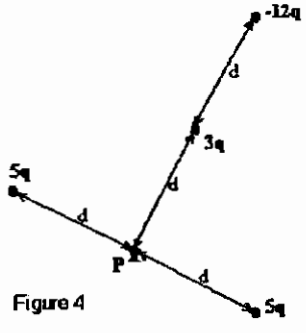


Figure 4

(a) q*Sqrt(2) N/C.
(b) 90*q N/C.
(c) zero
(d) 5*q N/C.
(e) 12*q N/C.

23-04
Question 461 0.38-79%

Four point charges are placed at the corners of a square as shown in figure 2. What is the magnitude of the electric field at the center of the square ?

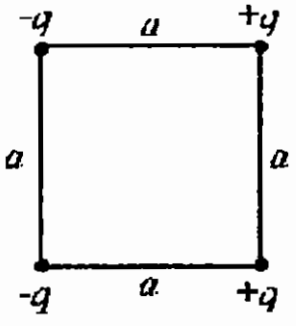


Figure 2

(a) zero
(b) 5.66*k*q/(a**2)
(c) 1.41*k*q/(a**2)
(d) 22.6*k*q/(a**2)
(e) 2.83*k*q/(a**2)

23-04
Question 462 0.45-46%

A charge of - 4.0 micro-Coulomb is located at the origin, and a charge of - 5.0 micro-Coulomb is located along the y-axis at y = 2.0 m. At what point on the y-axis is the electric field zero ?

(a) + 3.2 m
(b) - 0.94 m
(c) + 1.1 m
(d) + 0.94 m
(e) - 1.1 m

23-04
Question 463 0.39-80%

Two point charges are located as shown in figure 1. q1 = +1 micro-Coulomb and q2 = - micro-Coulomb. Find the magnitude of the electric field at point P.

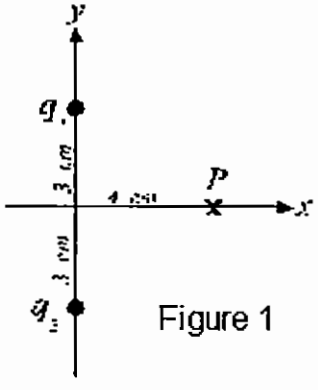


Figure 1

(a) 5.04*10**6 N/C
(b) 5.76*10**6 N/C
(c) 4.32*10**6 N/C
(d) zero
(e) 3.60*10**6 N/C

23-04

Question 464 0.34-51%

In figure (4), what is the magnitude of the electric field at point P, center of the equilateral triangle? [take d = 2 m, q = 10**(-9) C]

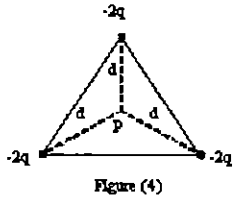


Figure (4)

(a) 22 N/C.
(b) 18 N/C.
(c) Zero.
(d) 9 N/C.
(e) 11 N/C.

23-04

Question 465 0.50-66%

In figure 4, a 0.3 g metallic ball hangs from an insulating string in a vertical electric field of 4000 N/C directed upward as shown. If the tension in the string is 0.005 N, then the charge on the ball is:

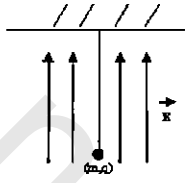


Figure 4

(a) 0.73 micro-C
(b) -0.73 micro-C
(c) 0.52 micro-C
(d) -0.52 micro-C
(e) -1.3 micro-C

23-04

Question 466 0.16-60%

In figure 5, four charges are placed on the circumference of a circle of diameter 2 m. If an electron is placed at the center of the circle, then the electron will [Take Q = 60 micro-C, q = 20 micro-C]

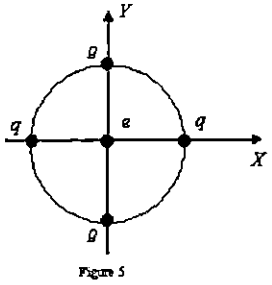


Figure 5

(a) move to the left.
(b) move to the right.
(c) move downward.
(d) stay at the center.
(e) move upward.

23-04
Question 467 0.46-48%
At which point can the electric field due to the two charges shown in figure 6 be zero?

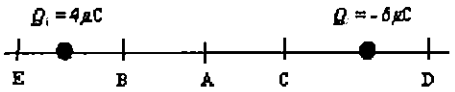


Figure 6

(a) point D.
(b) point C.
(c) point A.
(d) point B.
(e) point E.

23-04
Question 468 0.45-32%
The electric field 20 mm from a certain point charge has a magnitude |E|. The magnitude of the electric field 10 mm from the point charge is
(a) 4.0*|E|.
(b) 6.0*|E|.
(c) 2.0*|E|.
(d) 1.5*|E|.
(e) zero.

23-04
Question 469 0.47-53%
A charge of +20.0 micro-Coulomb is located at the origin and a charge of +15.0 micro-Coulomb is located at x = +10.0 cm. At what point on the x-axis, other than infinity, is the electric field zero?
(a) x = -5.36 cm
(b) x = +5.36 cm
(c) x = +4.64 cm
(d) x = -74.6 cm
(e) x = +74.6 cm

23-04
Question 470 0.40-34%
A +40-micro-Coulomb charge is positioned on the x axis at x = +4.0 cm. To produce a net electric field of zero at the origin, where should a -60 micro-Coulomb charge be placed?
(a) x=+4.9 cm
(b) x=+6.0 cm
(c) x=-6.0 cm
(d) x=+5.7 cm
(e) x=-5.3 cm

23-04
Question 471 0.45-31%
The electric field produced by a +3.0 C charge at a point 1000 m to the left of the charge is
(a) 3.0*10**4 N/C toward the left.
(b) 1.7*10**7 N/C toward the left.
(c) 2.7*10**4 N/C toward the right.
(d) 2.7*10**4 N/C toward the left.
(e) 3.0*10**4 N/C toward the right.

23-04
0.48-39%

Question 472

Three charges +2.00*10**(-8) C, +2.00*10**(-8) C, and -4.00*10**(-8) C are respectively arranged at the corners F, G, and H of a right-angle triangle as shown in figure 2. Find the magnitude and direction of the resultant electric field at point P due to the three charges.

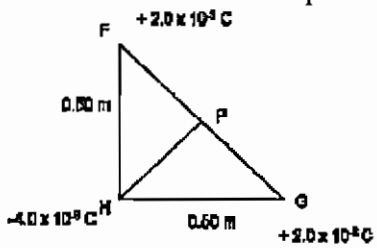


Figure 2

(a) 2.88*10**3 N/C away from H.
(b) 2.88*10**3 N/C towards H.
(c) 5.37*10**3 N/C away from H.
(d) 5.37*10**3 N/C towards H.
(e) 1.09*10**5 N/C towards F.

23-04
0.46-47%

Question 473

In figure 9, a small ball of mass m=2.0 g is hanging from a fixed point by a non-conducting string of length 1.00 m. The ball carries a charge q=25.0*10**(-9) C. The mass of the string is negligible. An electric field E with magnitude E=2.0*10**5 N/C, in the positive x-direction, causes the ball to be in an equilibrium position with an angle Theta. Find the angle Theta. [Take g = 9.80 m/s**2].

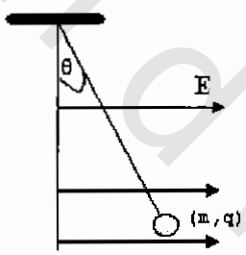


Figure 9

(a) 7.1 degrees.
(b) 14.3 degrees.
(c) 75.7 degrees.
(d) 10.0 degrees.
(e) 0.2 degrees.

23-3 A Point Charge in an Electric field

23-08

Question 474

A particle (m =1.0*10**-2 g, q = -4.0 micro C) is moving with a velocity of 20 m/s in the positive x-direction. If the particle enters a uniform electric field of 20 N/C in the positive x-direction, what is the particle's speed after 5.0 s?

(a) 30 m/s , in negative x-direction.
(b) 50 m/s , in negative x-direction.
(c) 30 m/s , in positive x-direction.
(d) 20 m/s , in positive x-direction.
(e) 20 m/s , in negative x-direction.

23-08

Question 475 0.60-53%

An electron enters a region of a uniform electric field directed along the positive x-axis and of magnitude 5 kN/C. The initial velocity of the electron is 10**4 km/s in the positive x direction. What is the speed of the electron 1.5 nano-seconds after entering this region?

(a) 2.1*10**3 km/s
(b) 1.1*10**3 km/s
(c) 2.4*10**4 km/s
(d) 8.7*10**3 km/s
(e) 1.1*10**4 km/s

23-08

Question 476

An electron starts from point P (at t = 0) with an initial velocity vo =(8.6*10**5)i m/s in an electric field E =(4.1*10**3)i N/C. Find the time it takes the electron to return to point P. (i is the unit vector along the positive x-axis.)

(a) 2.4*10**(-9) sec
(b) 1.2*10**(-9) sec
(c) 1.19*10**(-8) sec
(d) 2.4*10**(-8) sec
(e) 3.5*10**(-9) sec

23-08

Question 477

A proton enters a region of uniform electric field (E = 80 N/C) with an initial velocity of 20 km/s directed perpendicularly to the electric field. What is the speed of the proton 2.0 micro-seconds after entering this region?

(a) 25 km/s
(b) 35 km/s
(c) 42 km/s
(d) 4.7 km/s
(e) 15 km/s

23-08

Question 478

An electron, traveling with initial velocity 10**5 i m/s, enters a region of a uniform electric field given by E = 4.0*10**3 i N/C. Determine the time it takes for the electron to come to rest momentarily. (i is a unit vector in the positive x-direction)

(a) It does not come to rest because time would then be negative.
(b) 4.0*10**(-10) s.
(c) 1.4*10**(-10) s.
(d) 2.0*10**(-10) s.
(e) t=0, i.e. it immediately turns to the negative x-direction.

23-08

Question 479 0.41-60%

A proton is shot out along the +x-axis from the origin with a speed of 1.0*10**6 m/s. In this region a uniform electric field of 2500 N/C exits in the negative x-direction. Find the distance traveled by the proton before it momentarily comes to rest.

(a) 8.9 m.
(b) 1.0 m.
(c) 4.2 m.
(d) 2.1 m.
(e) 2.9 m.

23-08

Question 480 0.65-40%

A uniform electric field exists in a region between two oppositely charged plates. An electron, released from rest from the negative plate, strikes the other plate with a speed of 1.2*10**6 m/s, 15 nanoseconds after its release. What is the distance between the plates ?

(a) 2.0 cm
(b) 0.90 cm
(c) 1.4 cm
(d) 1.7 cm
(e) 1.1 cm

23-08

Question 481 0.39-35%

An electron with an initial velocity of 3.5*10**5 i (m/s) enters a region in which the electric field is 400 i (N/C). What is the speed of the electron two nano-seconds after it enters the electric field ? (i is a unit vector in the x direction)

(a) 3.5*10**5 m/s
(b) 2.8*10**5 m/s
(c) 4.9*10**5 m/s
(d) 2.1*10**5 m/s
(e) 5.6*10**5 m/s

23-08

Question 482 0.44-67%

A particle of mass 5.0 g and charge 40 mili-C moves in a region of space where the electric field is uniform and given by E = -5.5 i (N/C). If the velocity of the particle at t = 0 is given by v = 50 j (m/s), find the speed of the particle at t = 2 s. [i, and j are the unit vectors in the directions of x, and y respectively].

(a) 150 m/s.
(b) 101 m/s.
(c) 65 m/s.
(d) 34 m/s.
(e) 35 m/s.

23-08

Question 483 0.60-32%

Two particles of the same mass carrying charges +3Q and -2Q are shot into a region that contains a uniform electric field as in figure 2. The particles have the same initial velocities in the + x direction. The direction of the electric field is as shown. What will be the resulting paths for the particles?

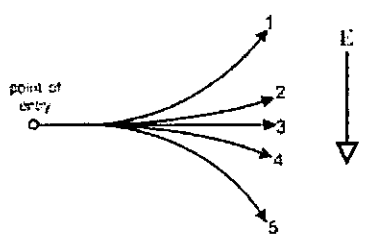


FIGURE 2

(a) path 5 for +3Q and path 2 for -2Q
(b) path 2 for +3Q and path 5 for -2Q
(c) path 1 for +3Q and path 4 for -2Q
(d) path 3 for +3Q and path 2 for -2Q
(e) path 4 for +3Q and path 3 for -2Q

23-08
Question 484 0.50-44%

Two 1.0 g spheres are charged equally and placed 2.0 cm apart. When released, each one begins to accelerate at 225 m/s**2. What is the magnitude of the charge on each sphere?

(a) 1.0*10**(-7) C.
(b) 8.0*10**(-9) C.
(c) 2.0*10**(-7) C.
(d) 3.0*10**(-7) C.
(e) 0.5*10**(-14) C.

23-08
Question 485 0.30-71%

A uniform electric field is set up between two large charged plates, see Figure 3. An electron is released from the negatively charged plate, and at the same time, a proton is released from the positively charged plate. They cross each other at a distance of 5.00*10(-6) m from the positively charged plate. If only the field due to the charged plates is considered, find the distance between the two plates. [Take the ratio mass of the electron : mass of the proton = 1 : 1833]

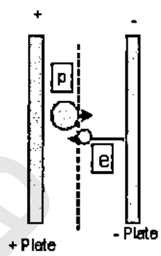


Figure 3

(a) 2.34 mm.
(b) 11.3 mm.
(c) 14.6 mm.
(d) 7.77 mm.
(e) 9.19 mm.

23-08
Question 486 0.55-55%

An electron is moving along the positive x-axis with a constant speed of 1.5*10**8 m/s When it is at a point +500 m from the origin, an electric field of magnitude 2.0*10**3 N/C and directed along the positive x-axis is switched on. How far will the electron reach in the field before stopping momentarily?

(a) 511 m.
(b) 468 m.
(c) 502 m.
(d) 551 m.
(e) 532 m.

23-9 A Dipole in an Electric field

23-09
Question 487

An electric dipole consists of a positive charge of magnitude 6.0*10**(-6) C at the origin and a negative charge of magnitude 6.0*10**(-6) C on the x-axis at x = 3.0*10**(-3) m. Its dipole moment is:

(a) 1.8*10**(-8) C.m, in the positive x direction.
(b) 1.8*10**(-8) C.m, in the negative x direction.
(c) 1.8*10**(-8) C.m, perpendicular to the x-axis.
(d) 3.6*10**(-8) C.m, in the negative x direction.
(e) Zero because the net charge is Zero.

23-09
Question 488 0.17-52%
Which of the following statements is WRONG:
(a) A shell of uniform charge density exerts a constant force on a charge inside it.
(b) Electric field lines extend away from a positive charge.
(c) Electric field can exert a torque on an electric dipole.
(d) A shell of uniform charge density exerts a constant force on a charge outside it.
(e) The magnitude of the charge on a positive ion is an integer multiple of the electron charge.

23-09
Question 489 0.55-53%
An electric dipole consists of charges +2e and -2e separated by 0.78*10**(-9) m. It is in an electr c field of strength 3.0*10**6 N/C. Calculate the magnitude of the torque on the dipole when the dipole is perpendicular to the field. [e is the magnitude of the charge on the electron.]
(a) 6.5*10**(-22) N.m.
(b) 8.5*10**(-22) N.m.
(c) 3.5*10**(-22) N.m.
(d) 7.5*10**(-22) N.m.
(e) 0 N.m.

23-09
Question 490
An electric dipole consists of two opposite charges, each of magnitude 5.0*10**(-19) C, separated by a distance of 1.00*10**(-9) m. The dipole is placed in an electric field of strength 2.45*10**5 N/C. Calculate the magnitude of the torque exerted on the dipole when the dipole moment is perpendicular to the electric field.
(a) 1.2*10**(-22) N*m.
(b) 3.5*10**(-22) N*m.
(c) - 2.0*10**(-22) N*m.
(d) 2.0*10**(-22) N*m.
(e) - 5.2*10**(-19) N*m.

23-09
Question 491
Which statement is false:
(a) The electric dipole consists of two charges of the same magnitude but opposite sign.
(b) Electric field lines extend away from negative charge and toward positive charge.
(c) The principle of superposition applies to electric fields as well as to electrostatic forces.
(d) When an electric dipole is placed in a uniform electric field, the net force on the dipole is zero.
(e) Electric fields are vector fields.

23-09
Question 492 0.28-62%
An electric dipole has a dipole moment of magnitude 2.0*10**-9 C.m. The dipole is placed in an external electric field whose strength is 300 N/C, with its dipole moment initially perpendicular to the field. The electric field rotates the dipole until it is aligned parallel to the field. How much work is done by the electric field ?
(a) -12*10**(-7) J
(b) +12*10**(-7) J
(c) zero
(d) -6.0*10**(-7) J
(e) +6.0*10**(-7) J

23-09
Question 493 0.34-19%
Which one of the following statements is WRONG?
(a) Electric field lines form a vector field.
(b) The principle of superposition applies to electric fields as well as electrostatic forces.
(c) Electric field lines extend away from negative charges and toward positive charges.
(d) The electric dipole consists of two charges having the same magnitude but opposite sign.
(e) When an electric dipole is placed in a uniform external electric field, the net force on it is zero.

23-09
Question 494 0.20-57%
A proton is located at the origin and an electron is located on the y axis at y = +1.0 mm. What is the electric dipole moment of these two particles? (i and j are the unit vectors in the x and y directions, respectively)
(a) -1.6*10**(-22)i (C.m)
(b) +1.6*10**(-22)i (C.m)
(c) +1.6*10**(-22)j (C.m)
(d) zero
(e) -1.6*10**(-22)j (C.m)

23-11
Question 495 0.38-49%
A point charge (q= -10.0 micro-C) is at the center of a metallic sphere that has a radius of 20.0 cm. The electric field 0.500 m away from the center of the sphere is found to be -432 kV/m. What is the charge density on the metallic sphere?
(a) 400 micro-C/m**2
(b) 4.00 C/m**2
(c) -4.00 C/m**2
(d) -4.00 micro-C/m**2
(e) 4.00 micro-C/m**2.

24-2 flux

24-02
Question 496
A uniform electric field E = (a i + b j) intersects a surface of area A. If the surface of the area A lies in YZ-plane, the flux through the area will be:
(a) b*A.
(b) Zero.
(c) a*A.
(d) a*b.
(e) A*A.

24-02
Question 497 0.56-55%
When a piece of paper is held with one face perpendicular to a uniform electric field, the electric flux is 48 N*m**2/C. When the plane of the paper makes 30 degrees with the direction of the electric field the electric flux through it is:
(a) 24 N*m**2/C
(b) 44 N*m**2/C
(c) 21 N*m**2/C
(d) 48 N*m**2/C
(e) 32 N*m**2/C

24-02
Quest on 498 0.00-66%
Calcu ate the electric flux (phi) through the curved surface of a cone of base radius R and height h. The electric field E is uniform and perpendicular to the base of the cone, and the field l nes enter through the base. The cone has no charge enclosed in it, as seen in figure (2).

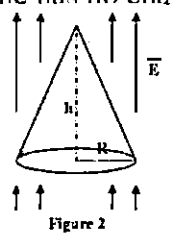


Figure 2

(a) Pi*R*h*E.
(b) -2*Pi*R*E.
(c) 2*Pi*R*E.
(d) -Pi*(R**2)*E.
(e) Pi*(R**2)*E.

24-02
Question 499 0.16-76%
Two concentric shells, one with radius R and the other with radius 2R, surround an isolated point charge. The ratio of the number of field lines through the larger shell to the number of field lines through the smaller is:
(a) 1/4.
(b) 1.
(c) 1/2.
(d) 4.
(e) 2.

24-02
Question 500
For the electric field:
E = (24 i + 30 j + 16 k) N/C,
where i, j, and k are the unit vectors in the directions of x, y, and z, respectively, the electric flux through a 2.0 m**2 portion of the yz-plane is:
(a) 60 N*m**2/C.
(b) 92 N*m**2/C.
(c) 48 N*m**2/C.
(d) 32 N*m**2/C.
(e) 80 N*m**2/C.

24-02
Question 501 0.51-34%
A closed cylinder whose main axis is along the x-axis is shown in figure 2. It is placed in a uniform electric field of magnitude 200 N/C pointing in the negative x-axis. The cylinder has a cross sectional area of 12.5 cm**2 and a length of 6.0 cm. The fluxes through faces I, II and III are respectively:

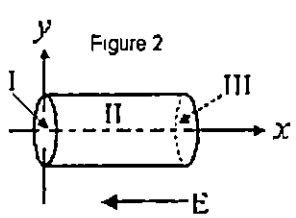


Figure 2

(a) zero , 0.25 , zero N*m**2/C
(b) zero , -0.25 , zero N*m**2/C
(c) - 0.25 , zero , 0.25 N*m**2/C
(d) - 0.25 , 0.25 , - 0.25 N*m**2/C
(e) 0.25 , zero , - 0.25 N*m**2/C

24-02

Question 502 0.34-63%

A cube, as in figure (6), has an edge length of 3.00 m in a region of a uniform electric field given by the equation: -> E = (- 5.00 j + 6.00 k) N/C, where i, j, and k are the unit vectors in the directions of x, y, and z respectively. Find the electric flux through the top face (shaded).

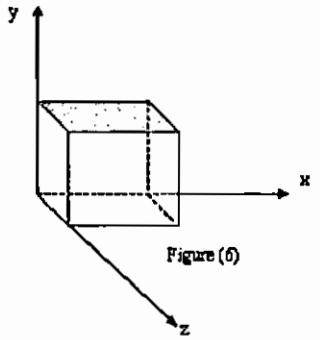


Figure (6)

(a) Zero.
(b) 45 N*m**2/C.
(c) - 30 N*m**2/C.
(d) 30 N*m**2/C.
(e) - 45 N*m**2/C.

24-3 flux of an Electric field

24-03

Question 503

An infinitely long line has a charge density of 7.6 nano-C/m. Calculate the electric flux through a spherical surface of radius R = 7.7 cm whose center, C, lies on the line charge as shown in Figure 3.

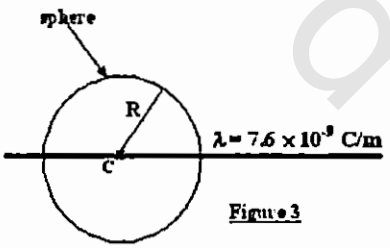


Figure 3

(a) zero
(b) 132 (N*m**2)/C
(c) 92.0 (N*m**2)/C
(d) 415 (N*m**2)/C
(e) 610 (N*m**2)/C

24-03

Question 504

A total charge of 5.00*10**(-6) C is uniformly distributed inside an irregular insulator. The volume of the insulator is 2.50 m**3. Now, imagine a cube of volume 0.50 m**3 inside the insulator. What is the total electric flux through the surface of the cube?

(a) 4.53*10**5 N*m**2/C.
(b) Zero.
(c) 1.13*10**5 N*m**2/C.
(d) 8.10*10**5 N*m**2/C.
(e) 2.51*10**6 N*m**2/C.

24-03

Question 505

A point charge of 2.0 micro-C is placed at the center of a cube 50 cm on edge. What is the flux through the bottom surface?

(a) 1.7*10**4 N*m**2/C.
(b) -2.8*10**4 N*m**2/C.
(c) -5.6*10**4 N*m**2/C.
(d) 1.1*10**5 N*m**2/C.
(e) 3.8*10**4 N*m**2/C.

24-03

Question 506 0.50-43%

The cube in figure 3 has edge lengths of 2.00 m and is oriented as shown in a region in which a uniform electric field exists. The electric field is given by: (-5.00 i + 8.00 k) N/C, where i and k are unit vectors parallel to the x-axis and z-axis respectively. Find the electric flux through the right face (shaded) of the box.

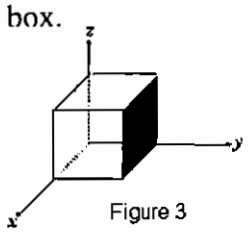


Figure 3

(a) zero
(b) +26.0 N.m**2/C
(c) -10.0 N.m**2/C
(d) +16.0 N.m**2/C
(e) +6.00 N.m**2/C

24-03

Question 507 0.39-74%

A spherical conducting shell has a radius of 20 cm. Point A is a distance of 30 cm from the center of the sphere. The electric field at point A is 500 N/C and is directed radially outward. An additional charge Q is introduced at the center of the shell. The electric field at point A decreases to 100 N/C. What is Q ?

(a) - 5 nano-Coulombs
(b) + 5 nano-Coulombs
(c) - 4 nano-Coulombs
(d) + 1 nano-Coulombs
(e) - 1 nano-Coulombs

24-03

Question 508 0.58-47%

The electric field in the region of space shown in figure 3 is given by: E = (8.0i + 2yj) (N/C), where y is in meters. What is the magnitude of the electric flux through the top face of the cube? (i and j are the unit vectors in the x and y directions, respectively)

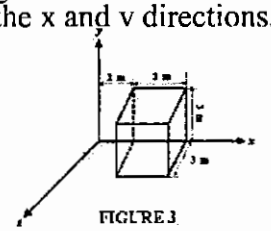


FIGURE 3

(a) 12 N.(m**2)/C
(b) 6.0 N.(m**2)/C
(c) 90 N.(m**2)/C
(d) 130 N.(m**2)/C
(e) 54 N.(m**2)/C

24-03

Question 509 0.51-63%

A charged conducting spherical shell with an outer radius of 2.0 m has a point charge of +3.0 micro-Coulomb at its center. The electric field at a distance of 3.0 from the center has a magnitude of 1.2*10**4 N/C and is radially outward. What is the charge on the outer surface of the shell?

(a) +12 micro-Coulomb
(b) -12 micro-Coulomb
(c) +6 micro-Coulomb
(d) -3 micro-Coulomb
(e) +3 micro-Coulomb

24-03

Question 510 0.54-50%

If a rectangular area is turned in a uniform electric field from a position where the maximum electric flux goes through it to a position where only half the maximum flux goes through it, what is the turned angle?

(a) 45 degrees
(b) 30 degrees
(c) 90 degrees
(d) 23 degrees
(e) 60 degrees

24-4 Gauss' Law

24-04

Question 511 0.41-45%

A point charge Q= 6 micro-C is placed at the center a rectangular box with dimensions a=b= 0.4 m and c= 0.6 m. Find the total electric flux through the surface of the box.

(a) 6.78*10**5 N*m**2/C
(b) 10.9*10**4 N*m**2/C
(c) 3.21*10**5 N*m**2/C
(d) Zero
(e) 9.30*10**5 N*m**2/C

24-04

Question 512 0.14-30%

Charges q and Q are placed on the x axis at x= 0 and x= 2.0 m, respectively. If q= -40 pico-C and Q= +30 pico-C, determine the net electric flux through a spherical surface of radius 1.0 m centered on the origin.

(a) -8.5 N*m**2/C
(b) -1.1 N*m**2/C
(c) -4.5 N*m**2/C
(d) -9.6 N*m**2/C
(e) -6.8 N*m**2/C

24-04

Quest on 513

In figure (1), what is the ratio of the electric flux that penetrates surface S1 to that penetrates surface S2? (Note that S1 and S2 are closed surfaces and q is a charge.)

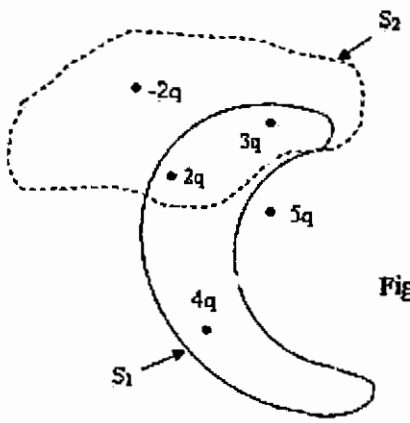


Figure I

(a) 2.
(b) 1.3.
(c) 0.
(d) 3.
(e) 1.0.

24-04

Question 514 0.44-48%

A point charge, q1 = -2.0*10**(-6) C, is placed inside a cube of side 5.0 cm, and another point charge q2 = 3.0*10**(-6) C is placed outside the cube. Find the net electric flux through the surfaces of the cube.

(a) +3.4*10**5 N m**2/C
(b) -2.3*10**5 N m**2/C
(c) 2.3*10**5 N m**2/C
(d) 1.1*10**7 N m**2/C
(e) -1.1*10**5 N m**2/C

24-04

Question 515 0.37-71%

A total charge of 5.00*10**(-6) C is uniformly distributed inside an irregularly-shaped insulator. The volume of the insulator is 3.0 m**3. Now, imagine a cube of volume 0.50 m**3 inside the insulator. What is the total electric flux through the surfaces of the cube?

(a) 2.5*10**3 N*m**2/C.
(b) Zero.
(c) 4.5*10**5 N*m**2/C.
(d) 8.1*10**5 N*m**2/C.
(e) 9.4*10**4 N*m**2/C.

24-04
).09-83%

Question 516

Charge is uniformly distributed over the entire xy plane with a surface charge density of 20 micro-Coulomb/m**2. A sphere has a radius of 1.0 m, and is centered at the origin. What is the net electric flux through the surface of the sphere?

(a) 2.8*10**7 N.(m**2)/C
(b) 1.4*10**7 N.(m**2)/C
(c) zero
(d) 7.1*10**6 N.(m**2)/C
(e) 2.2*10**6 N.(m**2)/C

24-04
).35-74%

Question 517

An imaginary closed spherical surface S of radius R is centered on the origin. A positive charge is originally at the origin, and the flux through the surface is Phi. The positive charge is slowly moved from the origin to a point 2*R away from the origin. In doing so the flux through S

(a) decreases to Phi/4.
(b) remains the same Phi.
(c) increases to 2*Phi.
(d) decreases to zero.
(e) increases to 4*Phi.

24-04
).30-40%

Question 518

Figure 1 shows three situations in which a Gaussian cube sits in an electric field. The arrows and the values indicates the directions(in N*m**2/C)of the flux through the six sides of each cube. In which situations does the cube enclose, a positive net charge, a negative net charges and zero net charge? respectively.

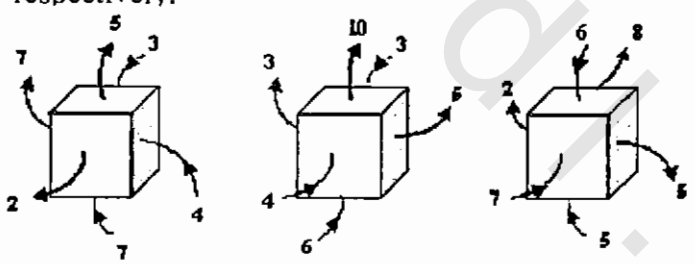


Figure 1

(a) 1,3 and 2.
(b) 2,1 and 3.
(c) 2,3 and 1.
(d) 3,2 and 1.
(e) 1,2 and 3.

24-04
).40-29%

Question 519

The net electric flux passing through a closed surface is -4.00*10**2 N*m**2/C. What is net electric charge contained inside the surface if the surface is a cylinder of height 3.52 cm and radius 1.12 cm.

(a) -3.54*10**(-9) C.
(b) 1.00*10**(-2) C.
(c) -1.00*10**(-2) C.
(d) zero.
(e) 3.54*10**(-9) C.

24-5 Gauss' Law and Coulomb's Law

24-05

Question 520

The electric field everywhere on the surface of a hollow sphere of radius 11 cm is measured to be equal 3.8*10**4 N/C and points radially inward towards the center of the sphere. How much charge is enclosed by this surface?

(a) 3.7*10**-8 C.
(b) -5.1*10**-8 C.
(c) -3.3*10**-8 C.
(d) -3.7*10**-8 C.
(e) 5.1*10**-8 C.

24-05

Question 521 0.49-54%

A positive point charge q sits at the center of a hollow spherical shell. The shell, with radius R and negligible thickness, has net charge -2q. The electric field strength outside the spherical shell (at r>R) will be:

(a) 3*k*q/r**2 radially inwards.
(b) k*q/r**2 radially inwards.
(c) 3*k*q/r**2 radially outwards.
(d) k*q/r**2 radially outwards.
(e) zero.

24-5 A Charged Isolated Conductor

24-06

Question 522

A spherical conducting shell of inner radius r1 and outer radius r2 has a net charge of 2 micro-C. If a point charge of -4.0 micro-C is placed at the geometrical center of the spherical shell, what is the charge on the outer surface of the spherical shell?

(a) -4.0 micro-C
(b) +4.0 micro-C
(c) -2.0 micro-C
(d) zero
(e) +2.0 micro-C

24-06

Question 523

An isolated conducting spherical shell has an inner radius of 4.0 cm and outer radius of 5.0 cm. A charge 8.0*10**(-6) C is put on the shell. What is the ratio of the charge on the inner surface of the shell to the charge on the outer surface?

(a) 7/10.
(b) 5/4.
(c) 8/5.
(d) Zero.
(e) 1.

24-06

Question 524 C.49-43%

A point charge of -50e lies at the center of a hollow spherical metal shell that has a net charge of -100e, as seen in figure (4). Calculate the charge on the (a) shell's inner surface, and (b) on its outer surface. [e is the magnitude of the charge on the electron.]

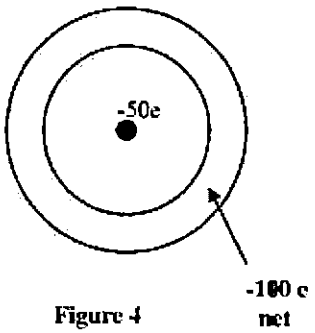


Figure 4

(a) (a) 50e (b) -150e.
(b) (a) 50e (b) -100e.
(c) (a) -50e (b) -100e.
(d) (a) Zero (b) -150e.
(e) (a) -50e (b) 150e.

24-06

Question 525

An isolated conductor of arbitrary shape has a net charge of -15*10**(-6) C. Inside the conductor is a cavity within which is a point charge q=-5.0*10**(-6) C. What is the charge on the cavity-wall, q(in), and what is the charge on the outer surface of the conductor, q(out)? [See figure (3)].

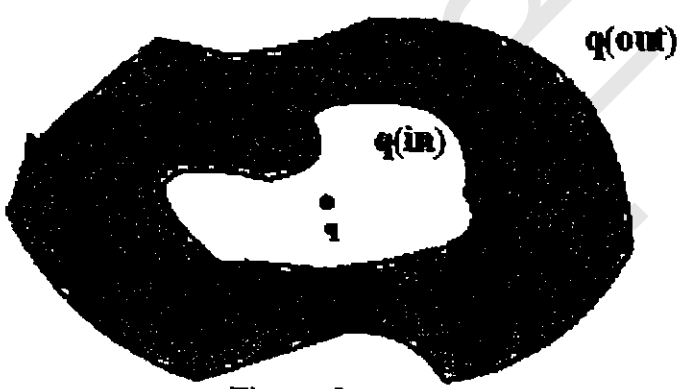


Figure 3

(a) q(in) =-5.0*10**(-6) C; q(out) = -10*10**(-6) C.
(b) q(in) = 5.0*10**(-6) C; q(out) = -15*10**(-6) C.
(c) q(in) = 5.0*10**(-6) C; q(out) = -20*10**(-6) C.
(d) q(in) =-5.0*10**(-6) C; q(out) = -15*10**(-6) C.
(e) q(in) = 5.0*10**(-6) C; q(out) = -10*10**(-6) C.

24-06

Question 526 0.29-78%

A point charge of +4.0 micro-C lies at the center of a hollow spherical conducting shell that has a net charge of -13.0 micro-C. If the inner radius of the shell is 2.0 cm and the outer radius is 3.0 cm, then the ratio between the charge density on the inner surface to the charge density on the outer surface is:

(a) 4 : 1.
(b) 1 : 2.
(c) -1 : 1.
(d) -1 : 2.
(e) 1 : 1.

24-06

Question 527 0.10-67%

A +20 micro-Coulomb point charge is at the center of a conducting spherical shell that has an outer radius of 1.0 m and an inner radius of 0.50 m. The net charge of the spherical shell is zero. What is the surface charge density on the outer surface of the shell?

(a) +6.4 micro-Coulomb/(m**2)
(b) -6.4 micro-Coulomb/(m**2)
(c) +1.6 micro-Coulomb/(m**2)
(d) -1.6 micro-Coulomb/(m**2)
(e) zero

24-7 Applying Gauss' Law: Cylindrical Symmetry

24-07

Question 528

Consider an infinitely long line of charge density 2.0 micro-C/m lying along the x-axis as shown in Figure 4. What is the ratio of electric field strength at point A to that at point B?

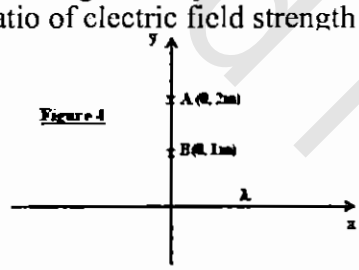


Figure 4

(a) 0.25
(b) 1.00
(c) 2.00
(d) 0.50
(e) 4.00

24-07

Question 529 0.48-42%

An infinite line of charge produces an electric field of 6.0*10**4 N/C at a perpendicular distance of 2.5 m from its axis. Calculate the linear charge density.

(a) 6.3*10**(-6) C/m.
(b) 7.0*10**(-6) C/m.
(c) 8.3*10**(-6) C/m.
(d) 9.5*10**(-6) C/m.
(e) 5.0*10**)-6) C/m.

24-07

Question 530 (.53-54%

Two long, charged, concentric cylindrical shells have radii 3.0 and 6.0 cm. The charge per unit length is -2.00*10**(-6) C/m on the inner cylinder and +5.00*10**(-6) C/m on the outer cylinder. Find the electric field at r = 4.0 cm, where r is the radial distance from the common central axis.

(a) 9.00*10**5 N/C radially outward
(b) 9.00*10**5 N/C radially inward
(c) 13.5*10**5 N/C radially inward
(d) 22.5*10**5 N/C radially inward
(e) 13.5*10**5 N/C radially outward

24-07

Question 531 (.47-45%

Figure 3 shows two infinitely long rods carrying uniform linear charge densities lambda1 and lambda2. If the net electric field at point A is zero, then the ratio lambda2/lambda1 is:

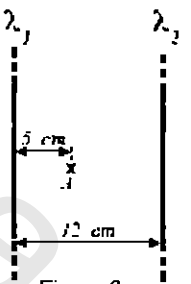


Figure 3

(a) 1.4
(b) 1.7
(c) 0.71
(d) 2.7
(e) 2.3

24-07

Question 532 ●.35-51%

Figure 1 shows two infinitely long lines of charge with uniform linear charges densities: lambda1 = -9.00 nano-Coulomb/m and lambda2 = +3.00 nano-Coulomb/m. The separation between the two lines of charge is d = 1.00 m. What is the net electric field at point P?

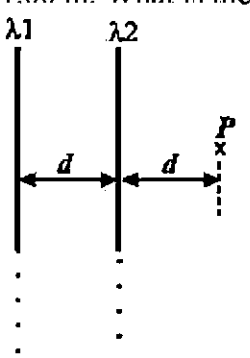


FIGURE 1

(a) 27 N/C to the left
(b) 72 N/C to the left
(c) 27 N/C to the right
(d) 135 N/C to the left
(e) 135 N/C to the right

24-07
0.52-35%

Question 533
In figure 2, the magnitude of the electric field at point A, due to an infinite line charge density of 9.0*10**(-6) C/m, is 7.2*10**4 N/C. If the point A is at a distance R from the line charge, what is R?

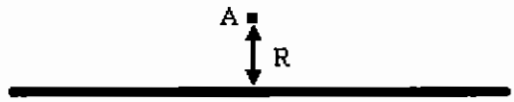


Figure (2)

(a) 1.2 m.
(b) 0.3 m.
(c) 3.4 m.
(d) 25 m.
(e) 2.3 m.

24-07
0.56-61%

Question 534
A very long uniform line of charge having a linear charge density of 6.8 micro-C/m lies along x-axis. A second line of charge has a linear charge density of -3.40 micro-C/m and is parallel to x-axis at y = 0.5 m. What is the net electric field at point where y= 0.25 m on y-axis?
(a) 7.3*10**2 N/C along -y-axis.
(b) 7.3*10**5 N/C along +y-axis.
(c) 4.8*10**4 N/C along -y-axis.
(d) 4.8*10**6 N/C along +y-axis.
(e) 3.4*10**6 N/C along +y-axis.

24-8 Applying Gauss' Law: Planar Symmetry

24-08

Question 535
Two infinite non-conducting parallel surfaces carry uniform charge densities of 0.20 nano-C/m**2 and -0.60 nano-C/m**2. What is the magnitude of the electric field at a point between the two surfaces?
(a) 17 N/C
(b) 34 N/C
(c) 90 N/C
(d) 45 N/C
(e) 23 N/C

24-08

Question 536
Fig. 7 shows two parallel plates, infinite and non-conducting, with surface charge densities of 8.9*10**(-4)C/m**2 and 8.9*10**(-4)C/m**2. B, a ball with negligible mass, carries a positive charge of 6.0*10**(-8) C and is attached to point A with a non-conducting string of length 10 cm. At equilibrium, the tension in the string is:

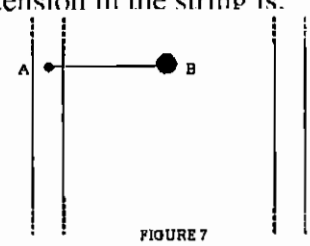


FIGURE 7

(a) 3.0 N.
(b) Zero.
(c) 6.0 N.
(d) 1.5 N.
(e) 0.3 N.

24-08

Question 537 0.41-70%

As shown in figure (3), a small, nonconducting ball of mass m = 1.0*10**(-6) kg and charge q = 2.0*10**(-8) C, distributed uniformly through its volume, hangs from an insulating thread that makes an angle theta = 20 degrees with a vertical, uniformly charged nonconducting sheet (shown in cross section). Considering the weight of the ball and assuming that the sheet extends far vertically and into and out of the page, calculate the surface charge density of the sheet.

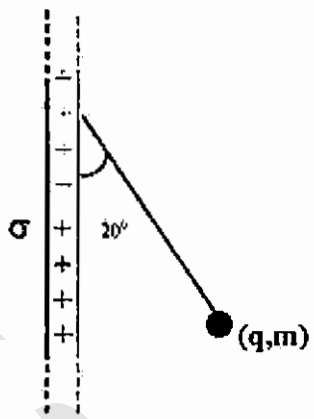


Figure 3

(a) 4.0*10**(-9) C/m**2.
(b) 8.7*10**(-9) C/m**2.
(c) 5.0*10**(-9) C/m**2.
(d) 2.5*10**(-9) C/m**2.
(e) 3.2*10**(-9) C/m**2.

24-08

Question 538 0.43-57%

Figure 4 shows cross-sections through two large, parallel non-conducting sheets with identical distributions of negative charge. The surface charge density for each sheet is 7.00*10**(-15) C/m**2. What is the electric field at point A ?

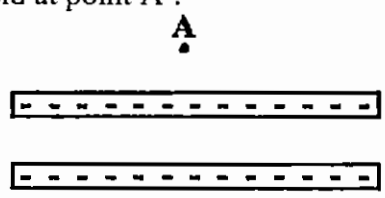


Figure 4

(a) 7.91*10**(-4) N/C upward
(b) 3.96*10**(-4) N/C downward
(c) 3.96*10**(-4) N/C upward
(d) 7.91*10**(-4) N/C downward
(e) 0

24-08

Question 539 0.36-36%

A small insulating sphere of mass m = 20.0*10**(-9) kg and charge q = + 1.00 nano-Coulomb is hanging at equilibrium above a charged insulating sheet. What is the surface charge density of the sheet ?

(a) - 3.47 nano-Coulomb/m**2
(b) + 1.73 nano-Coulomb/m**2
(c) + 3.47 nano-Coulomb/m**2
(d) + 2.50 nano-Coulomb/m**2
(e) - 1.73 nano-Coulomb/m**2

24-08

Question 540 0.42-35%

Figure 4 shows two large, parallel, non-conducting sheets, each with fixed uniform charge density: sigma1 = + 2.2*10**(-6) C/m**2 sigma2 = - 4.3*10**(-6) C/m**2. The ratio of the magnitude of the electric field at point A to that at point B is:

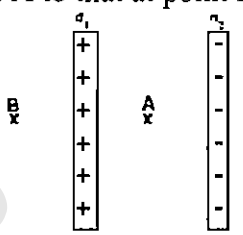


Figure 4

(a) 1.5
(b) 0.6
(c) 4.4
(d) 2.2
(e) 3.1

24-08

Question 541 0.34-65%

For the two infinite dielectric sheets, see figure (5), find the magnitude of the electric field at a point P. Consider that each sheet has a positive surface charge density of 10**2 C/m**2.

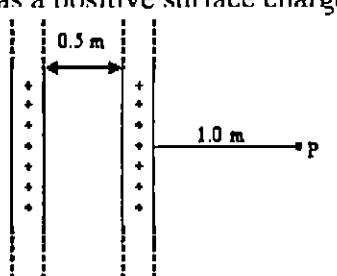


Figure (5)

(a) 2.2*10**13 N/C.
(b) 0.5*10**13 N/C.
(c) 1.1*10**13 N/C.
(d) Zero.
(e) 1.7*10**13 N/C.

24-08
0.41-62%

Question 542
Figure 7 shows portions of two large, parallel, nonconducting sheets, A and B. The surface charge densities are: sigma 1 = -4.5 micro-C/m**2 and sigma 2 = -6.5 micro-C/m**2. Find the electric field at any point between the two sheets.

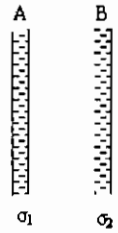


Figure 7

(a) 1.4*10**5 N/C towards A.
(b) 1.1*10**5 N/C towards B.
(c) zero.
(d) 1.1*10**5 N/C towards A.
(e) 1.4*10**5 N/C towards B.

24-08
0.33-61%

Question 543
A 40 N/C uniform electric field points perpendicularly toward a large neutral conducting sheet, as shown in figure 8. The surface charge densities (in C/m**2) on the right, sigma-R and left, sigma-L, respectively are:

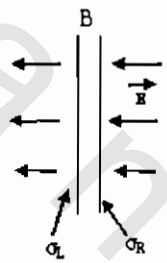


Figure 8

(a) + 7.0*10**(-10) ; -7.0*10**(-10).
(b) - 7.0*10**(-10) ; +7.0*10**(-10).
(c) + 3.5*10**(-10) ; -3.5*10**(-10).
(d) zero ; zero.
(e) - 3.5*10**(-10) ; +3.5*10**(-10).

24-08
0.30-66%

Question 544
Two large flat non-conducting sheets have equal but opposite surface charge densities. The distance between them is 2.0 cm. An electron released from rest from the negative plate strikes the positive plate after 15 nano-seconds. What is the magnitude of the surface charge density on each sheet?
(a) 3.0 nano-Coulomb/m**2
(b) 18 nano-Coulomb/m**2
(c) 7.5 nano-Coulomb/m**2
(d) 4.5 nano-Coulomb/m**2
(e) 9.0 nano-Coulomb/m**2

24-08
0.55-56%

Question 545
A charged, isolated, large non-conducting plate is placed on the XY-plane. At 1.5 m from the plate, on Z-axis, the electric field measured was 10**4 N/C and directed into the plate. What is the charge density on the plate?
(a) 1.8*10**(-7) C/m**2.
(b) 3.2*10**(-7) C/m**2.
(c) -3.2*10**(-7) C/m**2.
(d) -1.8*10**(-7) C/m**2.
(e) zero.

24-9 Applying Gauss' Law: Spherical Symmetry

24-09

Quest on 546 0.49-54%

Which one of the graphs shown in Figure 2 represents the variation of the magnitude of the electric field with the distance from the center of a solid charged conducting sphere of radius R in electrostatic equilibrium?

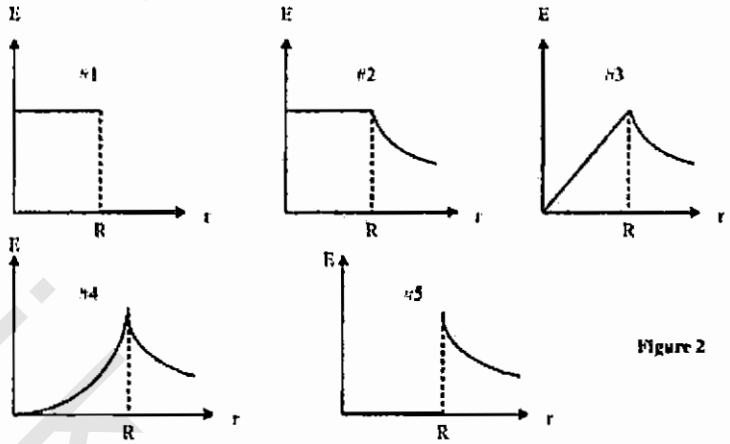


Figure 2

(a) #5
(b) #2
(c) #3
(d) #1
(e) #4

24-09

Question 547 0.21-39%

Two conducting spheres are far apart. The smaller sphere carries a total charge of 4 micro-C, and the larger sphere carries a total charge of 2 micro-C. The larger sphere has a radius that is twice that of the smaller sphere. After the two spheres are connected by a thin conducting wire, the charges on the smaller and larger spheres, respectively, are:

(a) 3 micro-C and 3 micro-C
(b) 2 micro-C and 4 micro-C
(c) -2 micro-C and 8 micro-C
(d) 0 micro-C and 6 micro-C
(e) -4 micro-C and 10 micro-C

24-09

Question 548

A solid insulating sphere has a charge of 20 micro-C uniformly distributed throughout its volume. The magnitude of the electric fields inside the sphere at r = 2 cm and outside the sphere at r = 10 cm, measured from the center of the sphere, are equal. Find the volume charge density of the sphere.

(a) 48 milli-C/m**3.
(b) 24 milli-C/m**3.
(c) 12 milli-C/m**3.
(d) 54 milli-C/m**3.
(e) 20 milli-C/m**3.

24-09

Question 549 0.11-75%

A long noncoducting cylinder (radius 12.0 cm) has a charge of uniform density 5.0 nano-C/m**3 distributed through its column. Determin the magnitude of the electric field 5.C cm from the axis of the cylinder. [See figure (3)].

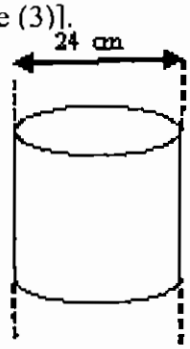


Figure (3)

(a) 14 N/C.
(b) 4 N/C.
(c) 22 N/C.
(d) 34 N/C.
(e) 31 N/C.

24-09

Question 550 0.37-60%

A noncoducting shell has a uniform negative charge of magnitude 5.0*10**(-5) C. Its inner and outer radii are 5.0 cm and 6.0 cm, respectively. The electric field at r = 3.0 cm, from the center, is:

(a) 4.5*10**9 N/C, inward.
(b) 1.5*10**9 N/C, outward.
(c) 4.5*10**9 N/C, inward.
(d) 1.5*10**9 N/C, inward.
(e) zero.

24-09

Question 551 0.33-49%

A hollow metallic sphere, of radius 2.0 cm, is filled with a non-conducting material which carries a charge of 5.0 pico-C distributed uniformly throughout its volume. What is the magnitude of the electric field 1.5 cm from the center of the sphere?

(a) zero.
(b) 17 N/C.
(c) 90 N/C.
(d) 84 N/C.
(e) 68 N/C.

24-09

Question 552 0.40-65%

A non conducting sphere, of radius 4.0 m, has a charge density of 2.0 micro-C/m**3. What is the electric field at a distance 1.7 m from the center?

(a) 4.8*10**3 N/C.
(b) 6.2*10**3 N/C.
(c) 1.3*10**5 N/C.
(d) 1.9*10**5 N/C.
(e) 2.5*10**5 N/C.

24-10
0.40-58%

Question 553

A solid insulating sphere has a charge of 20 micro-C uniformly distributed throughout its volume. The magnitude of the electric fields inside the sphere at r = 2 cm and outside the sphere at r = 10 cm, measured from the center of the sphere, are equal. Find the volume charge density of the sphere.

(a) 12 milli-C/m**3
(b) 24 milli-C/m**3
(c) 20 milli-C/m**3
(d) 54 milli-C/m**3
(e) 48 milli-C/m**3

Chapter 25 Electric Potential

25-1 Electric Potential Energy

25-01

Question 554

In figure (4), an electron moves from point 'I' to point 'F' in a uniform electric field directed as shown in the figure.

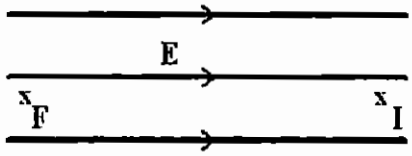


Figure 4

(a) An external force is required to move the electron from I to F.
(b) The electron moves to a lower potential.
(c) The electric potential energy of the electron increases.
(d) The electric field does negative work on the electron.
(e) The electric field does positive work on the electron.

25-01
0.60-64%

Question 555

A particle, of mass m and charge q, is released from rest at point A in a uniform electric field, see figure (2). The kinetic energy, due to the electric field, it attains after moving a distance y is:

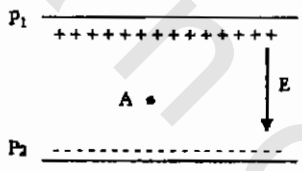


Figure (2)

(a) E*y.
(b) q*E*y/2.
(c) q*E*y.
(d) q*E*y**2.
(e) m*q*E*y.

25-01
0.50-54%

Question 556

Two oppositely charged parallel plates, 0.02 m apart, produce a uniform electric field between the plates. The potential energy U(J) of an electron in the field varies with displacement x(m) from one of the plates as shown in figure 5. What is the magnitude of the force on the electron?

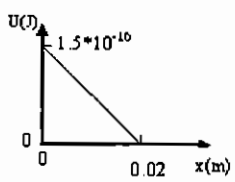


Figure 5

(a) 1.5*10**(-15) N.
(b) 3.0*10**(-18) N.
(c) zero.
(d) 6.0*10**(-20) N.
(e) 7.5*10**(-15) N.

25-2 Electric Potential

25-02

Question 557

A particle (m = 2.0 micro-g, q = - 5.0 micro-C) has a speed of 30 m/s at point A and moves, under the influence of a parallel and uniform electric field, to point B where its speed became 80 m/s. What is the potential difference [V(B)-V(A)].

(a) 6.3 V.
(b) Zero.
(c) 1.1 V.
(d) - 2.4 V.
(e) 3.5 V.

25-02
0.37-52%

Question 558

Two equal point charges (Q = 20 micro-C) are located at the vertices of an equilateral triangle of side a = 2 m as shown in Figure 3. What is the work done to bring a 5 micro-C point charge from infinity to the point P?

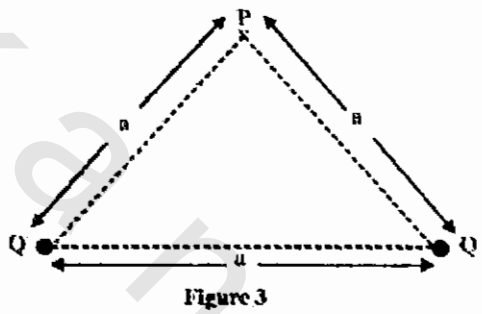


Figure 3

(a) 0.5 J
(b) 0.9 J
(c) 2.9 J
(d) 1.8 J
(e) 7.2 J

25-02
0.46-61%

Question 559

An electron moves from point i to point f in the direction of a uniform electric field. Which one of following statements is CORRECT?

(a) the electric field at point f is less than that at point i
(b) the electric potential increases
(c) The potential energy of the electron decreases
(d) the speed of the electron at point i is less than that at point f
(e) The potential energy of the electron increases

25-02

Question 560

Two large parallel plates are connected to a 100 V power supply. An electron starts from rest at one plate and accelerates toward the other. The speed of the electron when it hits the second plate is

(a) 2.1*10**7 m/s
(b) 3.5*10**6 m/s
(c) 5.9*10**6 m/s
(d) 6.0*10**5 m/s
(e) 7.8*10**6 m/s

25-02

Question 561 0.55-57%

Consider two points A and B in an electric field. A charged particle with a charge of - 8.0 micro-Coulomb is released from rest at point A. At point B, the kinetic energy of the particle is 4.8 J. what is the electric potential difference VB - VA ?

(a) - 480 kV
(b) - 600 kV
(c) + 600 kV
(d) + 125 kV
(e) + 480 kV

25-02

Question 562 0.43-62%

An electrons are accelerated by a potential difference of 2000 Volts. If this potential difference is increased to 8000 Volts, the speed of the electron will be increased by a factor of

(a) 2
(b) 8
(c) 1.5
(d) 3
(e) 4

25-3 EquIpotential Surfaces

25-03

Question 563

Which one of the following statements is TRUE?

(a) The electric field lines are always perpendicular to the associated equipotential surfaces.
(b) The magnitude of the electric flux through a surface enclosing a charge depends on the size and shape of the surface.
(c) If the electric potentials at points A and B are different, then the electric field strength at A and B must be different.
(d) For a spherically symmetric charge distribution, the equipotentials nearby the charge are parallel planes.
(e) The electric flux through an equipotential surface is always zero.

25-03

Question 564

Which one of the following statements is FALSE:

(a) The electric field of a charged conducting sphere is constant for distances larger than the radius of the sphere.
(b) The electric field due to a uniformly charged infinite flat sheet is independent of distance from the sheet.
(c) On irregularly shaped conductor, the charge density is higher at the sharp edges.
(d) The flux through a closed surface is proportional to the charge enclosed by the surface.
(e) The electric field inside a charged conductor in electrostatic equilibrium is zero.

25-03

Question 565

A 2 meters conducting rod is fixed perpendicularly to a uniform 200 N/C electric field. The potential difference between its ends is:

(a) 400 Volts.
(b) Zero.
(c) 300 Volts.
(d) -400 Volts.
(e) 150 Volts.

25-03

Question 566

A charge q is located at the center of a circle with a large radius R, see figure 4. Another charge Q is located on the circumference of the circle at the x-axis. What is the work, in Joules, needed to move Q from its location to point F, on the x-axis, along the circumference?

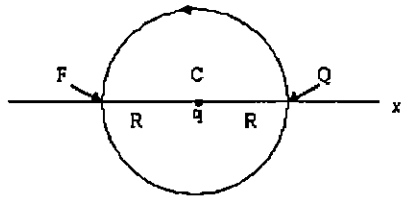


FIGURE 4

(a) 2*k*q*Q/R.
(b) k*q*Q/(2*R).
(c) Zero.
(d) k*q/(2R).
(e) k*q*Q/R.

25-03
0.41-55%

Question 567

Consider the parallel conducting plates shown in figure 1. The distance between the equipotential surfaces A and B is 1.00 cm and the electric potential on surface A is - 280 V. What is the electric potential on the equipotential surface B ?

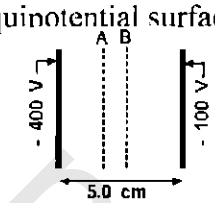


Figure 1

(a) - 160 V
(b) - 150 V
(c) - 440 V
(d) - 220 V
(e) - 340 V

25-03
0.46-51%

Question 568

Which one of the following statements is true?

(a) The electric field lines are perpendicular to the equipotential surfaces.
(b) Any two equipotential surfaces are always parallel.
(c) The electric field is a scalar quantity.
(d) We have to do work to move a charged particle along an equipotential surface.
(e) The electric potential is a vector quantity.

25-03
0.37-49%

Question 569

A metallic sphere, in electrostatic equilibrium, has a radius R and carries a net charge Q. Which of the following statements are true for the sphere?

i- It is made of a non-conducting material.
ii- The excess charge resides on its surface.
iii- The electric field inside it is zero.
iv- The electric potential inside it is constant.

(a) i, ii, and iii only.
(b) i and ii only.
(c) ii, iii, and iv only.
(d) i, ii, and iv only.
(e) iii, and iv only.

25-4 Calculating the Potential from the field

25-04

Question 570 0.21-44%

Consider an insulating infinite plane sheet of uniform charge density sigma. The electric potential at point A is 200 V and at point B is 350 V as shown in Figure 4. What is the charge density on the plane sheet?

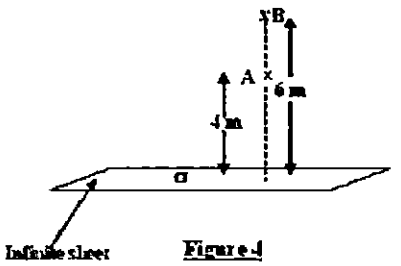


Figure 4

(a) 1.33 nano-C/m**2
(b) 2.64 nano-C/m**2
(c) 0.652 nano-C/m**2
(d) -0.652 nano-C/m**2
(e) -1.33 nano-C/m**2

25-04

Question 571 0.40-73%

Figure 6 shows three points X, Y and Z forming an equilateral triangle of side S in a uniform electric field of strength E. A unit positive test charge is moved from X to Y, then from Y to Z, and from Z back to X. Which one of the following correctly gives the work done by an external agent in moving the charge along the various parts of the path?

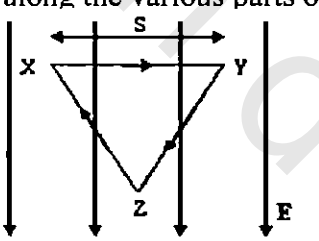


Figure 6

(a) -E*S, -E*S*tan(60 degrees) , + E*S*Sin(60 degrees).
(b) 0, -E*S*Cos(60 degrees) , + E*S*Sin(60 degrees).
(c) 0, -E*S*Sin(60 degrees) , + E*S*Sin(60 degrees).
(d) 0, -E*S*Cos(60 degrees) , + E*S*Cos(60 degrees).
(e) E*S, -E*S*Sin(60 degrees) , + E*S*Cos(60 degrees).

25-5 Potential Due to a Point Charge

25-05

Question 572

A 4.0 nano-C point charge is located at the origin, and a second point charge (-5.0 nano-C) is placed on the y axis at y = 60 cm. If point A is at (45 cm, 0) and point B is at (80 cm, 0) what is the potential difference between points A and B (VA - VB)?

(a) 30 V
(b) 20 V
(c) zero
(d) 17 V
(e) 40 V

25-05
0.31-19%

Question 573
Consider a metallic sphere carrying a charge of 4.0*10**(-8) C and having a potential of 400 V. Find the diameter of the sphere.
(a) 3.6 m.
(b) 6.0 m.
(c) 4.2 m.
(d) 1.8 m.
(e) 1.2 m.

25-05
0.44-38%

Question 574
If an isolated metal sphere of radius r = 10 cm has a net charge of 4.0 micro-C. What is the potential on the surface of the sphere? [Consider V = 0 at infinity]
(a) 4.2*10**5 V.
(b) -4.2*10**6 V.
(c) 3.6*10**5 V.
(d) zero.
(e) 3.6*10**6 V.

25-5 Potential Due to a Group of Point Charges

25-06

Question 575
In Figure (2), if Q=4.0*10**-9 C, what is the potential difference V(A)-V(B)?

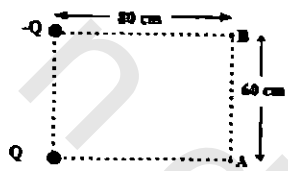


Figure # 2

(a) 22 V.
(b) 12 V.
(c) 18 V.
(d) 09 V.
(e) 27 V.

25-06

Question 576
Two point charges Q1 and Q2 are positioned as shown in Figure(2). If Q1 = 2.0*10**(-9) C, Q2 = - 2.0*10**(-9) C, a = 3.0 m, and b = 4.0 m, what is the electric potential difference, VA - VB?

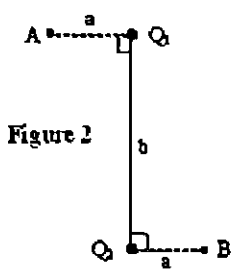


Figure 2

(a) -4.8 V
(b) 8.4 V
(c) 4.8 V
(d) -8.4 V
(e) -6.0 V

25-06
Question 577 0.54-54%

Consider the configuration shown in figure 2. What is Va - Vb ?

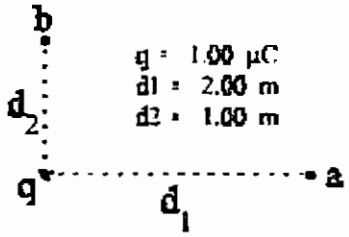


FIGURE 2

(a) - 13.5 kV
(b) + 6.75 kV
(c) + 4.50 kV
(d) - 4.50 kV
(e) + 13.5 kV

25-06
Question 578 0.63-50%

In figure 6, point P is at the center of the square. Find the net electric potential at point P. Assume V = 0 at infinity.

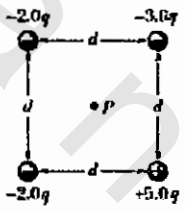


Figure 6

(a) - 2.8 kq/d
(b) + 2.8 kq/d
(c) zero
(d) + 1.4 kq/d
(e) - 1.4 kq/d

25-06
Question 579 0.49-58%

In figure (7), what is the net potential at point P due to the four point charges if **V** = 0 at infinity ? [take d = 2 cm, q = 1.0 micro-C].

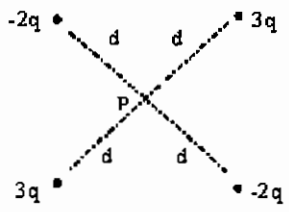


Figure (7)

(a) - 4.6*10**7 V.
(b) - 9.0*10**5 V.
(c) 9.0*10**5 V.
(d) Zero.
(e) 4.6*10**7 V.

25-06

Question 580 0.54-62%

Find the electrostatic potential at x = 0 for the following distribution of charges:-2q at x= 10 cm and -2q at x= -10 cm. [Take q = 1.0*10**(-9) C, and the electrostatic potential at infinity = 0]

(a) -180 V.
(b) -360 V.
(c) zero.
(d) 360 V.
(e) 180 V.

25-06

Question 581 0.51-21%

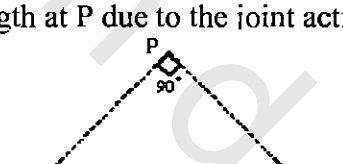
Two charged particles lie on the x axis as follows: a +70.0 nano-Coulomb at x = -7.00 m a -107 nano-Coulomb at x = -3.00 m What is the electric potential at the origin? (V = 0 at infinity)

(a) +276 V
(b) +131 V
(c) -350 V
(d) -231 V
(e) +456 V

25-06

Question 582 0.36-73%

In figure 4, the point charge Q1 causes an electric potential of 60 V and an electric field strength of 30 V/m at P, and the the point charge Q2, separately, causes an electric potential of 120 V and electric field strength of 40 V/m at P. Which of the following gives possible values of potential and field strength at P due to the joint action of Q1 and Q2?



Figure(4)

(a) -600 V, 10 V/m.
(b) 135 V, 50 V/m.
(c) 180 V, 50 V/m.
(d) 135 V, 70 V/m.
(e) 180 V, 70 V/m.

25-06

Question 583 0.39-54%

Two charges, q1=+2.0 micro-C and q2=-2.0 micro-C, are placed as shown in figure 2. At the midpoint between the charges, which one of the following statements correctly describes the electric field (E.F.) and the electric potential (E.P.)? [electric potential at infinity = 0]

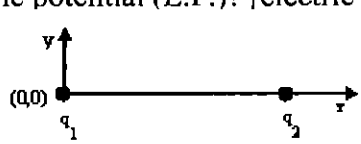


Figure 2

(a) E.F. is directed toward q2 and the E.P. is negative.
(b) E.F. is directed toward q1 and the E.P. is zero.
(c) E.F. is directed toward q2 and the E.P. is positive.
(d) E.F. is directed toward q1 and the E.P. is negative.
(e) E.F. is directed toward q2 and the E.P. is zero.

25-9 Calculating the field from the Potential

25-09
Question 584 0.55-54%
An infinite nonconducting sheet has a surface charge density 0.10*10**(-6) C/m**2 on one side. How far apart are equipotential surfaces whose potentials differ by 90 V?
(a) 2.0 cm.
(b) 1.6 cm.
(c) 0.88 cm.
(d) 1.8 cm.
(e) 2.5 cm.

25-09
Question 585 0.41-41%
The electric potential at points in an xy-plane is given by
V = 4.0*(x**2) - 5.0*(y**2),
where V is in volts, and x and y are in meters. What is the magnitude of the electric field at point (2.0 m, 3.0 m)?
(a) 15 V/m
(b) 28 V/m
(c) 25 V/m
(d) 31 V/m
(e) 34 V/m

25-09
Question 586 0.59-43%
The electric potential at point A in an electric field is 15 V smaller than at point B. If a charge q = -2.0 C is moved from A to B, then the electric potential energy of this charge will:
(a) increase by 30 J.
(b) decrease by 15 J.
(c) increase by 25 J.
(d) decrease by 30 J.
(e) increase by 15 J.

25-09
Question 587 0.50-64%
Two large, parallel, conducting plates are 20 cm apart and have charges of equal magnitude but opposite signs on their facing surfaces. An electron, placed anywhere between the two plates experiences an electrostatic force of 1.6*10**(-15) N. Find the magnitude of the potential difference between the two plates.
(a) 30 kV
(b) 50 kV
(c) 2 kV
(d) 10 kV
(e) 4 kV

25-09
Question 588 0.56-61%
The electric potential at points in the xyplane is given by: V = (x**3 - 2*x*y) Volts, where x and y are in meters. The magnitude of the electric field at the point with the coordinates x = 1 m and y = 2 m is:
(a) Sqrt(2) V/m.
(b) Sqrt(8) V/m.
(c) Sqrt(3) V/m.
(d) Sqrt(5) V/m.
(e) Zero.

25-09
Quest on 589 0.45-41%
The potential of a charge distribution is given by: V(x,y) = A [y*(x**2)- x*(y**2)], where A is in appropriate units. The electric field will be zero at the point:
(a) x = 0, and y = 0.
(b) x = 1, and y = -1.
(c) x = 0, and y = 1.
(d) x = 1, and y = 1.
(e) x = 1, and y = 0.

25-09
Quest on 590 0.55-44%
The electric potential in a certain region is given by: V = [2.00*(x**2)]-[3.00*(y**2)] where V is in volts and x and y are in meters. What is the magnitude of the electric field at the point (1.40 3.40)?
(a) 20.4 V/m
(b) 14.8 V/m
(c) 5.60 V/m
(d) 26.0 V/m
(e) 21.2 V/m

25-09
Question 591 0.51-61%
Points A [at (3,6) m] and B [at (8,-3) m] are in a region where the electric field is given by E = 12i (N/C), where i is a unit vector in the x direction. What is the electric potential difference VA-VB?
(a) -60 V
(b) +50 V
(c) -80 V
(d) +80 V
(e) +60 V

25-09
Question 592 0.19-81%
In figure 3, two large horizontal metal plates are separated by 4 mm. The lower plate is at a potential of -6.0 V. What potential should be applied to the upper plate to create an electric field of strength 4000 V/m UPWARDS in the space between the plates?

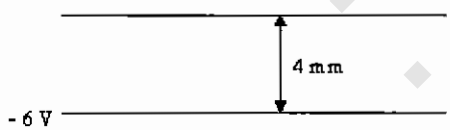


Figure (3)

(a) -16 V.
(b) 10 V.
(c) -10 V.
(d) -22 V.
(e) 22 V.

25-09
Question 593 0.36-62%
Over a certain region of space, the electric potential is give by: V(x,y) = x**2 +y**2 +2*x*y. Find the angle that the electric field vector makes with Z-axis at the point P(1.0,2.0,0.0)
(a) 75 degrees.
(b) 45 degrees.
(c) 90 degrees.
(d) 0 degrees.
(e) 60 degrees.

25-10 Electric Potential Energy of a System of Point Charges

25-10

Question 594 0.37-60%

Two charged parallel plates are separated by a distance of 3 mm. If an electron starts from rest at one plate and reaches the other plate with a final speed of 3.7*10**6 m/s, what is the change in electric potential between the initial position and the final position of the electron?

(a) -39 V
(b) +39 V
(c) +24 V
(d) -24 V
(e) -56 V

25-10

Question 595

Consider the four charges shown in Figure 5. How much work is required, by an external agent, to move the charge q to infinitv. (Take a = 1.0 micro-C.)

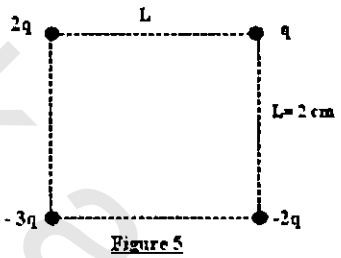


Figure 5

(a) 0.52 J
(b) -0.32 J
(c) -0.95 J
(d) 0.32 J
(e) 0.95 J

25-10

Question 596 0.28-43%

A metallic sphere of radius 8 cm is charged to a potential of -500 V (take V = 0 at infinity). An electron is initially 15 cm from the center of the sphere. What must the initial speed of the electron if be if it is to barely hit the sphere (vf = 0)?

(a) 3.2*10**5 m/s
(b) 32 m/s
(c) 4.5*10**4 m/s
(d) 9.1*10**6 m/s
(e) 7.8*10**7 m/s

25-10

Question 597 0.31-43%

Two point charges, one is Q1= 6 micro-C and located at (0, 12 cm) and the other is Q2= 6 micro-C and located at (0, -12 cm). How much work must be done by an external agent to move a charge Q3= -6 micro-C from the origin (0,0) to a point having coordinates (5 cm, 0)?

(a) -308 mJ
(b) zero
(c) 415 mJ
(d) 308 mJ
(e) -415 mJ

25-10

Question 598
A particle [m = 8.0*10**(-9) kg, q = +6.0*10**(-9) C] has a speed of 80 m/s at point A and moves to point B where the potential is 2.0*10**3 V greater than at point A. What is the particle's kinetic energy at point B? (Assume that only electric forces act on the particle during its motion.)
(a) 38*10**(-6) J.
(b) 28*10**(-6) J.
(c) 14*10**(-6) J.
(d) 40*10**(-6) J.
(e) 10*10**(-6) J.

25-10

Question 599
Four charges, (-e, +e, -e, +e), are arranged as in figure (2). Calculate the work required to remove the positive charge (+e) on the right side to infinity.

$a = 3 \times 10^{-10}$ m
e = charge of an electron

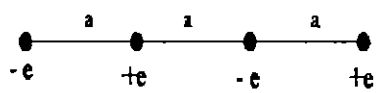


Figure 2

(a) 6.4*10**(-19) J.
(b) 3.2*10**(-19) J.
(c) 1.6*10**(-19) J.
(d) 0.8*10**(-19) J.
(e) 0.4*10**(-19) J.

25-10

Question 600
In figure 2, four charges are fixed at the corners of a square whose sides are of length d. The work done by an external agent to bring a fifth charge, Q, from infinity to the center of the square is:

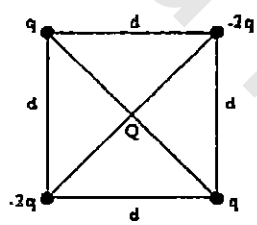


FIGURE 2

(a) - 2.8*k*q*Q/d.
(b) 3.4*k*q*Q/d.
(c) 1.4*k*q*Q/d.
(d) 1.4*k*q*Q/d.
(e) 2.8*k*q*Q/d.

25-10

Question 601
An electric dipole, of electric charge 9.3*10**(-12) C and distance 1.0*10**(-3) m, is in an electric field of strength 1100 N/C. What is the difference in potential energy corresponding to dipole orientations parallel and anti-parallel to the field?
(a) 3.87*10**(-11) J.
(b) 1.03*10**(-11) J.
(c) 6.15*10**(-15) J.
(d) 4.08*10**(-13) J.
(e) 2.05*10**(-11) J.

25-10

Question 602 0.54-47%

Two equal charges, each of 0.12 C, are separated by a distance of 1.8 m. What is the work done, by an external agent, to bring a charge of 0.15 C from infinity to the midpoint between the two charges?

(a) 2.1*10**8 J.
(b) 0.6*10**8 J.
(c) 1.7*10**7 J.
(d) 3.6*10**8 J.
(e) 2.0*10**8 J.

25-10

Question 603 0.21-57%

What is the electric potential energy of an electron at a distance r = 2.40*10**(-10) m from the nucleus of a hydrogen atom (the nucleus consists of a single proton)?

(a) 6.8 eV.
(b) - 6.8 eV.
(c) - 6.0 eV.
(d) 6.0 eV.
(e) - 8.5 eV.

25-10

Question 604

What is the external work required to bring four 2.0*10**(-9) C point charges from infinity and to place them at the corner of a square of side 0.14 m

(a) 0.6*10**(-6) Joule.
(b) 1.4*10**(-6) Joule.
(c) 1.0*10**(-6) Joule.
(d) 0.3*10**(-6) Joule.
(e) 1.8*10**(-6) Joule.

25-10

Question 605

In figure (6), Q1 = 2.0*10**(-6) C and Q2 = - 2.0*10**(-6) C. What is the external work needed to move a charge Q = - 4.0*10**(-6) C at constant speed from point A at the center of the square to point B at the corner?

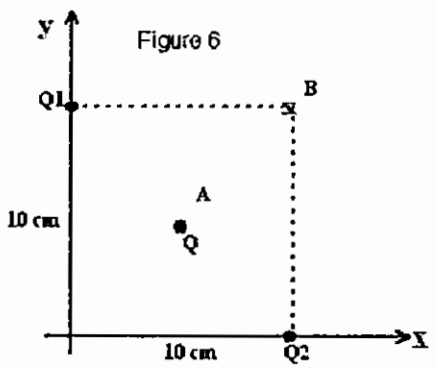


Figure 6

(a) 7.2*10**(-6) Joule.
(b) - 5.1*10**(-6) Joule.
(c) 5.1*10**(-6) Joule.
(d) - 7.2*10**(-6) Joule.
(e) Zero.

25-10
0.43-63%

Question 606

Two electrons are fixed 2.0 cm apart. Another electron is shot from infinity with a speed v and comes to rest at a point midway between the two electrons. Find v.

(a) 255 m/s
(b) 318 m/s
(c) 963 m/s
(d) 612 m/s
(e) 742 m/s

25-10
0.49-26%

Question 607

What is the electric potential energy of the charge configuration shown in figure 3 ?

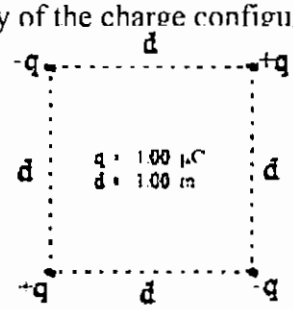


FIGURE 3

(a) zero
(b) + 46.5 mJ
(c) + 23.3 mJ
(d) - 46.5 mJ
(e) - 23.3 mJ

25-10
0.42-34%

Question 608

An electric dipole is placed perpendicular to a uniform electric field of magnitude 1*10**5 N/C. How much work must be applied by an external agent in order to align the dipole opposite to the field ? For the dipole : q = 1 micro-Coulomb and d = 2 mm.

(a) - 0.1 mJ
(b) + 0.1 mJ
(c) + 0.4 mJ
(d) + 0.2 mJ
(e) - 0.4 mJ

25-10
0.55-53%

Question 609

Two positive charges, each of magnitude Q, are fixed at two corners of an equilateral triangle (see figure 5). The work required, by an external agent, to move a third positive charge q from A to C is:

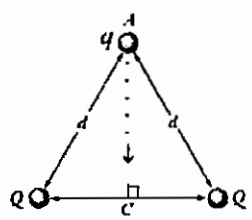


Figure 5

(a) zero
(b) + kQq/d
(c) - 2kQq/d
(d) - kQq/d
(e) + 2kQq/d

25-10
0.39-55%

Question 610

Two balls with charges 5.0 micro-C and 10 micro-C are at a distance of 1.0 m from each other. In order to reduce the distance between them to 0.5 m the amount of work to be performed is:

(a) 0.45 J.
(b) 4.5*10**(-4) J.
(c) 45.0 J.
(d) 1.2*10**(-4) J.
(e) 0.23 J.

25-10
0.47-59%

Question 611

Three point charges are initially infinitely far apart. Two of the point charges are identical and have charge Q. If zero net work is required to assemble the three charges at the corners of an equilateral triangle of side d, then the value of the third charge is

(a) - 2*Q.
(b) Q/2.
(c) - Q/2.
(d) - Q/3.
(e) Q/3.

25-10
0.50-66%

Question 612

In figure 9, two equal positive charges, each of magnitude 5.0*10**(-5) C, are fixed at point A and B separated by a distance of 6 m. An equal and opposite charge moves towards them along the line CO. At point C, 4.0 m from O, the kinetic energy of the moving charge is 4.0 J. What is the kinetic energy of this charge when it passes point O?

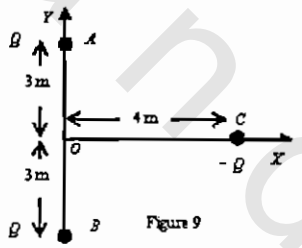


Figure 9

(a) 4.3 J.
(b) 10.0 J.
(c) 2.2 J.
(d) 19.0 J.
(e) 12.5 J.

25-10
0.53-57%

Question 613

In figure 4: q1 = +1.0 micro-Coulomb, q2= -1.0 micro-Coulomb, d = 1.0 mm and the particles were initially at rest. Particle 1 is fixed in position but particle 2 is free to move. Particle 2, with a mass of 0.010 g, is now released. What is its speed when its distance from particle 1 is d/2?

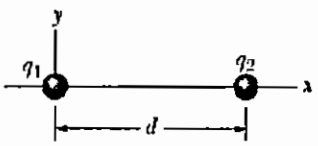


FIGURE 4

(a) 1.3*10**3 m/s
(b) 2.6*10**3 m/s
(c) 3.9*10**3 m/s
(d) 5.2*10**3 m/s
(e) 6.5*10**3 m/s

25-10
Question 614 0.32-67%
An electron and a proton are a distance of 1.5 nano-meter apart. How much work is required by an external agent to double the distance between the two particles? (The particles are at rest before and after the move.)
(a) +2.3*10**(-19) J
(b) -2.3*10**(-19) J
(c) -3.1*10**(-19) J
(d) +7.7*10**(-20) J
(e) -7.7*10**(-20) J

25-10
Question 615 0.48-69%
An electron is shot directly toward the center of a large metal plate that has excess negative charge with surface charge density 2.0*10**(-6) C/m**2. If the initial kinetic energy of the electron is 1.6*10**(-13)J and if the electron is to stop (owing to electrostatic repulsion from the plate) just as it reaches the plate, how far from the plate must it be shot?
(a) 4.4 m.
(b) 8.0 m.
(c) 22 m.
(d) 3.4 m.
(e) 1.2 m.

25-10
Question 616 0.33-62%
In the xy plane, a charge q1 = 3.0 micro-C located at (3.0 cm, 0.0) and another charge q2 = -4.0 micro-C located at (0.0 cm, 4.0 cm). How much work must be done, by an external agent, to bring these charges to their fixed positions starting from infinite separation. [Consider V = 0 at infinity]
(a) -2.2 J.
(b) 3.5 J.
(c) 1.5 J.
(d) -3.5 J.
(e) 2.2 J.

25-10
Question 617 0.31-75%
It is required 1.0 mJ of work to move two identical positive charges +q from infinite separation so that they are separated by a distance a. How much work is required to move four identical positive charges +q from infinite separation so that they are arranged at the corner of a square with edge length a? [Consider V = 0 at infinity]
(a) 6.5 mJ.
(b) 5.4 mJ.
(c) 2.0 mJ.
(d) 4.0 mJ.
(e) 3.5 mJ.

25-10
Question 618 0.38-51%
Two small charges (q1 =1.0*10**(-8) C and q2 =-4.0*10**(-8) C) move from an initial separation of 0.02 m to a final separation of 0.01 m. The change in their electrical potential energy is
(a) -2.7*10**(-4) J.
(b) 1.8*10**(-4) J.
(c) -3.2*10**(-4) J.
(d) -1.8*10**(-4) J.
(e) 3.2*10**(-4) J.

25-10

Question 619 0.43-44%

A point charge Q, at the center of a circle, is surrounded by six charges each of magnitude q at a distance r as shown in figure 4. How much work is done by an external agent to remove the charge Q from the center to infinity? [Consider the electrostatic potential at infinity = 0]

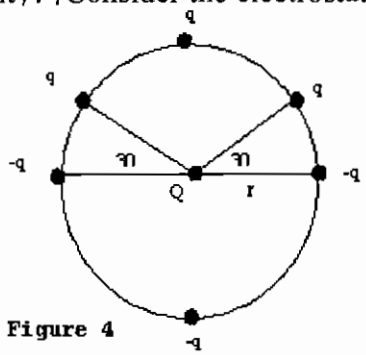


Figure 4

(a) zero.
(b) k*6*q/r**2.
(c) k*3*Q*q/r.
(d) k*6*Q*q/r**2.
(e) k*6*q/r.

25-10

Question 620 0.47-60%

Two protons, P, are fixed 6.0 m apart, as shown in figure 7. An electron, e, is released from point A. Find its speed at point O, midway between the protons.

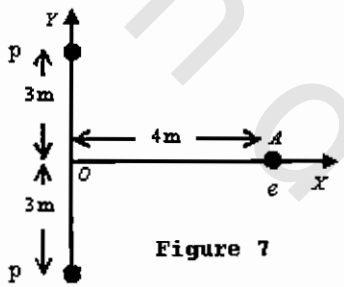


Figure 7

(a) 0.1 m/s.
(b) 24.0 m/s.
(c) 2.4 m/s.
(d) 11.6 m/s.
(e) 121 m/s.

25-11 Potential of a Charged Isolated conductor

25-11

Question 621 0.44-56%

Two conducting spheres are very far apart. The smaller sphere carries a total charge of 6 micro-C. The larger sphere has a radius twice that of the smaller sphere and is neutral (Q = 0). After the two spheres are connected by a thin conducting wire, the charges on the smaller and the larger spheres, respectively are:

(a) -4 micro-C and 10 micro-C
(b) 0 and 6 micro-C
(c) 2 micro-C and 4 micro-C
(d) -6 micro-C and 12 micro-C
(e) 3 micro-C and 3 micro-C

25-11

Question 622 0.33-32%

Consider two concentric (thin and conducting) spherical shells. The inner has a radius a = 15 cm and a charge of 10 nano-C. The outer shell has a radius b = 30 cm and a charge of -15 nano-C. Find the electric potential on the surface of the inner shell.

(a) 200 V
(b) 110 V
(c) 300 V
(d) 250 V
(e) 150 V

25-11

Question 623

A solid conducting sphere of radius R = 5.0 cm has a charge density of 2.0*10**(-6) C/m**2 on its surface. What is the electric potential at the center of the sphere? (Take V = 0 at infinity.)

(a) 2.2*10**4 V
(b) zero
(c) 7.2*10**4 V
(d) 3.6*10**4 V
(e) 1.1*10**4 V

25-11

Question 624 0.46-37%

Consider a solid conducting sphere of radius 10 cm and carrying a charge Q= -30 nano-C. Determine the potential difference (Vb-Va) between point "a" at the origin and point "b" 20 cm from the center of the sphere.

(a) 2700 V
(b) 1350 V
(c) zero
(d) -2700 V
(e) -1350 V

25-11

Question 625 0.32-35%

Which one of the following statements is TRUE for a metallic conductor:

(a) If it carries a net charge, then the charge must be uniformly distributed throughout its volume.
(b) If it carries a net charge, then the charge must be distributed on its surface.
(c) It cannot carry a net charge
(d) If it carries a net charge, then the charge has to be positive.
(e) The potential inside the conductor in static equilibrium is smaller than on the surface.

25-11

Question 626

Two conducting spheres are very far apart. The smaller sphere carries a total charge of 6 micro-C. The larger sphere has a radius twice that of the smaller sphere and is neutral (Q = 0). After the two spheres are connected by a thin conducting wire, the charges on the smaller and the larger spheres, respectively are:

(a) -4 micro-C and 10 micro-C.
(b) 3 micro-C and 3 micro-C.
(c) 0 and 6 micro-C.
(d) 2 micro-C and 4 micro-C.
(e) -6 micro-C and 12 micro-C.

25-11

Question 627

In figure (8), a hollow sphere, of radius r that carries a negative charge -q, is put inside another hollow sphere, of radius R that carries a positive charge Q. At a distance x from the common center, such that r < x < R, the potential is:

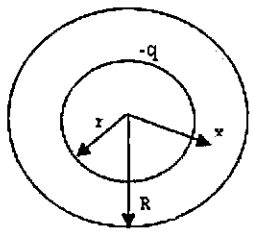


Figure 8

(a) k*[(Q/R)-(q/r)].
(b) k*[(Q/R)-(q/x)].
(c) k*[(Q/x)-(q/R)].
(d) k*[(Q/R)+(q/x)].
(e) k*[(Q/R)+(q/r)].

25-11

Question 628

In figure (5), a hollow sphere, of radius r that carries a negative charge -q, is put inside another hollow sphere, of radius R that carries a positive charge Q. At a distance x from the common center, such that r < x < R, the electric potential is:

(a) k*[(Q/R)+(q/r)].
(b) k*[(Q/R)-(q/r)].
(c) k*[(Q/R)+(q/x)].
(d) k*[(Q/x)-(q/R)].
(e) k*[(Q/R)-(q/x)].

25-11

Question 629 0.55-47%

Find the electric potential at the center of a charged metal sphere of radius 15 cm if the electric field at its surface is 1.2*10**4 N/C.

(a) 2.7 kV
(b) 1.8 kV
(c) 1.2 kV
(d) zero
(e) Infinity

25-11

Question 630 0.47-45%

Two conducting spheres A and B are electrically isolated. The smaller sphere A has a total charge of 6*10**(-8) C and radius R. Sphere B has a radius (2*R) and is neutral. After connecting the two spheres by a conducting wire, find the charge on sphere B.

(a) - 6*10**(-8) Coulomb
(b) + 6*10**(-8) Coulomb
(c) + 2*10**(-8) Coulomb
(d) + 4*10**(-8) Coulomb
(e) + 3*10**(-8) Coulomb

25-11
0.46-34%

Question 631

Which one of the following statements is CORRECT ?

(a) All points of a conductor in electrostatic equilibrium are at the same potential.
(b) If a conducting sphere carries a net charge, the charge will be uniformly distributed over its volume.
(c) Electric field lines are always in the direction of increasing electric potential.
(d) Electric field lines are always parallel to equipotential surfaces.
(e) The electric field at the surface of a conductor in electrostatic equilibrium is parallel to the surface of the conductor.

25-11
0.47-39%

Question 632

Which of the following statements are CORRECT:

1. Electric charge is quantized.
2. The potential at the center of a charged conductor is zero.
3. If E = 0 at a point P then V must be zero at P.
4. The electric field inside a charged conductor is zero.
5. If V = 0 at a point P then E must be zero at P.

(a) 1, 2, and 5.
(b) 1 and 4.
(c) 2 and 4.
(d) 1, 2 and 3.
(e) 3 and 5.

25-11
0.24-74%

Question 633

Consider two concentric conducting shells of radii (a) and (b), b > a. The smaller (inner) shell has a positive charge (q) and the larger (outer) shell has a charge (Q). If the potential on the inner shell is zero, what is the value of Q?

(a) Q = b*q/a.
(b) Q = - q.
(c) Q = -b*q/a.
(d) Q = -a*q/b.
(e) Q = a*q/b.

25-11
0.43-63%

Question 634

A +4.C pico-Coulomb charge is uniformly distributed over the surface of a solid conducting sphere of radius 8.0 mm. Point A is 4.0 mm from the center of the sphere and point B is 20 mm from the center of the sphere. Determine the electric potential difference VA - VB.

(a) +7.2 V
(b) -2.7 V
(c) -7.2 V
(d) +2.7 V
(e) +4.5 V

25-11
0.32-36%

Question 635

Which of the following statements are CORRECT:

(1) The electric flux through a Gaussian surface depends on the shape of the surface.
(2) The electric flux through a closed surface depends on the net charge enclosed by the surface.
(3) The electric field inside a uniformly charged solid conducting sphere in electrostatic equilibrium is zero.
(4) The electric potential inside a uniformly charged solid conducting sphere in electrostatic equilibrium is zero.

(a) 3 and 4 only.
(b) 1, 2, 3, and 4.
(c) 1 and 2 only.
(d) 4 only.
(e) 2 and 3 only.

Chapter 26 Capacitance

26-3 Calculating the capacitance

26-03

Question 636
A parallel plate capacitor of capacitance C has a charge of magnitude q when connected to a battery of potential difference V. After being fully charged, the capacitor is disconnected from the battery and the separation between the plates is doubled. Which one of the following statements is TRUE?
(a) The capacitor's capacitance doubles.
(b) The magnitude of the charge on the plates doubles.
(c) The voltage across the plates doubles.
(d) The magnitude of the charge on the plates is halved.
(e) The voltage across the plates is halved.

26-03

Question 637 (41-46%)
A parallel-plate capacitor having square plates of side 10 cm separated by a distance of 1 mm. If the capacitor is charged to 12 V, what is the magnitude of the charge found on each plate?
(a) zero
(b) 1.06 nano-C
(c) 2.12 nano-C
(d) 6.18 nano-C
(e) 8.48 nano-C

26-03

Question 638 (29-30%)
A parallel plate capacitor is connected to a battery that has a constant voltage. If the capacitor plates are pulled apart (while still connected to the battery),
(a) Both the electric field and the charge on the plates increase.
(b) Both the electric field and the charge on the plates decrease.
(c) The electric field remains constant and the charge on the plate decreases.
(d) Both the electric field and the charge on the plate remain constant.
(e) The electric field decreases and the charge on the plates remains constant.

26-03

Question 639
A parallel-plate capacitor has a plate area of 0.2 m**2 and a plate separation of 0.1 mm. If the charge on each plate has a magnitude of 4.0*10**(-6) C the electric field between the plates is approximately:
(a) Zero.
(b) 1.4*10**4 V/m.
(c) 9.2*10**3 V/m.
(d) 4.2*10**6 V/m.
(e) 2.3*10**6 V/m.

26-03

Question 640 (61-69%)
A parallel plate capacitor has a plate area of 0.2 m**2 and a plate separation of 0.1 mm. The charge on each plate is 4.0 microCoulombs. What is the electric field between the plates ?
(a) 1.0*10**6 V/m
(b) 4.0*10**12 V/m
(c) 2.3*10**6 V/m
(d) 4.0*10**2 V/m
(e) zero

26-03
0.25-27%

Question 641
Two concentric spherical shells of radii 10 cm and 5.0 cm are charged to a potential difference of 20 V. How much energy is stored in this spherical capacitor?
(a) 9.8*10**(-8) J .
(b) 5.4*10**(-9) J .
(c) 1.3*10**(-9) J.
(d) 3.1*10**(-7) J.
(e) 2.2*10**(-9) J.

26-03
0.14-79%

Question 642
A parallel-plate capacitor (with plates A and B) has circular shape of radius 6.0 cm separated by 2.0 mm. Find the total charges on both plates (A and B) when a 12 V battery is connected.
(a) 600 pico-C
(b) zero
(c) 700 pico-C
(d) 400 pico-C
(e) 10 pico-C

26-4 Capacitors in Parallel and in series

26-04

Question 643
How many 60 micro F capacitors would need to be connected in series in order to store a charge of 2.0*10**-4 C with a potential of 100 volts across the capacitors, see Figure (3)?

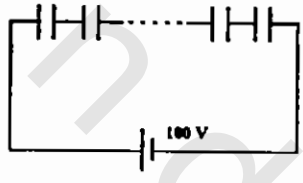


Figure # 3

(a) 43.
(b) 30.
(c) 21.
(d) 70.
(e) 35.

26-04
0.40-62%

Question 644
If Vab is equal to 50 V, find the charge stored and the potential difference across the 25 micro-F capacitor shown in Figure 5.

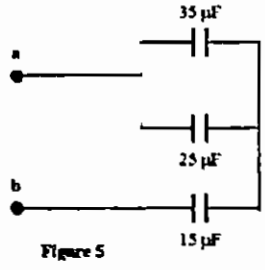


Figure 5

(a) 600 micro-C and 10 V
(b) 250 micro-C and 40 V
(c) 300 micro-C and 20 V
(d) 600 micro-C and 20 V
(e) 250 micro-C and 10 V

26-04

Question 645

A 30 micro-F capacitor charged to 3.0 V and a 50 micro-F capacitor charged to 4.0 V are connected to each other, positive plate to positive plate and negative to negative. What is the charge on the 50 micro-F capacitor after the two are so connected and equilibrium is reached?

(a) 320 micro-C
(b) 157 micro-C
(c) 290 micro-C
(d) 109 micro-C
(e) 181 micro-C

26-04

Question 646

0.32-28%

Fifty capacitors of equal capacitance are connected in parallel. The equivalent capacitance of the combination is 120 micro-F. What is the capacitance of each capacitor?

(a) 5.8 micro-F
(b) 60 micro-F
(c) 2.4 micro-F
(d) 0.42 micro-F
(e) 6.0 milli-F

26-04

Question 647

An isolated capacitor, C1 = 20.0 micro-F has a potential difference of 26.0 V. When an uncharged capacitor C2, of unknown value, is connected across C1, the potential difference becomes 16.0 V for both. What is the value of C2?

(a) 25.0*10**(-6) F.
(b) 12.5*10**(-6) F.
(c) 1.00*10**(-6) F.
(d) 10.2*10**(-6) F.
(e) 20.0*10**(-6) F.

26-04

Question 648

Calculate the total charge stored by a combination of three capacitors, 2.0*10**(-6) F, 4.0*10**(-6) F, and 6.0*10**(-6) F, when connected in series to a 10-V battery.

(a) 0.1*10**(-6) C.
(b) 11*10**(-6) C.
(c) 46*10**(-6) C.
(d) 0.9*10**(-6) C.
(e) 92*10**(-6) C.

26-04

Question 649

The equivalent capacitance between points a and b in the combination of capacitors in figure 6 is:

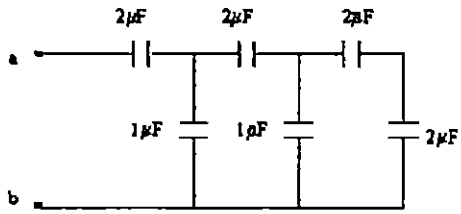


FIGURE 6

(a) 1.0*10**(-6) F.
(b) 3.0*10**(-6) F.
(c) 2.0*10**(-6) F.
(d) 1.5*10**(-6) F.
(e) 0.5*10**(-6) F.

26-04

Question 650 0.46-54%

Consider the circuit shown in figure (5). If C1 = 1 micro F, C2 = 6 micro F and C3 = 3 micro F, what is the charge on C3?

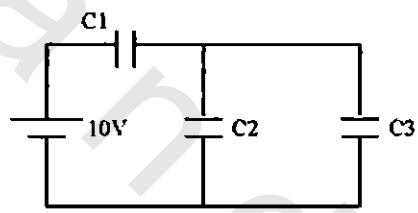


Figure 5

(a) 9 micro C.
(b) 6 micro C.
(c) 5 micro C.
(d) 3 micro C.
(e) 2 micro C.

26-04

Question 651 0.15-85%

A 2.5 micro F capacitor, C1, is charged to a potential difference V1 = 10 V, using a 10 V battery. The battery is then removed and the capacitor is connected to an uncharged capacitor, C2, with capacitance of 10 micro F. What is the potential difference across C1 and C2, respectively?

(a) 5 V, 5 V.
(b) 2 V, 2 V.
(c) 2 V, 8 V.
(d) 1 V, 9 V.
(e) 6 V, 6 V.

26-04

Question 652

A 2 micro-F and a 1 micro-F capacitor are connected in series and a potential difference is applied across the combination. The 2 micro-F capacitor has:

(a) half the charge of the 1 micro-F capacitor.
(b) zero of stored energy.
(c) twice the potential difference of the 1 micro-F capacitor.
(d) twice the charge of the 1 micro-F capacitor.
(e) half the potential difference of the 1 micro-F capacitor.

26-04

Question 653

Three identical capacitors have a capacitance of 3.0*10**(-6)F each. The equivalent capacitance of their series connection is "Cs" and the equivalent capacitance of their parallel connection is "Cp". The ratio Cs/Cp is:

(a) 1/4.
(b) 9.
(c) 1/9.
(d) 1.
(e) 2.

26-04

Question 654 0.53-55%

Figure 5 shows six capacitors each having a capacitance of 6-microFarad. The capacitance between points a and b is:

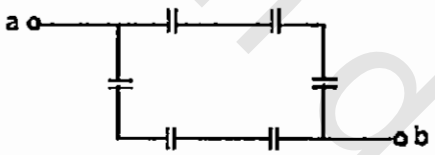


Figure 5

(a) 3 microFarad
(b) 4 microFarad
(c) 6 microFarad
(d) 1 microFarad
(e) 9 microFarad

26-04

Question 655 0.53-53%

Capacitor C1 has a capacitance of 4 micro-Farad. It is charged using a 100-volt battery. The battery is disconnected. Then, C1 is connected in parallel to another uncharged capacitor C2. Now, the potential difference between the plates of each capacitor is 40 V. What is the value of C2 ?

(a) 8 micro-Farad
(b) 6 micro-Farad
(c) 10 micro-Farad
(d) 2 micro-Farad
(e) 4 micro-Farad

26-04

Question 656 0.46-28%

Find the equivalent capacitance of three capacitors connected in series. Assume the three capacitors are: C1 = 2.00 micro-F, C2 = 4.00 micro-F and C3 = 8.00 micro-F.

(a) 3.01 micro-F.
(b) 15.4 micro-F.
(c) 1.14 micro-F.
(d) 0.88 micro-F.
(e) 26.1 micro-F.

26-04

Question 657 0.31-44%

In figure (8), find the total charge stored by the three capacitors if the potential difference V is 10.0 volts. Assume C1 = 10.0 micro-F, C2 = 5.00 micro-F and C3 = 4.00 micro-F.

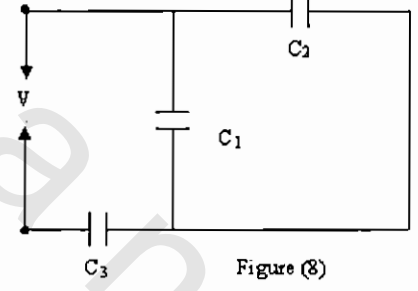


Figure (8)

(a) 63.4 micro-C.
(b) 26.1 micro-C.
(c) 31.6 micro-C.
(d) 61.3 micro-C.
(e) 22.1 micro-C.

26-04

Question 658 0.42-53%

Two capacitors, C1 and C2, are connected in series and a potential difference is applied to the combination. If the capacitor that is equivalent to the combination has the same potential difference, then the charge on the equivalent capacitors is the same as:

(a) The product of the charges on C1 and C2.
(b) The charge on C1 or C2.
(c) The sum of the charges on C1 and C2.
(d) The difference of the charges on C1 and C2.
(e) The ratio of the charges on C1 and C2.

26-04

Question 659 0.57-44%

A 10.0 micro-Farad capacitor is charged to a potential difference of 10.0 V. A 5.00 micro-Farad capacitor is charged to a potential difference of 5.00 V. The two charged capacitors are then connected to each other in parallel with positive plate connected to positive plate and negative plate connected to negative plate. What is the final common potential difference between the plates of each capacitor?

(a) 6.25 V
(b) 8.33 V
(c) 12.5 V
(d) 7.50 V
(e) 6.67 V

26-04

Question 660 0 65-33%

In figure 5, what is the electric charge on C4. C1 = 20, C2 = 10, C3 = 14, C4 = 30, and Vo = 45 V. Values of the capacitances are in micro-Farads.

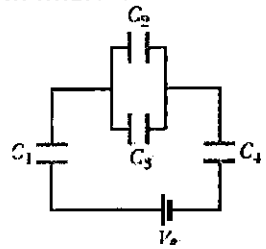


FIGURE 5

(a) 108 micro-Coulomb
(b) 262 micro-Coulomb
(c) 360 micro-Coulomb
(d) 330 micro-Coulomb
(e) 135 micro-Coulomb

26-04

Question 661 C.40-37%

The three capacitors in figure 5 have an equivalent capacitance of 12.4 micro-F, find the capacitance of C1.

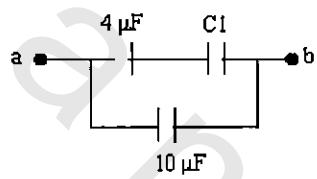


Figure (5)

(a) 7.0 micro-F
(b) 6.0 micro-F
(c) 10 micro-F
(d) 4.0 micro-F
(e) 5.0 micro-F

26-04

Question 662 C.44-68%

In figure 6, a capacitor of capacitance C = 9.0 micro-F is charged to a potential difference Vo = 10.0 volts. The charging battery is disconnected and the capacitor is connected to uncharged capacitor of unknown capacitance Cx. The potential difference across the combination is reduced to V = 3.0 volts. Find the value of Cx.

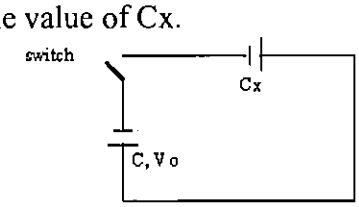


Figure (6)

(a) 3.0 micro-F.
(b) 11 micro-F.
(c) 8.0 micro-F.
(d) 21 micro-F.
(e) 42 micro-F.

26-04
0.21-70%

Question 663
Consider two separate capacitors: c1=30 micro-F carries a charge of q1=6.0*10**2 micro-C and c2=50 micro-F, carries a charge of q2=1.0*10**3 micro-C. If the opposite polarity terminals of the two capacitors are connected together as shown in figure 10, find the new voltage across c1.

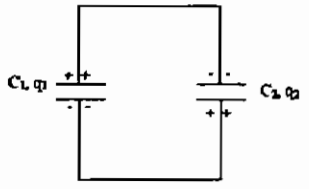


Figure 10

(a) 5.0 Volts.
(b) 10 Volts.
(c) 3.8 Volts.
(d) 2.2 Volts.
(e) 15 Volts.

26-5 Energy Stored In an Electric field

26-05
0.51-61%

Question 664
If C = 24 micro-F and Vab is equal to 20 V, what is the total energy stored by the group of capacitors shown in Figure 4?

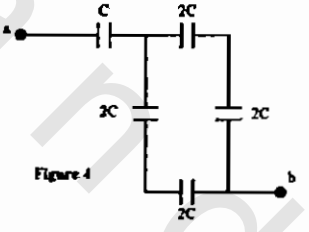


Figure 4

(a) 1.5 mJ
(b) 6.4 mJ
(c) 2.5 mJ
(d) 5.2 mJ
(e) 3.2 mJ

26-05

Question 665
A 9.0-V battery is connected to three capacitors as shown in Figure 6. What is the energy stored in the 6 micro-F capacitor?

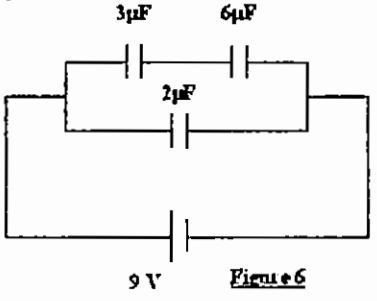


Figure 6

(a) 12 micro-J
(b) 62 micro-J
(c) 35 micro-J
(d) 27 micro-J
(e) 53 micro-J

26-05

Question 666 0.45-39%

In Figure 5, if C1= 40 micro-F, C2= 30 micro-F, C3= 36 micro-F,C4= 52 micro-F, and V0= 20 V, what is the energy stored in capacitor C3?

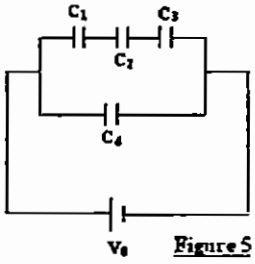


Figure 5

(a) 749 micro-J
(b) 236 micro-J
(c) 300 micro-J
(d) 352 micro-J
(e) 121 micro-J

26-05

Question 667

Consider the combination of capacitors in Fig. (3). The energy stored in the 5 micro-F capacitor is 0.20 J. The energy stored in 4 micro-F capacitor is:

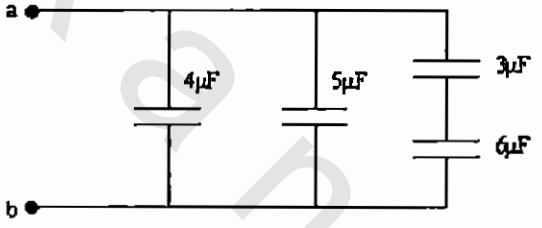


Figure 3

(a) 0.04 J.
(b) 0.40 J.
(c) 0.36 J.
(d) 0.16 J.
(e) 0.20 J.

26-05

Question 668

A parallel combination of two capacitors, C1 and C2 where C2=2*C1, is connected to a battery. If the charge accumulated on C1 is 2.0*10**(-6) C and the total energy stored in the combination is 12.0*10**(-9) Joule, then the capacitance of C2 is:

(a) 1.5*10**(-6) F.
(b) 2.5*10**(-6) F.
(c) 1.5*10**(-3) F.
(d) 1.0*10**(-3) F.
(e) 3.0*10**(-6) F.

26-05

Question 669

Capacitors A and B are identical. Capacitor A is charged so it stores 4 J of energy and capacitor B is uncharged. The capacitors are then connected in parallel. The total stored energy in the capacitors is now:

(a) 8 Joules.
(b) 4 Joules.
(c) 1 Joules.
(d) 2 Joules.
(e) 16 Joules.

26-05
0.53-43%

Question 670

In figure 6: V = 100 V, C1 = 10.0, C2 = 5.00, C3 = 4.00. All capacitor values are in micro-Farads. What is the energy stored in C1 ?

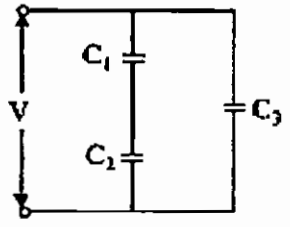


Figure 6

(a) 11.2 mJ
(b) 5.56 mJ
(c) 1.12 mJ
(d) 50.0 mJ
(e) 10.3 mJ

26-05
0.55-63%

Question 671

For the system of capacitors shown in figure 4, what is the total energy stored by the capacitors ?

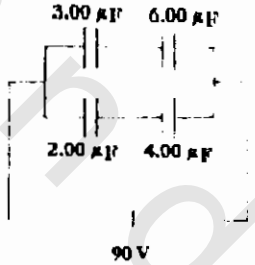


FIGURE 4

(a) 14.6 mJ
(b) 29.2 mJ
(c) 13.5 mJ
(d) 0.150 mJ
(e) 27.0 mJ

26-05
0.29-63%

Question 672

In figure 7, C1 = 12 micro-Farads, C2 = 6 micro-Farads and C3 = 20 micro-Farads. What is the total energy stored by the capacitors ?

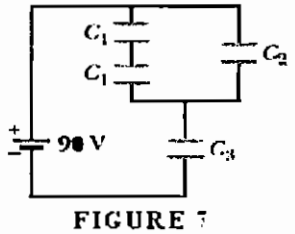


FIGURE 7

(a) 0.491 mJ
(b) 88.4 mJ
(c) 30.4 mJ
(d) 0.100 mJ
(e) 0.981 mJ

26-05
Question 673 0 39-23%
A battery is used to charge a parallel-plate capacitor. The battery is disconnected, and then, the plates are pulled apart to twice their original separation. This process will double the :
(a) capacitance
(b) surface charge density on each plate
(c) electric field between the plates
(d) stored energy
(e) charge on each plate

26-05
Question 674 0 39-75%
An isolated conducting sphere whose radius R is 2.00 cm has a charge q = 16.0*10(-9) C. What is the energy density at the surface of the sphere?
(a) 0.57 J/m**3.
(b) 0.01 J/m**3.
(c) 3.66 J/m**3.
(d) 1.22 J/m**3.
(e) 2.22 J/m**3.

26-05
Question 675 0 42-22%
A parallel-plate air-filled capacitor, of area 25 cm**2 and plate separation of 1.0 mm, is charged to a potential difference of 600 V. Find the energy density between the plates.
(a) 3.2 J/m**3.
(b) 7.4 J/m**3.
(c) 0.3 J/m**3.
(d) 1.9 J/m**3.
(e) 1.6 J/m**3.

26-05
Question 676 0 36-52%
A parallel-plate capacitor has plates of area A and separation d and is charged by a battery of a potential difference V. If the charging battery is disconnected, then the work required, by external agent, to separate the plates of the capacitor to infinite distance is: [Take A = 2.0 m**2, V = 12 Volts, d = 3.0 cm]
(a) -89 nano-J.
(b) 12 nano-J.
(c) 65 nano-J.
(d) 42 nano-J.
(e) 22 nano-J.

26-05
Question 677 0 46-47%
Three capacitors C1=5 micro-F, C2=10 micro-F and C3= 3 micro-F are connected to a 20 V battery as shown in Figure 8. Find the stored electric energy in C2.

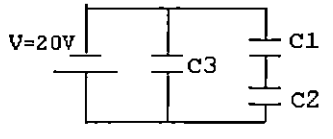


Figure 8

(a) 4.0*10**(-6) J.
(b) 2.2*10**(-4) J.
(c) 1.0*10**(-5) J.
(d) 1.3*10**(-4) J.
(e) 0.3*10**(-4) J.

26-6 Capacitor with a Dielectric

26-06

Question 678 0.56-60%

A certain air filled parallel-plate capacitor is connected across a 20 V battery. When the battery is disconnected and a dielectric slab is inserted into and fills the region between the plates, the voltage across the plates drops by 12 V. What is the dielectric constant of the slab?

(a) 2.5
(b) 1.7
(c) 0.4
(d) 2.1
(e) 0.6

26-06

Question 679 0.38-40%

A parallel-plate capacitor is to be constructed using paper as a dielectric. If the maximum voltage before breakdown is 3.2*10**3 V, what thickness of dielectric is needed? (The dielectric strength of paper is 16*10**6 V/m).

(a) 0.6 mm
(b) 0.8 mm
(c) 0.4 mm
(d) 0.2 mm
(e) 0.5 mm

26-06

Question 680

A 72-V battery is connected across a 0.50 micro-F, air filled, parallel-plate capacitor. With the battery still connected, the space between the plates is filled with a dielectric, whereupon the charge on the capacitor is increased by 90 micro-C. What is the dielectric constant of the dielectric?

(a) 2.5
(b) 1.5
(c) 5.0
(d) 4.5
(e) 3.5

26-06

Question 681 0.31-52%

A 6-micro-F air filled capacitor is connected across a 100 V battery. After the capacitors is fully charged, it is immersed in transformer oil (dielectric constant of 4.5). How much additional charge flows from the battery if it remains connected during the immersion process?

(a) 11 mC
(b) 0.37 mC
(c) 43 mC
(d) 2.1 mC
(e) 3.8 mC

26-06

Question 682
Find the WRONG statement: When a dielectric materials is inserted between the plates of an isolated capacitor, it will provide the following advantages:
(a) Increase the maximum operating voltage of the capacitor.
(b) Increase the capacitance of the capacitor.
(c) Mechanical support between the conducting plates.
(d) Increase the maximum energy that can be stored in the capacitor.
(e) Increase the original charge on the conducting plates.

26-06

Question 683
A parallel-plate capacitor, of capacitance 1.0*10**(-9) F, is charged by a battery to a potential difference of 12.0 volts. The charging battery is then disconnected and oil with dielectric constant = 4.0 fills the inside space between the plates. The resulting potential difference in volts, between the plates is:
(a) 3.0*10**(-9).
(b) 1.0*10**(-9).
(c) 48.
(d) 12.
(e) 3.

26-06

Question 684 0 51-44%
Consider an isolated capacitor of capacitance C0 and charge Q0. Which of the following statements is true when a dielectric slab is inserted between the plates of the capacitor?
(a) The energy stored in the capacitor does not change.
(b) The potential difference across the capacitor does not change.
(c) The capacitance goes to zero.
(d) The capacitance of the capacitor does not change.
(e) The charge on the capacitor does not change.

26-06

Question 685 0 51-35%
A parallel plate capacitor, with the space between the plates filled with polystyrene, has a capacitance of 10 nano-F. If the separation between the plates is 3.5 cm and the dielectric constant of the polystyrene is 2.6, what is the area of each plate?
(a) 2.50 m**2
(b) 0.11 m**2
(c) 0.04 m**2
(d) 15.2 m**2
(e) 1.20 m**2

26-06

Question 686 0 49-53%
The potential difference between the plates of an isolated, charged capacitor is Vo. A slab of dielectric material is inserted filling completely the space between the plates. The potential difference across the capacitor is now Vo/2. Find the dielectric constant of the material.
(a) 2
(b) 4
(c) 0.5
(d) 16
(e) 8

26-06
0.63-44%

Question 687

The space between the plates of a 2.0-nanoFarad parallel-plate capacitor is completely filled with a dielectric of dielectric constant k = 5. A battery is used to charge the capacitor to a potential difference of 100 V. Then the battery is disconnected and the dielectric is pulled completely out of the capacitor. What is the final energy stored in the capacitor ?

(a) 0.5*10**(-5) J
(b) 1.0*10**(-5) J
(c) 2.0*10**(-5) J
(d) 5.0*10**(-5) J
(e) 0.2*10**(-5) J

26-06
0.14-79%

Question 688

An air filled parallel-plate capacitor has a capacitance of 1.00*10**(-12) F. The plate separation is then doubled and a wax dielectric is inserted, completely filling the space between the plates. As a result the, capacitance becomes 2.00*10**(-12) F. The dielectric constant of the wax is:

(a) 0.50.
(b) 8.00.
(c) 0.25.
(d) 4.00.
(e) 2.00.

26-06
0.00-0%

Question 689

A parallel-plate capacitor has an area A and a separation d. Find its capacitance if it is filled with two dielectrics as shown in figure 3. [Co is the capacitance of the air-filled parallel-plate capacitor. K1 = 3 and K2 = 1.5 are the dielectric constants]

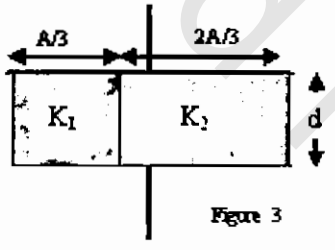


Figure 3

(a) 3*Co.
(b) 6*Co.
(c) Co.
(d) 4*Co.
(e) 2*Co.

26-06
0.25-66%

Question 690

A parallel plate capacitor is fully charged to potential V. A dielectric with dielectric constant k = 4 is inserted between the plates of the capacitor while the potential difference between the plates remains constant. Which one of the following statements is INCORRECT?

(a) The capacitance increases by a factor of four.
(b) The electric field between the plates increases by a factor of four.
(c) The energy density remains unchanged.
(d) The stored energy increases by a factor of four.
(e) The charge on the capacitor increases by a factor of four.

26-06
0.40-56%

Question 691

A 25 micro-F parallel plates capacitor is constructed using Pyrex glass as a dielectric. If the thickness of the Pyrex glass sheet is doubled, calculate the new capacitance of the capacitor. (Dielectric constant of Pyrex Glass = 5.6)

(a) 50.0 micro-F.
(b) 30.2 micro-F.
(c) 100 micro-F.
(d) 6.25 micro-F.
(e) 12.5 micro-F.

Chapter 27 Current and Resistance

27-2 Electric current

27-02

Question 692 0.39-33%

The sum of the currents entering a junction equals the sum of the currents leaving that junction is a consequence of:

(a) Newton's second law
(b) Coulomb's law
(c) conservation of charge
(d) Ampere's law
(e) conservation of energy

27-02

Question 693

If 4.7*10**(16) electrons pass a particular point in a wire every minute, what is the current in the wire?

(a) 2.9*10**(-3) A.
(b) 9.1*10**(-3) A.
(c) 1.3*10**(-4) A.
(d) 2.9*10**(-5) A.
(e) 4.7*10**(-3) A.

27-02

Question 694

A portion of a circuit is shown in figure (6), with the values of the currents given for some branches. What is the direction and value of the current I?

Figure 6

(a) Up, 4 A.
(b) Down, 4 A.
(c) Down, 2 A.
(d) Up, 6 A.
(e) Down, 6 A.

27-02

Question 695 0.54-55%

Conduction electrons move to the right in a certain wire. This indicates that:

(a) the current density points to the left but the direction of the electric field is unknown.
(b) the current density and the electric field both point to the right.
(c) the current density points to the right but the electric field points to the left.
(d) the current density points to the left but the electric field points to the right.
(e) the current density and the electric field both point to the left.

27-02

Question 696 0.03-20%
Three wires are joined together at a junction. A 0.40-A current flows toward the junction from one wire and a 0.3-A current flows away from the junction in the second wire. The current in the third wire is
(a) 0.10-A, toward the junction.
(b) 0.70-A, toward the junction.
(c) 0.10-A, away from the junction.
(d) 0.70-A, away from the junction.
(e) 0.30-A, toward the junction.

27-3 Current Density

27-03
Question 697 0.41-39%
A cylindrical wire of radius R = 2.0 mm has a uniform current density J = 2.0*10**(5) A/m**2. What is the current through the portion of the wire between radial distances R/3 and R/2? (see figure 1)

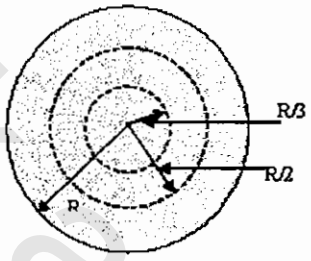


Figure 1

(a) 0.35 A.
(b) 5.31 A.
(c) 1.95 A.
(d) 3.73 A.
(e) 9.11 A.

27-03
Question 698 0.45-30%
A conducting wire has a length of 10 m and is made of a material with a resistivity of 1.0*10**(-8) ohm*m. What is the current density in the wire if the potential difference between its ends is 0.50 V?
(a) 5.0*10**(-10) A/(m**2)
(b) 5.0*10**(-8) A/(m**2)
(c) 5.0*10**(-9) A/(m**2)
(d) 5.0*10**6 A/(m**2)
(e) 5.0*10**8 A/(m**2)

27-4 Resistance and Resistivity

27-04
Question 699 0.53-60%
A 10-m long wire has a cross section area of 0.5 mm**2. The material of the wire has a resistivity of 5.0*10**(-8) ohm*m at 20 degree-C. A potential difference of 1.0 V is maintained across the ends of the wire. If the resistance changes by 0.3 ohms for a temperature change of 60 C-degree, what is the temperature coefficient of resistivity of this material?
(a) 7.8*10**(-4) /C-degree
(b) 1.7*10**(-3) /C-degree
(c) 3.9*10**(-4) /C-degree
(d) 5.0*10**(-3) /C-degree
(e) 2.5*10**(-3) /C-degree

27-04

Question 700 0.54-41%

At 40 degrees-C the resistance of a gold wire is 80 Ohms. What is the resistance of the same wire at 60 degrees-C? (Alpha(gold) = 3.4*10**(-3) /C-degrees).

(a) 98 Ohms
(b) 90 Ohms
(c) 85 Ohms
(d) 88 Ohms
(e) 95 Ohms

27-04

Question 701

A wire having a resistance of 3 Ohms is stretched so that its length is tripled while its volume remains unchanged. The resistance of the stretched wire is:

(a) 9 Ohms
(b) 1 Ohm
(c) 3 Ohms
(d) 1/3 Ohm
(e) 27 Ohms

27-04

Question 702 0.48-41%

Determine the radius of an aluminum wire which has a resistance of 33 Ohms per 1000 m of length of the wire. (Resistivity of aluminum is 2.8*10**(-8) Ohms*m.)

(a) 1.0 mm
(b) 0.76 mm
(c) 2.2 mm
(d) 0.52 mm
(e) 0.11 mm

27-04

Question 703 0.38-54%

A metallic wire has the smallest resistance when it is

(a) thick, long and hot.
(b) thick, short and cool.
(c) thin, long and hot.
(d) thin, short and cool.
(e) thin, short and hot.

27-04

Question 704 0.29-36%

A copper cable is to be designed to carry a current of 3 A with a power loss of 2 milli-watts per meter. What is the required radius of the copper wire? (resistivity of copper is 1.7*10**(-8) ohms-m.).

(a) 4.9 cm
(b) 0.36 cm
(c) 36 cm
(d) 0.49 cm
(e) 3.6 cm

27-04

Question 705

For an Ohmic conductor of length L and radius r, which one of the following statements is FALSE:

(a) Resistivity has a units of Ohm.m.
(b) with increasing the length L the resistance increases.
(c) The voltage across the conductor increases linearly with the current passing through it.
(d) with increasing the temperature of the conductor the resistance increases.
(e) with increasing the radius r the resistance increases.

27-04

Question 706

At what temperature would the resistance of a conductor be double its resistance at 30 degrees Celsius? [The temperature coefficient of resistivity of the conductor is 2.0*10**(-2) K**-1]

(a) 80 degrees Celsius.
(b) 50 degrees Celsius.
(c) -20 degrees Celsius.
(d) 60 degrees Celsius.
(e) 20 degrees Celsius.

27-04
0 39-39%

Question 707

A solid piece made of copper has the shape and dimensions shown in figure (6). Determine the resistance for the current that flows through the solid in the z-direction. (resistivity of copper = 1.69*10**(-8) ohm-meter).

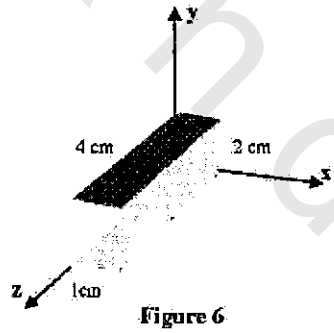


Figure 6

(a) 8.5*10**(-7) ohms.
(b) 2.1*10**(-7) ohms.
(c) 3.4*10**(-6) ohms.
(d) 2.9*10**(-5) ohms.
(e) 8.5*10**(-6) ohms.

27-04
0 54-35%

Question 708

At 20 degree C, a 100-W light bulb has a resistance of 12 ohms. To increase the resistance of the light bulb to 48 ohms, the temperature of the filament should be: [Assume the temperature coefficient of resistivity of the filament is constant and = 0.006 (degree C)**(-1)].

(a) 576 degree C.
(b) 500 degree C.
(c) 520 degree C.
(d) 150 degree C.
(e) 654 degree C.

27-04

Question 709

A copper wire "1" has a length L1 and diameter d1. Another copper wire "2" has a length L2 and diameter d2. At constant temperature, the second conductor has smaller resistance if:

(a) d2 = d1 and L2 > L1.
(b) d2 < d1 and L2 < L1.
(c) d2 < d1 and L2 = L1.
(d) d2 > d1 and L2 < L1.
(e) d2 > d1 and L2 > L1.

27-04

Question 710

A cylindrical copper rod has resistance R. It is reformed to half of its original length with no charge in the volume. It's new resistance is:

(a) 2*R.
(b) 8*R.
(c) R.
(d) R/4.
(e) R/2.

27-04
0.63-50%

Question 711

A copper wire of cylindrical shape has resistance R. What is the resistance of a second wire, made of the same material, that is twice as long and has twice the diameter ?

(a) 4R
(b) 2R
(c) R/2
(d) R/4
(e) R

27-04
0.36-45%

Question 712

A bar of copper is heated from 280 K to 300 K. Which of the following statements is NOT TRUE?

(a) Its mass will remain unchanged.
(b) Its density will increase slightly.
(c) Its weight will remain unchanged.
(d) Its electrical resistance will increase slightly.
(e) Its length will increase slightly.

27-04
0.47-58%

Question 713

A 20% increase in the resistance of a copper wire was noticed when its temperature was raised above room temperature. Find the final temperature of the wire if the temperature coefficient of resistivity for copper is 4.0*10** (-3) /K. [Assume the room temperature = 290 K]

(a) 300 K.
(b) 351 K.
(c) 340 K.
(d) 999 K.
(e) 322 K.

27-04
0.:5-46%

Question 714
The resistivity of nichrome wire is 1.0*10**(-6) Ohm.m. Calculate the length of wire needed for a 1200 watt electric heater that is connected across a 120 V potential difference. [The wires radius is 0.40 mm]

(a) 4.5 m.
(b) 8.0 m.
(c) 6.0 m.
(d) 1.5 m.
(e) 3.0 m.

27-04
0.-0-32%

Question 715
Figure 7 shows three cylindrical copper conductors along with their face areas and length. Rank them according to the current through them, greatest first, when the same potential difference V is placed across their lengths.

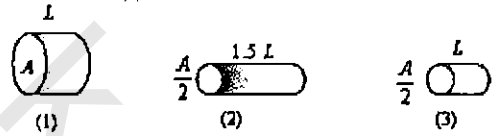


Figure (7)

(a) 1,3 and 3.
(b) 2,1 and 3.
(c) 1,2 and 3.
(d) 3,2 and 1.
(e) 1,3 and 2.

27-04
0.. 0-26%

Question 716
What diameter must a copper wire have if its resistance is to be the same as that of an equal length of an aluminum wire with 3.26 mm diameter? [Resistivity of aluminum = 2.75*10**(-8) Ohm.m; Resistivity of copper = 1.69*10**(-8) Ohm.m;]
(a) 2.6 mm.
(b) 3.3 mm.
(c) 4.0 mm.
(d) 8.3 mm.
(e) 10 mm.

27-5 Ohm's Law

27-05
0.-1-35%

Question 717
A hair dryer of resistance 80 ohms is plugged into a 120-V line. The charge passing through it in one hour is:
(a) 900 coulombs.
(b) 1.5 coulombs.
(c) 5400 coulombs.
(d) 2400 coulombs.
(e) 90 coulombs.

27-05

Question 718 0.45-37%

A potential difference of 9.0 V is applied across the length of a cylindrical conductor with radius 2.0 mm. Calculate the current density if the conductor has a resistance of 90 ohms.

(a) 5.0*10**3 A/m**2.
(b) 2.3*10**7 A/m**2.
(c) 6.0*10**3 A/m**2.
(d) 2.0*10**3 A/m**2.
(e) 8.0*10**3 A/m**2.

27-05

Question 719 0.42-19%

A current of 5.0 A exists in a 10 ohms resistor for 5.0 min. How many electrons pass through any cross section of the resistor in this time?

(a) 6.1*10**23
(b) 7.8*10**21
(c) 9.4*10**21
(d) 1.2*10**21
(e) 3.3*10**22

27-05

Question 720 0.33-18%

If 5.00*10**21 electrons pass through a 20.0-ohm resistor in 10.0 minutes, what is the potential difference across the resistor?

(a) 26.7 V
(b) 32.3 V
(c) 21.4 V
(d) 54.1 V
(e) 37.4 V

27-7 Power in Electric Circuits

27-07

Question 721

The filaments of two tungsten bulbs A and B are made with wires of the same length. At 110 Volts, the power dissipated from A and B are 400 W and 100 W, respectively. Ignore the variation of resistance with respect to temperature. The ratio of the diameter of filament A to the diameter of filament B is

(a) 4:1.
(b) 1:1.
(c) 1:4.
(d) 1:2.
(e) 2:1.

27-07

Question 722 0.51-63%

How many electrons pass, in 10 minutes, through a light bulb rated at 30 W when it is operated at 120 V?

(a) 7.8*10**20 electrons
(b) 6.5*10**20 electrons
(c) 7.8*10**21 electrons
(d) 9.4*10**20 electrons
(e) 2.2*10**21 electrons

27-07

Question 723
In one hour, how many electrons pass between the terminals of a 12-V car battery when a 96 watts headlight is used?
(a) 2.8*10**23 electrons
(b) 2.6*10**19 electrons
(c) 5.0*10**19 electrons
(d) 1.8*10**23 electrons
(e) 6.6*10**22 electrons

27-07

Question 724
An electric device, which heats water by immersing a resistance wire in the water, generates 300 J of heat per second when an electric potential difference of 12 V is placed across its ends. What is the resistance of the heater wire?
(a) 0.58 Ohms
(b) 2.1 Ohms
(c) 0.94 Ohms
(d) 0.48 Ohms
(e) 0.81 Ohms

27-07

Question 725 0.28-39%
A light bulb is rated at 30 W and operates at 120 V. How much charge passes through this bulb in 1 minute?
(a) 12 Coulombs
(b) 120 Coulombs
(c) 15 Coulombs
(d) 7.0 Coulombs
(e) 19 Coulombs

27-07

Question 726
In one hour, how many electrons pass between the terminals of a 12-V car battery when a 96 watts headlight is used?
(a) 2.8*10**23 electrons.
(b) 6.6*10**22 electrons.
(c) 1.8*10**23 electrons.
(d) 2.6*10**19 electrons.
(e) 5.0*10**19 electrons.

27-07

Question 727
A resistance operated at 110 Volts has a power output of 100 Watt. What is the percentage increase of the power if the voltage increase to 121 Volts. (Assume that the resistance stays constant.)
(a) 0.9%.
(b) 21%.
(c) 11%.
(d) 25%.
(e) 3.7%.

27-07

Question 728
If 110 Volts is applied to a wire, the current density is 1.5*10**6 A/m**2. If the resitivity of the wire is 48.2*10**(-8) Ohm.m, the length of the wire is:
(a) 19 m.
(b) 38 m.
(c) 152 m.
(d) 76 m.
(e) 254 m.

27-07

Question 729
An electric device, which heats water by immersing a resistance wire in the water, generates 153 J of heat per second when an electric potential difference of 12 V is placed across its ends. What is the resistance of the heater wire?
(a) 0.58 Ohms
(b) 2.10 Ohms
(c) 0.94 Ohms
(d) 0.48 Ohms
(e) 0.81 Ohms

27-07
0.20-22%

Question 730
At T = 20 degrees-C, the length of a wire is 10 m, and its cross sectional area is 0.50 mm**2. A potential difference of 1.0 V is maintained across the ends of the wire. The resistance of the wire changes by 0.30 ohms for a temperature change of 50 Celsius degrees. what is the temperature coefficient of resistivity of the wire ? At T = 20 degrees, the resistivity is 5.0*10**(-6) ohm*m.

(a) 6.0*10**(-4) degrees**(-1)
(b) 15*10**(-3) degrees**(-1)
(c) 15*10**(-4) degrees**(-1)
(d) 6.0*10**(-5) degrees**(-1)
(e) 15*10**(-5) degrees**(-1)

27-07
0.31-42%

Question 731
A current of 0.300 A is passed through a lamp for 2.00 minutes using a 6.00-V battery. The energy dissipated by the lamp during the 2.00 minutes is:
(a) 36.0 J
(b) 216 J
(c) 12.0 J
(d) 1.80 J
(e) 20.0 J

27-07
0.43-72%

Question 732
A copper wire of cross sectional area 3.00*10**(-6) m**2 and length 4.00 m has a current of 2.25 A uniformly distributed across that area. How much electric energy is converted to thermal energy in 10.0 minutes ? [The resistivity of copper is 1.68*10**(-8) ohm*m]
(a) 30.2 J
(b) 68.0 J
(c) 21.7 J
(d) 0.50 J
(e) 13.6 J

27-07
Question 733 0.52-44%
A heater element of resistance 10**3 Ohm is constructed to operate at 110 V. How much thermal energy is produced in one hour by the heater?
(a) 6.2*10**5 J.
(b) 2.2*10**7 J.
(c) 1.9*10**5 J.
(d) 5.1*10**2 J.
(e) 4.4*10**4 J.

27-07
Question 734 0.52-47%
An unknown resistor dissipates 0.50 W when connected to a 3.0 V potential difference. How much will this resistor dissipate when connected to a 1.0 V potential difference? (Assume that the value of the resistance does not change).
(a) 0.056 W
(b) 1.5 W
(c) 0.50 W
(d) 6.0 W
(e) 0.17 W

27-07
Question 735 0.56-29%
A potential difference (V) is applied across a cylindrical metallic wire of radius r and length L. Both V and L are doubled, but r is halved. Which of the following statements is CORRECT?
(a) The power dissipated will increase by a factor of 8.
(b) The power dissipated will increase by a factor of 4.
(c) The power dissipated will decrease by a factor of 16.
(d) The power dissipated will decrease by a factor of 2.
(e) The power dissipated will increase by a factor of 2.

27-07
Question 736 0.29-73%
A heating coil is immersed in a 0.2 kg of cold water. The coil is connected to a 12 V supply and a current of 5 A flows for 140 seconds. Calculate the temperature increase of the water. [Specific heat of water is 4200 J/(kg*K)]
(a) 12 K.
(b) 10 K.
(c) 30 K.
(d) 5 K.
(e) 15 K.

27-07
Question 737 0.59-52%
A 500 W electric heater is designed to operate from a 120-V power supply. The line voltage decreases and the heater takes only 459 W. Find the voltage drop in the line voltage (Assuming the resistance is constant).
(a) 10 Volts.
(b) 5 Volts.
(c) 2 Volts.
(d) 15 Volts.
(e) 3 Volts.

27-07
0.45-23%

Question 738

A 1200-W heater is used to heat 2.0 kg of water from 30 degrees Celsius to 80 degrees Celsius. What is the minimum time in which this can be done? [specific heat of water = 4.181 kJ/(kg*K)]

(a) 418 s.
(b) 60 s.
(c) 696 s.
(d) 348 s.
(e) 120 s.

Chapter 28 Circuits

28-3 Calculating the Current in a Single-Loop Circuit

Question 739 0.37-56%

Kirchoffs two laws for electric circuits can be derived by using certain conservation laws. On which conservation laws do Kirchoffs laws depend?

(a) charge ; mass.
(b) current ; charge.
(c) charge ; energy.
(d) current ; angular momentum.
(e) mass; energy.

28-03

28-4 Other Single-Loop Circuits

28-04

Question 740

A battery is connected to a resistor, and a current of 4.0 A exists in the circuit. When an additional 15-Ohm resistor is added to the circuit in series with the original resistor, the current drops to 1.0 A. What is the emf of the battery?

(a) 15 Volts.
(b) 25 Volts.
(c) 50 Volts.
(d) 20 Volts.
(e) 30 Volts.

28-04

Question 741 0.48-37%

Three resistors, of resistance 2.0 Ohm, 4.0 Ohm and 6.0 Ohm, are connected to a 24 Volt battery as shown in figure (2). The power dissipated in the 2.0 Ohm resistor is:

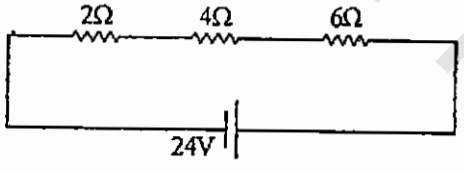


Figure (2)

(a) 8 W.
(b) 4 W.
(c) 24 W.
(d) 12 W.
(e) 48 W.

28-04

Question 742 0.24-51%

Two light bulbs, of 25 Watts and 100 Watts, are connected in series to 110 Volts source. Which of the following statements is correct:

(a) The current in the 100 Watts bulb is greater than that in the 25 Watts bulb.
(b) The current in the 100 Watts bulb is less than that in the 25 Watts bulb.
(c) The current in the 100 Watts bulb is the same as that in the 25 Watts bulb.
(d) Each bulb will have a potential difference of 55 Volts.
(e) Both bulbs will light with equal brightness.

28-04
Question 743 0.28-58%
An electrical source with internal resistance r = 2.0 Ohm is used to operate a lamp of resistance R = 18 Ohm. What fraction of the total power is delivered to the lamp?
(a) 0.8.
(b) 0.5.
(c) 1.8.
(d) 0.9.
(e) 0.2.

28-5 Potential Differences

28-05
Question 744 0.49-47%
In Figure 4, if I = 1.5 A in the circuit segment shown, what is the potential difference Vb-Va?

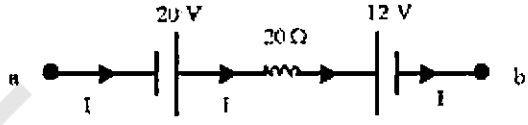


Figure 4

(a) - 38 V
(b) + 12 V
(c) + 38 V
(d) + 22 V
(e) - 22 V

28-05
Question 745 0.39-43%
In Figure 3, the current in the 3 ohms resistor is 4 A. The potential difference Vb - Va is:

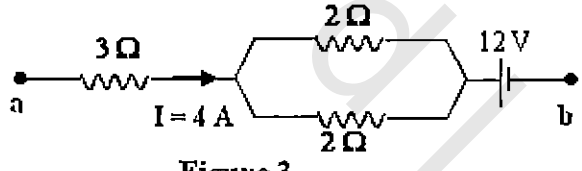


Figure 3

(a) -28 V
(b) -22 V
(c) 12 V
(d) 22 V
(e) 28 V

28-05
Question 746 0.12-65%
If the current I in figure (5) is equal to 4.0 A, then the potential difference between point 1 and 2, i.e. (V2 - V1), is:

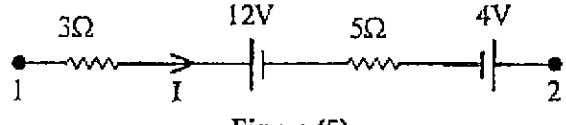


Figure (5)

(a) - 24 Volts.
(b) 24 Volts.
(c) 40 Volts.
(d) - 40 Volts.
(e) Zero.

28-05

Question 747 0 42-69%

A battery is connected across a series combination of two identical resistors. If the potential difference across the terminals of the battery is V, and the current in the battery is I, then

(a) the potential difference across each resistor is V and the current in each resistor is I/2.
(b) the potential difference across each resistor is V/2 and the current in each resistor is I.
(c) the potential difference across each resistor is V/2 and the current in each resistor is I/2.
(d) the potential difference across each resistor is V and the current in each resistor is I.
(e) the potential difference across each resistor is V/2 and the current in each resistor is 2I.

28-05

Question 748 0 50-48%

In figure 5, the current in the 5.0-ohm resistor is 3.0 A. What is the potential difference Va - Vb ?

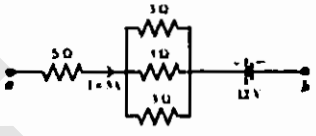


FIGURE 5

(a) + 30 V
(b) - 6.0 V
(c) + 6.0 V
(d) + 54 V
(e) - 30 V

28-05

Question 749 0 52-25%

In figure 2, a battery of emf of 12-Volt and internal resistance of r = 3.0 Ohm is connected to a bulb of resistance R. If the bulb will light at a steady current of 0.1 A, what should the value of R be?

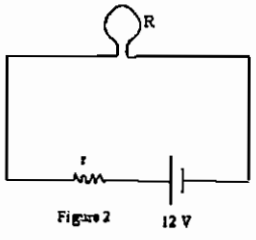


Figure 2

(a) 117 Ohm.
(b) 40 Ohm.
(c) 200 Ohm.
(d) 130 Ohm.
(e) 35 Ohm.

28-05

Question 750 0 38-50%

The current in single-loop circuit is 5.0 A. When an additional resistance of 2.0 Ohm is added in series, the current drops to 4.0 A. What was the resistance in the original circuit?

(a) 6.0 Ohm.
(b) 1.0 Ohm.
(c) 8.0 Ohm.
(d) 2.0 Ohm.
(e) 4.0 Ohm.

28-05

Question 751

In the circuit shown in figure 1, calculate potential difference VB-VA. The points A, B and C are three junctions. [Take the current I=2.0 A]

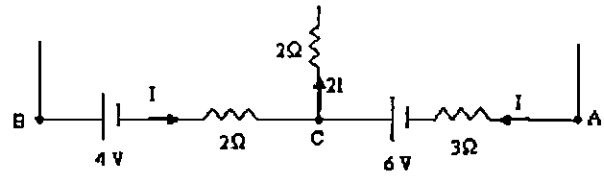


Figure (1)

(a) 12 V.
(b) 9.0 V.
(c) 7.0 V.
(d) 11 V.
(e) 8.0 V.

28-6 Multi-Loop Circuits

28-06

Question 752

In figure (4) V=14 Volts, R1=2-Ohm, R2=10-Ohm, R3=4-Ohm and R4=6-Ohm. Find the current passing through R1.

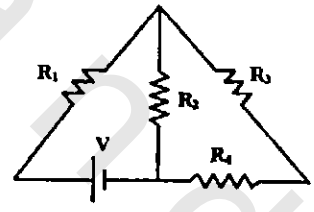


Figure # 4

(a) 2 A.
(b) 3 A.
(c) 5 A.
(d) 9 A.
(e) 1 A.

28-06

Question 753

In figure (1), find the magnitude and direction of the current passing through the 3 Ohm resistor.

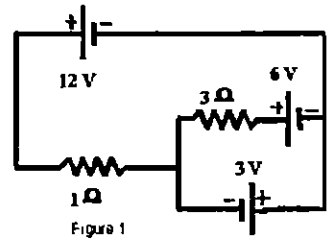


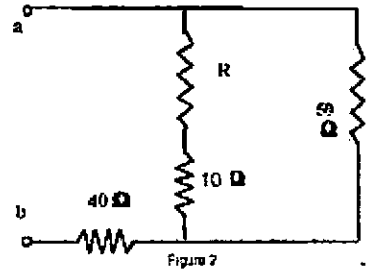
Figure 1

(a) 12 A, downwards.
(b) 6 A, downwards.
(c) 3 A, upwards.
(d) 4 A, upwards.
(e) 9 A, downwards.

28-06

Question 754

The equivalent resistance between terminals a and b in Figure (2) is 65 Ohm. Calculate the value of the resistor R.



(a) 60 Ohms.
(b) 40 Ohms.
(c) 25 Ohms.
(d) 10 Ohms.
(e) 80 Ohms.

28-06
0 61-51%

Question 755

What is the power dissipated in the 3-Ohm resistor shown in Figure 3?

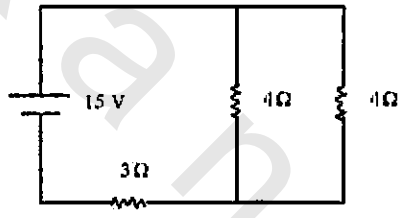


Figure 3

(a) 72 W
(b) 36 W
(c) 22 W
(d) 12 W
(e) 27 W

28-06
0 42-48%

Question 756

Find the value of R in the circuit shown in Figure 5.

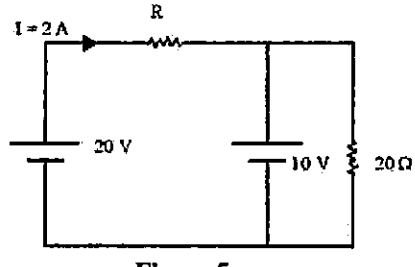


Figure 5

(a) 5 Ohms
(b) 8 Ohms
(c) 2 Ohms
(d) 1 Ohms
(e) 7 Ohms

28-06

Question 757
Calculate the voltage E of the battery shown in Figure 1.

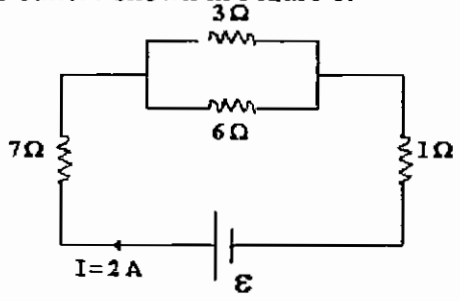


FIGURE 1

(a) 30 V
(b) 10 V
(c) 40 V
(d) 20 V
(e) 50 V

28-06

Question 758
The light bulbs in the circuit of Figure 2 are identical. When the switch S is closed, then:

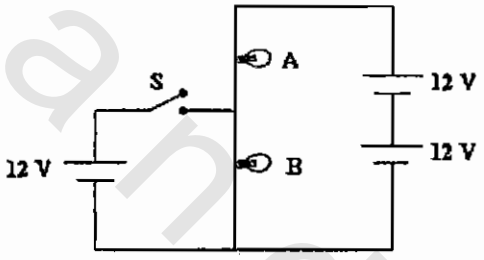


FIGURE 2

(a) nothing changes to the intensity of the light bulbs.
(b) the intensities of both light bulbs increase.
(c) the intensity of light bulb B increases while the intensity of light bulb A decreases.
(d) both light bulbs turn off.
(e) the intensity of light bulb A increases while the intensity of light bulb B decreases.

28-06

Question 759
The circuit in Figure 3 has been connected for a long time. Find the potential difference Vb - Va.

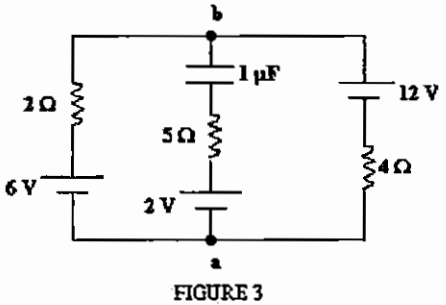


FIGURE 3

(a) 12 V
(b) 10 V
(c) 8 V
(d) 2 V
(e) 6 V

28-06

Question 760 0. 1-36%

Consider the circuit shown in Figure 2. What is the value of current in the 3-ohms resistor?

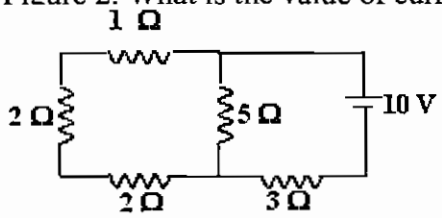


Figure 2

(a) 1.8 A
(b) 10 A
(c) 0.25 A
(d) 5.5 A
(e) 3.6 A

28-06

Question 761

In figure (3), if R = 2 Ohms, at what rate is the thermal energy being generated in the 4*R resistor?

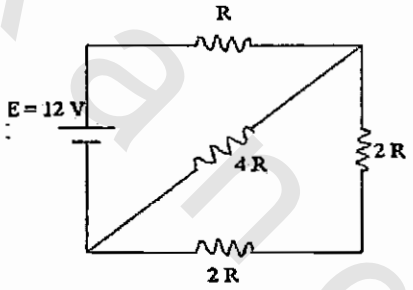


Figure 3

(a) 8 Watts.
(b) 16 Watts.
(c) 64 Watts.
(d) 24 Watts.
(e) 12 Watts.

28-06

Question 762

For the circuit shown in figure (4), if Va-Vc = 20 Volts, what is the potential difference Vɔ-Vd?

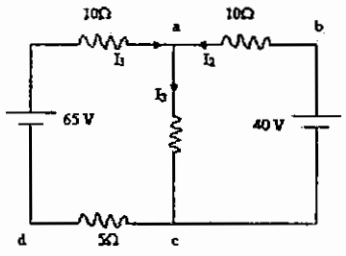


Figure 4

(a) -55 Volts.
(b) 25 Volts.
(c) -25 Volts.
(d) 35 Volts.
(e) 55 Volts.

28-06

Question 763
In figure (2), if Vc-Vd=6.0 Volts. what is the emf of the batterv?

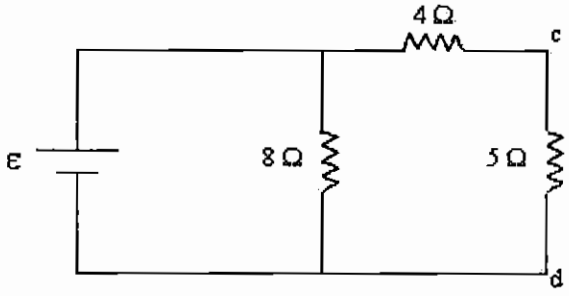


Figure 2

(a) 10.8 Volts.
(b) 13.9 Volts.
(c) 11.7 Volts.
(d) 9.61 Volts.
(e) 18.2 Volts.

28-06

Question 764
Finc the values of the currents in figure (3).

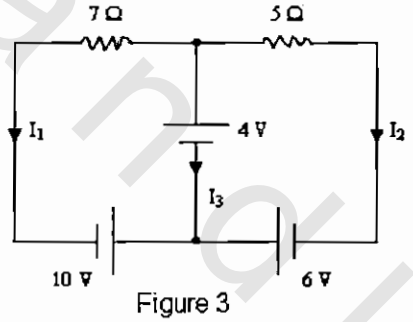


Figure 3

(a) I1 = 2 A, I2 = -2 A, I3 = zero.
(b) I1 = -2 A, I2 = -2 A, I3 = -4 A.
(c) I1 = 2 A, I2 = 2 A, I3 = -4 A.
(d) I1 = -2 A, I2 = 2 A, I3 = zero.
(e) I1 = 2 A, I2 = 2 A, I3 = 4 A.

28-06

Question 765
Which of the following statements are WRONG:

1. In order to achieve the lowest resistance from several resistors, they should be connected in parallel.
2. In order to achieve the lowest capacitance from several capacitors, they should be connected in parallel.
3. The resistance of a conductor does not depend on temperature.
4. A dielectric increases the capacitance of a capacitor.
5. The electric flux through a closed surface is always zero.

(a) 2, 3 and 5.
(b) 1 and 4.
(c) 1 and 3.
(d) 2 and 4.
(e) 1, 2 and 3.

28-06
0.33-29%

Question 766
The current in the 8.0 Ohm resistor shown in the circuit of figure (3) is:

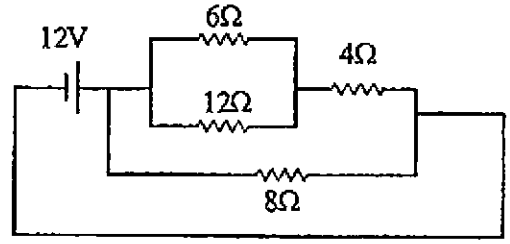


Figure (3)

(a) 2.4 A.
(b) 3.0 A.
(c) 1.5 A.
(d) 0.67 A.
(e) 0.4 A.

28-06

Question 767
In figure (5), all the resistors have a value of 2 Ohms. The battery is ideal with an emf = 15 V. What is the potential difference across the resistor R3?

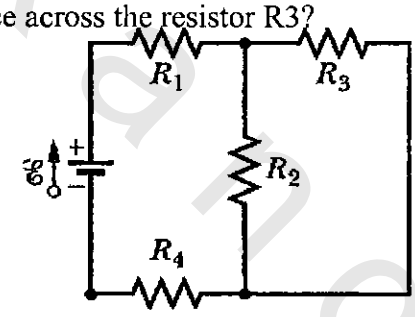


Figure 5

(a) 5.0 Volts.
(b) 2.5 Volts.
(c) 3.0 Volts.
(d) 1.5 Volts.
(e) 15 Volts.

28-06

Question 768
The current in the 5.0-ohm resistor in the circuit shown in figure (7) is:

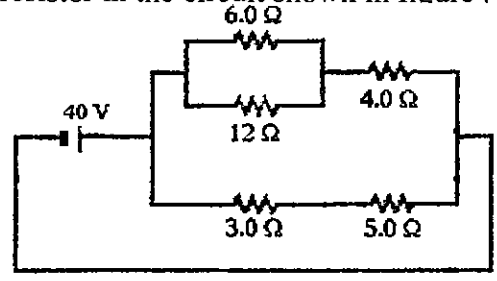


Figure 7

(a) 0.42 A.
(b) 5.0 A.
(c) 2.4 A.
(d) 3.0 A.
(e) 0.67 A.

28-06

Question 769

In figure (8), what is the potential difference Va-Vb

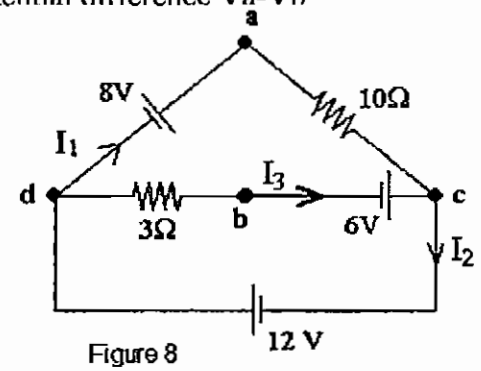


Figure 8

(a) 6 V.
(b) 10 V.
(c) 26 V.
(d) 2 V.
(e) 8 V.

28-06
0.53-51%

Question 770

In figure 6: R1 = 2.0 ohms, R2 = 4.0 ohms, R3 = 8.0 ohms, E1 = 2.0 volts, E2 = 4.0 volts and E3 = 6.0 volts. What is the rate of energy dissipation in R1 ?

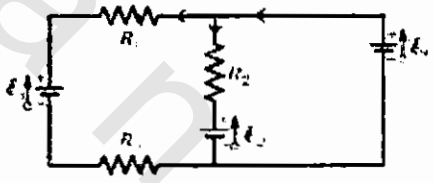


FIGURE 6

(a) 0.32 W
(b) 0.08 W
(c) 0.24 W
(d) 0.40 W
(e) 0.16 W

28-06
0.41-65%

Question 771

A metal wire of resistance R is cut into three equal pieces that are then connected side by side to form a new wire the length of which is equal to one-third the original length. What is the resistance of the new wire ?

(a) R/3
(b) R/9
(c) 3*R
(d) 9*R
(e) R

28-06
0.36-41%

Question 772

What maximum power can be generated from an 18-V battery using any combination of a 6 0-ohm resistor and a 9.0-ohm resistor ?

(a) 71 W
(b) 54 W
(c) 80 W
(d) 22 W
(e) 90 W

28-06
0.50-35%

Question 773

For the circuit shown in figure 4, find the potential difference VA - VB, if I1 = 3.0 A and I3 = 4.0 A.

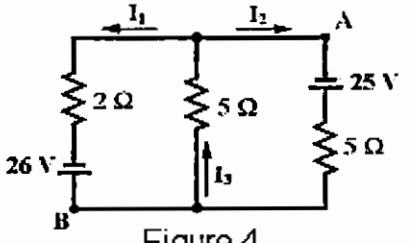


Figure 4

(a) - 30 V
(b) + 20 V
(c) - 20 V
(d) + 32 V
(e) - 32 V

28-06
0.35-65%

Question 774

The resistance between points a and b in figure 5 is 60 ohms. What is the value of R ?

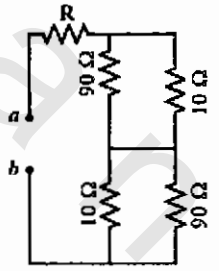


Figure 5

(a) 42 ohms
(b) 0.5 ohms
(c) 18 ohms
(d) 10 ohms
(e) 50 ohms

28-06
0.35-34%

Question 775

Calculate the power dissipated in the 6.0-ohm resistor in figure 6.

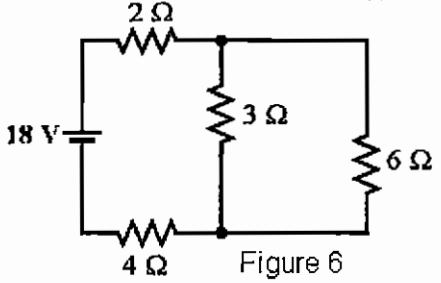


Figure 6

(a) 30 W
(b) 1.5 W
(c) 1.7 W
(d) 2.3 W
(e) 3.4 W

28-06
0.41-55%

Question 776

In figure 3, if R = 10 Ohm find the current in R.

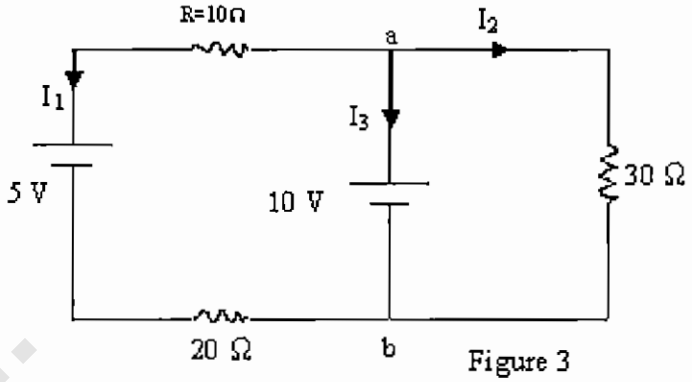


Figure 3

(a) 0.2 A.
(b) - 0.4 A.
(c) - 1.1 A.
(d) 0.4 A.
(e) - 0.2 A.

28-06
0.44-61%

Question 777

What is the power dissipated in 4.0 Ohm resistor in Figure 4.

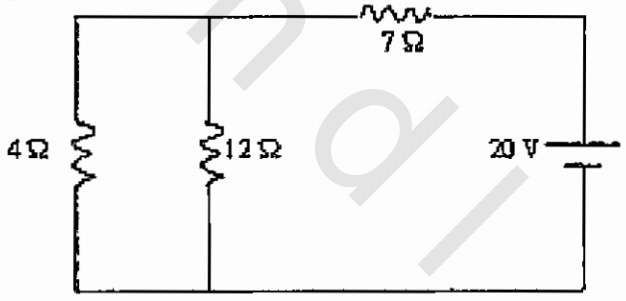


Figure 4

(a) 3.0 W.
(b) 9.0 W.
(c) 4.3 W.
(d) 1.2 W.
(e) 6.0 W.

28-06
0.5-44%

Question 778

A 6-V battery supplies a total of 48 W to two identical light bulbs connected in parallel. The resistance (in ohm) of each bulb is

(a) 1.5
(b) 3.0
(c) 4.0
(d) 1.0
(e) 0.7

28-06

Question 779 0.56-59%

Find the potential difference (VB-VA) between points B and A of the circuit shown in figure (4)

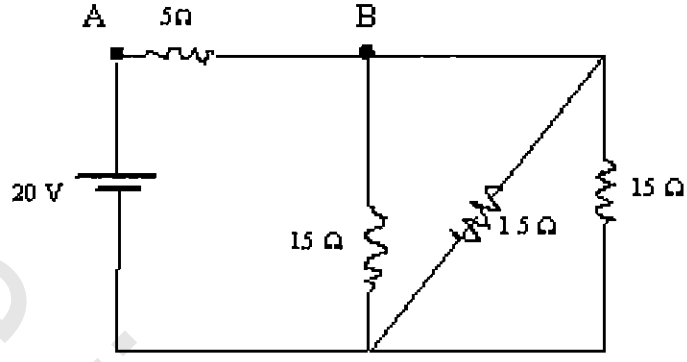


Figure 4

(a) 10 volts.
(b) 20 volts.
(c) 5 volts.
(d) - 10 volts.
(e) - 5 volts.

28-06

Question 780 0.51-61%

Find the value of R1 in the circuit of figure (5)

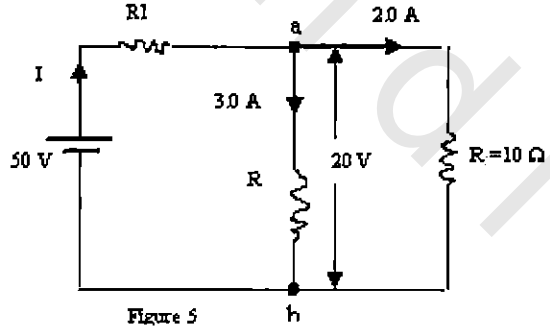


Figure 5

(a) 6.0 ohms.
(b) 8.0 ohms.
(c) 4.0 ohms.
(d) 9.0 ohms.
(e) 2.0 ohms.

28-06

Question 781 0.38-73%

A single loop circuit contains a resistance R and an ideal battery. If a second resistor is connected in parallel with R:

(a) the voltage across R will increase.
(b) the equivalent resistance of the circuit will increase.
(c) the total current through the battery will increase.
(d) the current through R will decrease.
(e) the rate of energy provided by the battery will not change.

28-06

Question 782 0.24-81%

Three resistors and two batteries are connected as in figure 3. What is the magnitude of the current through the 12-V battery?

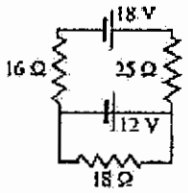


FIGURE 3

(a) 0.30 A
(b) 0.15 A
(c) 0.52 A
(d) 0.82 A
(e) 0.67 A

28-06

Question 783 0.43-41%

Three resistors are connected as shown in figure 3. The potential difference between points A and 3 is 26 V. How much current flows through the 4-Ohm resistor?

Figure 3

(a) 8.7 A
(b) 4.0 A
(c) 10.0 A
(d) 6.0 A
(e) 2.0 A

28-06

Question 784 0.52-43%

In the circuit shown in figure 4, I=0.65A and R=15 Ohms. What is the value of the emf of the battery?

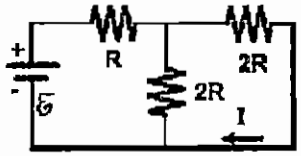


Figure 4

(a) 65 V
(b) 17 V
(c) 34 V
(d) 39 V
(e) 25 V

28-06
0.42-40%

Question 785
In the circuit shown in figure 5, what is the current in the 8.00-Ohm resistor?

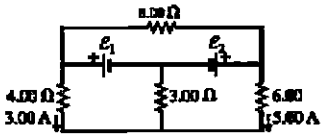


Figure 5

(a) 11.25 A to the right
(b) 3.38 A to the left
(c) 11.25 A to the left
(d) 2.25 A to the right
(e) 2.25 A to the left

28-06
0.27-23%

Question 786
A number of 240-Ohms resistors are connected in parallel to a 120-V source. If the maximum current allowed in the circuit is 9 A, determine the largest number of resistors, which can be used in this circuit without exceeding the maximum current.
(a) 9.
(b) 25.
(c) 36.
(d) 18.
(e) 34.

28-06
0.44-35%

Question 787
In figure 6, three identical light bulbs are connected to a battery. Which one of the following statements is CORRECT?

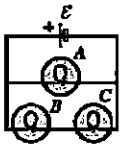


Figure 6

(a) The smallest current passes through A.
(b) The current through all resistors is the same.
(c) The largest current passes through A.
(d) The largest current passes through B.
(e) The largest current passes through C.

28-7 The Ammeter and the Voltmeter

28-8 RC circuits

28-08
0.48-50%

Question 788
A capacitor in an RC circuit is charged to 85% of its maximum value in 2.4 s. What is the time constant of this circuit?
(a) 2.4 s
(b) 1.9 s
(c) 1.3 s
(d) 2.9 s
(e) 0.9 s

28-08

Question 789

A 4.00 micro-F capacitor is charged to 24.0 V. Find the charge on the capacitor 4.00 milli-seconds after it is connected across a 200-Ohm resistor.

(a) 100 micro-C
(b) 0.647 micro-C
(c) 15.5 micor-C
(d) 2.45 micro-C
(e) 0.324 micro-C

28-08
0.32-28%

Question 790

Which one of the following statements is WRONG:

(a) The emf of a battery is equal to the terminal voltage when there is no current passing through the battery.
(b) Two resistors connected in parallel have the same potential difference across them.
(c) Kirchhoff's rules are statements of conservation of charge and energy.
(d) A charged capacitor connected to a resistor will discharge faster when the resistance is increased.
(e) If the voltage is held constant across a resistor, the power dissipated in the resistor decreases when the resistance increases.

28-08
0.50-37%

Question 791

A certain capacitor (initially uncharged), is connected in in series with a resistor and a battery. After, being charged for 10 ms the charge on the capacitor is half of its maximum value. What is the time constant (RC) of the circuit?

(a) 2.24 milli-s
(b) 45.3 milli-s
(c) 59.2 milli-s
(d) 20.5 milli-s
(e) 14.4 milli-s

28-08

Question 792

How long will it take a charged capacitor of 50.0*10**(-6) F to loss 30% of its initial energy if allowed to discharge through a 40 Ohm resistor?

(a) no enough information.
(b) 0.36*10**(-3) s.
(c) 0.18*10**(-3) s
(d) 0.02*10**(-3) s.
(e) Infinity.

28-08

Question 793

The capacitor in figure (1) is initially charged to 50 V and then the switch is closed. What charge flows out of the capacitor during the first minute after the switch was closed?

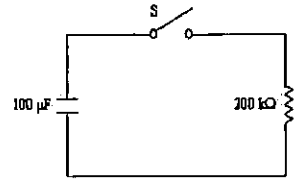


Figure 1

(a) 3.6 mC.
(b) 4.8 mC.
(c) 0.3 mC.
(d) 1.4 mC.
(e) 1.7 mC.

28-08

Question 794

At t=0, a 2.0*10**(-6) Farad capacitor is connected in series to a 20-V battery and a 2.0*10**6 Ohm resistor. How long does it take for the potential difference across the capacitor to be 12 V?

(a) 3.7 s.
(b) 2.0 s.
(c) 2.8 s.
(d) 0.6 s.
(e) 1.2 s.

28-08
0.59-50%

Question 795

A certain capacitor, in series with a 720-ohm resistor, is being charged. At the end of 10 milliseconds, its charge is 50 % of the maximum charge. The capacitance is:

(a) 20 micro-Farad
(b) 14 micro-Farad
(c) 10 micro-Farad
(d) 7.2 micro-Farad
(e) 9.6 micro-Farad

28-08
0.37-27%

Question 796

In the circuit shown in figure 3, the capacitor was initially uncharged. At time t = 0, switch S is closed. If T denotes the time constant, the current through the 3-ohm resistor at t = T/10 is

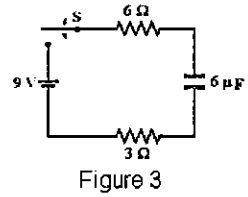


Figure 3

(a) zero.
(b) 0.90 A.
(c) 1.5 A.
(d) 2.5 A.
(e) 3.0 A.

28-08
Question 797 0.40-70%
A resistor R = 30*10**6 Ohm is connected in series with a capacitor C = 3.0 micro-F and a 21-Volt battery for long time. The battery was removed, then R and C are connected in a loop. What is the energy stored in the capacitor C after one minute?
(a) 47 micro-J.
(b) 11 micro-J.
(c) 204 micro-J.
(d) 24 micro-J.
(e) 174 micro-J.

28-08
Question 798 0.57-41%
A capacitor, initially uncharged in a single-loop RC circuit, is charged to 85% of its final potential difference in 2.4 s. What is its time constant in seconds?
(a) 2.8
(b) 1.5
(c) zero
(d) 1.7
(e) 1.3

28-08
Question 799 0.53-45%
A 1-micro-Farad uncharged capacitor and a 3000-ohm resistor are connected in series, and then (at time t = 0) a 6-V potential difference is applied across them. Find the time at which the voltage on the capacitor is 3.8 V.
(a) 8.0 ms
(b) 15 ms
(c) 1.5 ms
(d) 3.0 ms
(e) 12 ms

28-08
Question 800 0.24-64%
A capacitor of capacitance C is discharging through a resistor of resistance R. In terms of RC, when will the energy stored in the capacitor reduces to one fifth of its initial value?
(a) 0.70 RC.
(b) 1.20 RC.
(c) 0.55 RC.
(d) 0.80 RC.
(e) 0.35 RC.

28-08
Question 801 0.61-53%
A 5.0-micro-F capacitor is fully charged by connecting it to a 12-V battery. After disconnecting the battery, it was allowed for capacitor to discharge through a simple RC circuit, with a time constant of 4.0 s. What is the charge on the capacitor after one time constant has elapsed?
(a) 2.2*10**(-5) C
(b) 3.8*10**(-5) C
(c) 1.2*10**(-5) C
(d) 7.4*10**(-5) C
(e) 5.5*10**(-5) C

Chapter 29 Magnetic Fields

29-1 The Magnetic field

29-01

Question 802 0-10-42%

A loop of wire carrying a current of 2.0 A is in the shape of a right-angle triangle with two equal sides, each 15 cm long. A 0.70-T uniform magnetic field is in the plane of the triangle and is directed as shown in figure 7. The magnetic force on side 3 is :

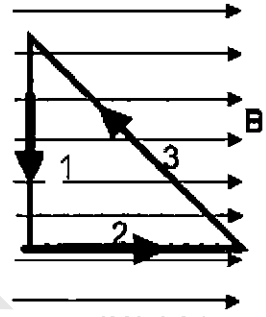


FIGURE 7

(a) 0.21 N, out the page
(b) 0.30 N, out of the page
(c) 0.30 N, into the page
(d) zero
(e) 0.21 N, into of the page

29-2 The Definition of B

29-02

Question 803

A charged particle moves in the positive x-direction with velocity v. If there is a magnetic field into the page, then the kinetic energy of the particle will

(a) be negative.
(b) oscillate.
(c) remain constant.
(d) decrease.
(e) increase.

29-02

Question 804

Which statement is WRONG:

(a) If an electron is deflected to the left by a magnetic field, a proton in the same field will deflect to the right.
(b) A straight current carrying wire aligned parallel to a magnetic field will experience no force.
(c) The force experienced by a moving charge in a magnetic field is directed tangentially to the magnetic field lines.
(d) The force due to a magnetic field on a moving charge does not change the energy of the charge.
(e) Magnetic field lines have no beginning or end.

29-02
0.55-47%

Question 805

An electron is projected into a uniform magnetic field B = (1.4i + 2.1j) T. Find the force on the electron when the velocity is v = (3.7*10**5 j) m/sec (i, j and k are the unit vectors in the x, y and z directions, respectively).

(a) (8.3*10**(-14) k) N
(b) (5.2*10**(-15) i) N
(c) (1.2*10**(-13) i) N
(d) ZERO
(e) (7.8*10**(-15) k) N

29-02
0.36-41%

Question 806

Which one of the following statements is TRUE A magnetic field cannot

(a) change the kinetic energy of a moving charged particle.
(b) accelerate a moving charged particle.
(c) be directed perpendicular to the velocity of the particle.
(d) exert a force on a moving charged particle.
(e) change the momentum of a moving charged particle.

29-02

Question 807

Find the CORRECT statement in the following: A magnetic field applies a force on a charged particle located within it:

(a) if the charge is moving parallel to the magnetic field lines.
(b) if the charge is moving not parallel to the magnetic field lines.
(c) never.
(d) always.
(e) if the charge is at rest.

29-02

Question 808

An electron is projected into a uniform magnetic field B = (1.4i + 2.1j) T. Find the force on the electron when the velocity is v = (3.7*10**5 j) m/sec. respectively).

(a) (1.2*10**(-13) i) N.
(b) (5.2*10**(-15) i) N.
(c) ZERO.
(d) (8.3*10**(-14) k) N.
(e) (7.8*10**(-15) k) N.

29-02

Question 809

An electron is projected into a uniform magnetic field B = (0.8 k) T. Find the magnitude of the magnetic force, on the electron when the velocity is:

v = (5.0*10**5 i + 3.0*10**5 j) m/sec.

(i, j and k are the unit vectors in the x, y and z directions, respectively).

(a) 7.8*10**(-18) N.
(b) ZERO.
(c) 7.5*10**(-14) N.
(d) 5.2*10**(-15) N.
(e) 1.2*10**(-13) N.

29-02

Question 810

In figure (4), a loop of wire carrying a current, I, of 2.0 A is in the shape of a right triangle with two equal sides, each 15 cm long. A 0.7 T uniform magnetic field is in the plane of the triangle and is perpendicular to the hypotenuse. The resultant magnetic force on the two equal sides is:

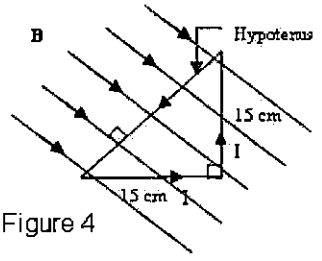


Figure 4

(a) 0.30 N, out of the page.
(b) 0.30 N, into the page.
(c) 0.41 N, out of the page.
(d) 0.41 N, into the page.
(e) Zero.

29-02

Question 811 0.45-36%

What is the initial direction of the deflection of an electron, moving in the y direction as it enters the magnetic field shown in figure (7)? [The magnetic field is in the xy-plane and makes an angle of 45 degrees with the x axis].

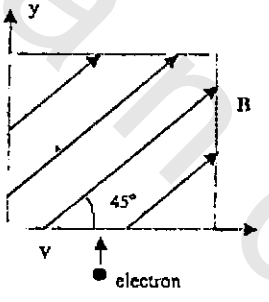


Figure (7)

(a) 45 degrees with the x direction.
(b) out of the page.
(c) y direction.
(d) 45 degrees with the y direction.
(e) into the page.

29-02

Question 812 0.30-21%

An electron moves in the positive x direction, through a uniform magnetic field B pointing in the negative y direction, as shown in figure 7. The magnetic force on the electron is

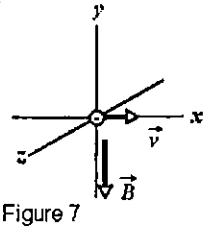


Figure 7

(a) in the negative z direction.
(b) in the positive z direction.
(c) in the positive y direction.
(d) in the negative x direction.
(e) in the negative y direction.

29-02

Question 813 0.45-27%

An electron that has velocity v = 3.2*10**7 i m/s traveling parallel to a uniform magnetic field of strength 2.60*10**(-3) Tesla. The force on the electron is: [i is the unit vectors in the directions of x]

(a) 5.0*10**(-15) N.
(b) 1.4*10**(-15) N.
(c) 2.3*10**(-15) N.
(d) zero.
(e) 6.1*10**(-15) N.

29-02

Question 814 0.36-61%

The path of a charged particle in a magnetic field, when its direction of motion is not at right angle to the magnetic field, will be a:

(a) circle.
(b) helix.
(c) parabola.
(d) straight line.
(e) hyperbola.

29-02

Question 815 0.39-55%

At a point in a uniform magnetic field the acceleration of an electron is 5.0*10**14 m/s**2 and its speed is 7.0*10**6 m/s. If the magnitude of the magnetic field is 1.0 mT, what is the angle between the electrons velocity and the magnetic field?

(a) 29 degrees.
(b) 90 degrees.
(c) zero degrees.
(d) 45 degrees.
(e) 24 degrees.

29-02

Question 816 0.60-39%

A proton moves with constant velocity, v = (8.0*10**5 m/s) i, through crossed electric and magnetic fields. If the magnetic field is B = (2.5 mT) j, what is the electric field? [i, j and k are the unit vectors in the positive x, y and z directions, respectively].

(a) (-1.0 kV/m) k.
(b) (+1.0 kV/m) j.
(c) (-2.0 kV/m) k.
(d) (-2.5 kV/m) i.
(e) (+2.0 kV/m) k.

29-02

Question 817 0.11-75%

Which one of the following statements is FALSE (NOT TRUE). A uniform magnetic field

(a) accelerates a moving charge.
(b) exerts a force on a moving charge.
(c) changes the momentum of a moving charge.
(d) of the earth is a measurable quantity.
(e) changes the kinetic energy of a charge.

29-02

Question 818 0.19-72%

Two particles move through a uniform magnetic field that is directed out of the page as shown in figure 5, which also shows the paths taken by the two particles as they move through the field. The particles are not subject to any other forces or fields. Which one of the following statements is CORRECT?

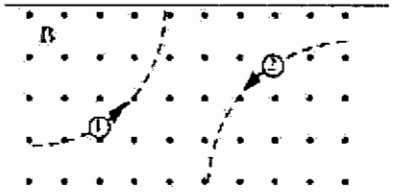


Figure 5

(a) Particle 1 is negative, but particle 2 is positive.
(b) The particles may both be neutral.
(c) Both particles are negatively charged.
(d) Both particles are positively charged.
(e) Particle 1 is positive, but particle 2 is negative.

29-02

Question 819 0.43-59%

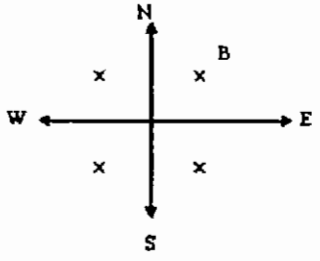
A proton moves through uniform magnetic and electric fields. The magnetic field is B = -3.0 i (mT) and the electric field is E = +4.0 k (V/m). At one instant, the velocity of the proton is v = +250 j (m/s). At that instant, what is the magnitude of the net force on the proton? (i, j and k are the unit vectors along the x, y and z directions, respectively)

(a) 6.1*10**(-19) N
(b) 6.5*10**(-19) N
(c) 7.6*10**(-19) N
(d) 1.2*10**(-19) N
(e) 5.2*10**(-19) N

29-02

Question 820 0.29-62%

In figure 5, an electron moves toward the west at speed of 1.0*10**7 m/s in a downward (normal into the page) uniform magnetic field of 3.0*10**(-4) T. The magnetic force on the electron is



Figure(5)

(a) 4.8*10**(-16), west.
(b) 1.6*10**(-16), north.
(c) 1.6*10**(-16), south.
(d) 4.8*10**(-16), north.
(e) 4.8*10**(-16), south.

29-02

Question 821 0.31-60%

A charged particle is placed in a region of space and it experiences a force only when it is in motion. It can be conclude that the region encloses

(a) A magnetic field only.
(b) An electric field only.
(c) Both a magnetic field and a gravitational field.
(d) Both a magnetic field and an electric field.
(e) Both a gravitational field and an electric field.

29-02

Question 822 0.48-63%

An electron enters a region that contains a magnetic field directed into the page as shown in figure 7. The velocity of the electron makes an angle of 30 degrees with the +y axis. What is the direction of the magnetic force on the electron when it enters the field?

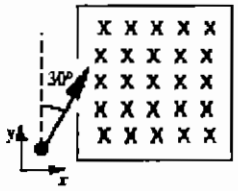


Figure 7

(a) at an angle of 30 degrees below the positive x axis and in the plane of the page.
(b) at an angle of 30 degrees above the positive x axis and in the plane of the page.
(c) upwards and out of the page.
(d) at an angle of 60 degrees below the positive x axis and in the plane of the page.
(e) at an angle of 60 degrees above the positive x axis and in the plane of the page.

29-02

Question 823 0.35-56%

For a charged particle moving in a magnetic field, the magnetic field can

(1) change its velocity.
(2) change its speed.
(3) change its acceleration.
(4) change its kinetic energy.

(a) 1 and 2 only.
(b) 4 only.
(c) 1 and 3 only.
(d) 3 and 4 only.
(e) 1, 2, 3, and 4.

29-3 Crossed fields: Discovery of the Electron

29-03

Question 824

In the velocity selector, an electron passes, without deflection, through a region where there is an electric and a magnetic field perpendicular to each other. If the electric field is E=4.5*10**3 V/m and the magnetic field is B=9.0*10**-3 T, what is the kinetic energy of the electron, in electron Volts? (1 eV=1.6*10**-19 J)

(a) 2.84 eV.
(b) 0.54 eV.
(c) 1.40 eV.
(d) 0.35 eV.
(e) 0.71 eV.

29-03

Question 825
In a region where an electric field E and a magnetic field B are perpendicular to each other, a beam of charged particles, each of mass m and charge q, passes through this region. The kinetic energy of a particle passing undeflected normal to these two fields is:
(a) m q /(2 E B).
(b) m E**2 /(2 B**2).
(c) m q B /(2 E).
(d) m E**2 /(2 q B).
(e) m B**2 /(2 q E**2).

29-03
Question 826 0 46-35%
An electric field of 1.5*10**3 V/m and a magnetic field of 0.50 T act on a moving electron to produce no net force. Calculate the minimum speed of the moving electron.
(a) Zero.
(b) 3.0*10**3 m/s.
(c) 7.5*10**3 m/s.
(d) 0.75*10**3 m/s.
(e) 4.5*10**3 m/s.

29-03
Question 827 0 32-31%
An electron enters a region of uniform electric and magnetic fields. It is observed that the velocity of the electron is unaffected. A possible explanation is that the velocity is:
(a) parallel to B
(b) perpendicular to B and parallel to E
(c) perpendicular to E and parallel to B
(d) perpendicular to both E and B
(e) parallel to E and has magnitude E/B

29-03
Question 828 0 48-43%
A proton with velocity v = (2.0*10**6) i (m/s) moves horizontally into a region of space in which there is an electric field E = (- 5000) j (N/C) and a magnetic field B. Find the smallest magnetic field such that the proton will continue to move horizontally undeflected. (i, j and k are unit vectors in the x, y and z directions, respectively)
(a) (1.5 i + 2.5 j)*10**(-3) (T)
(b) + 2.5*10**(-3) j (T)
(c) - 2.5*10**(-3) k (T)
(d) + 2.5*10**(-3) k (T)
(e) - 2.5*10**(-3) j (T)

29-03
Question 829 0 35-62%
An electric field and a magnetic field normal to each other. The electric field is 4.0 kV/m and the magnetic field strength is 2.0 mT. They are act on a moving electron to produce no force, calculate the electron speed.
(a) 8.0*10**6 m/s.
(b) 3.0*10**9 m/s.
(c) 2.0*10**6 m/s.
(d) 1.2*10**6 m/s.
(e) 5.2*10**7 m/s.

29-03
0.44-46%

Question 830

A charged particle is projected with velocity v into a region where there exists a uniform electric field of strength E perpendicular to a uniform magnetic field of strength B. If the velocity of the charged particle is to remain constant, the minimum velocity must be

(a) of magnitude E/B and parallel to B.
(b) of magnitude B/E and perpendicular to both E and B.
(c) of any magnitude but at 45 degrees to both E and B.
(d) of magnitude E/B and parallel to E.
(e) of magnitude E/B and perpendicular to both E and B.

29-5 A Circulating Charged Particle

29-05

Question 831

A proton with a velocity of 6*10**6 m/s travels at right angles to a magnetic field of 0.5 Tesla. What is the frequency of the proton's orbit?

(a) 3.6*10**6 Hz.
(b) 7.6*10**6 Hz.
(c) 8.4*10**6 Hz.
(d) 9.0*10**6 Hz.
(e) 2.1*10**7 Hz.

29-05

Question 832

An electron moving perpendicular to a 50 micro-T magnetic field, goes through a circular trajectory. What is the time required to complete one revolution?

(a) 420 micro-seconds
(b) 420 nano-seconds
(c) 715 nano-seconds
(d) 840 micro-seconds
(e) 150 nano-seconds

29-05

Question 833

A deuteron is accelerated from rest through a 10**4 V potential difference and then moves perpendicular to a magnetic field with B = 1.6 T. What is the radius of the resulting circular path? [For deuteron: m=3.3*10*(-27) kg, q=1.6*10**(-19) C.]

(a) 13*10**(-3) m.
(b) 22*10**(-3) m.
(c) 11*10**(-6) m.
(d) 36*10**(-3) m.
(e) 15*10**(-4) m.

29-05
0.40-40%

Question 834

What uniform magnetic field, applied perpendicular to a beam of electrons moving at 1.4*10**6 m/s is required to make the electrons travel in a circular orbit of radius 0.40 m?

(a) 3.0*10**(-5) T.
(b) 1.0*10**(-5) T.
(c) 5.0*10**(-5) T.
(d) 2.0*10**(-5) T.
(e) 7.0*10**(-5) T.

29-05

Question 835

Particle #1 (of mass m and charge q) and another particle #2 (of mass 3 m and charge q) are accelerated through a common potential difference V. The two particles enter a uniform magnetic field B along a direction perpendicular to B. If particle #1 moves in a circular path of radius r1, then the radius r2 of the circular path of particle #2 is:

(a) r1*Sqrt(2).
(b) r1*Sqrt(6).
(c) 2.0*r1.
(d) r1*Sqrt(3).
(e) r1*Sqrt(5).

29-05

Question 836 0 56-51%

An electron with a kinetic energy of 1.5 keV circles in a plane perpendicular to a uniform magnetic field. The radius of the orbit is 20 cm. Find the magnitude of the magnetic field.

(a) 2.5*10**(-5) T
(b) 6.5*10**(-4) T
(c) 4.7*10**(-4) T
(d) 8.4*10**(-4) T
(e) 3.0*10**(-4) T

29-05

Question 837 0 41-55%

An electron moving at right angle to a uniform magnetic field completes a circular orbit in 10**(-8) s. What is the magnitude of the magnetic field.

(a) 4.2*10**(-3) T.
(b) 3.6*10**(-3) T.
(c) 2.5*10**(-3) T.
(d) 6.3*10**(-3) T.
(e) 1.0*10**(-3) T.

29-05

Question 838 0 41-24%

Figure 6 shows the circular paths of an electron and a proton that travel at the same speed in a uniform magnetic field B, which points into the page. (a) Which particle follows the bigger circle, and (b) does that particle travel clockwise or counterclockwise?

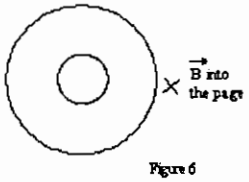


Figure 6

(a) Not enough information given.
(b) (a) electron (b) clockwise
(c) (a) electron (b) counterclockwise
(d) (a) proton (b) counterclockwise
(e) (a) proton (b) clockwise

29-05

Question 839 0.53-48%

An e ectron is accelerated from rest through a potential difference of 500 Volts, then injected into a uniform magnetic field. Once in the magnetic field, it complctes one revolution in 4.0 nano-s. What is the radius of the orbit?

(a) 8.4 mm
(b) 4.2 mm
(c) 13 mm
(d) 1.0 mm
(e) 16.8 mm

29-7 Magnetic force on a Current-Carrying Wire

29-07

Question 840 0.43-44%

A wire of total length 4L and carrying a current I is placed in a uniform magnetic field B that is directed out of the page as shown in Figure 6. Determine the net magnetic force on the wire.

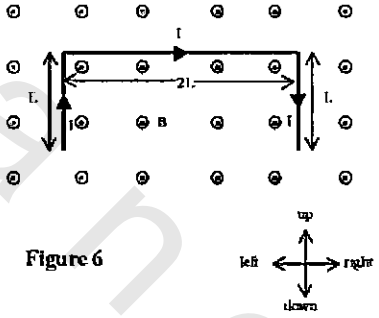


Figure 6

(a) 2ILB up
(b) 4ILB down
(c) 2ILB left
(d) 2ILB down
(e) 4ILB up

29-07

Question 841 0.29-40%

A segment of wire carries a current of 25 A. It is bent into the shape shown in Figure 4. The wire is placed in a uniform magnetic field of 40 mT and directed out of the page. Find the magnitude of the magnetic force on this segment of wire.

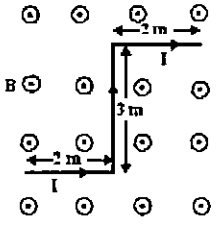


Figure 4

(a) 4.1 N
(b) 5.0 N
(c) 3.6 N
(d) 2.5 N
(e) 7.0 N

29-07

Question 842

Two infinite wires are parallel to the y-axis. One carries current i1 = 12 A in the +y-axis at x=0; the other carries i2 at x = 8.0 cm. For what magnitude and direction of i2 will the resultant magnetic field be zero at x = 6.0 cm?

(a) 4.0 A in the -y-axis.
(b) 4.0 A in the +y-axis.
(c) 6.0 A in the -y-axis.
(d) 6.0 A in the +y-axis.
(e) 2.0 A in the +y-axis.

29-07

Question 843 0.45-36%

A wire bent into a semicircle of radius R = 2.0 m forms a closed circuit and carries a current of 1.5 A. The circuit lies in the xy-plane, and a uniform magnetic field B = 3.0 T is present along the y axis, as shown in figure (6). Find the magnitude of the magnetic force on the curved portion of the wire.

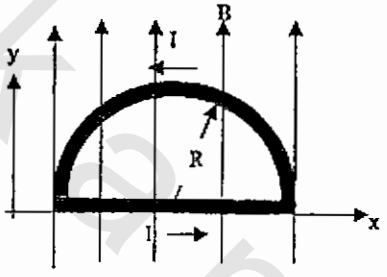


Figure (6)

(a) 6.0 N.
(b) 9.0 N.
(c) 12 N.
(d) 0 N.
(e) 18 N.

29-07

Question 844 0.56-49%

A wire 72 cm in length has a mass of 15 g. It is suspended by a pair of flexible leads in a magnetic field B = 0.54 T pointing out of the page, as shown in figure 8. What current must exist in the wire for the tension in the supporting leads to be zero ?

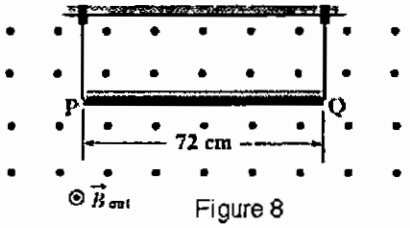


Figure 8

(a) 0.49 A from Q to P
(b) 0.38 A from P to Q
(c) 0.38 A from Q to P
(d) 0.49 A from P to Q
(e) 0.039 A from Q to P

29-07

Question 845 0.40-68%

A straight horizontal length of copper wire is located in a place where the magnetic field of the earth B = 0.5*10**(-4)T (see figure 5). What minimum current in the wire is needed to balance the gravitational force on the wire? [The linear density of the wire is 60.0 gram/m]

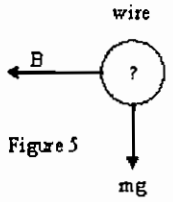


Figure 5

(a) 3.2*10**4 A, into the page.
(b) 1.2*10**4 A, out of the page.
(c) 1.2*10**4 A, into the page.
(d) 4.3*10**4 A, out of the page.
(e) 4.3*10**4 A, into the page.

29-07

Question 846 0.43-66%

In figure 7, a rectangular loop, L1 = 2.0 cm by L2 = 3.0 cm, carrying a current I = 0.1 A, is suspended from a spring of spring constant, k = 8.0*10**(-2) N/m. The loop is placed into a uniform magnetic field, which points into the page, and the spring is observed to stretch 1.0 cm. What is the magnitude of the magnetic field? [Neglect the mass of the loop]

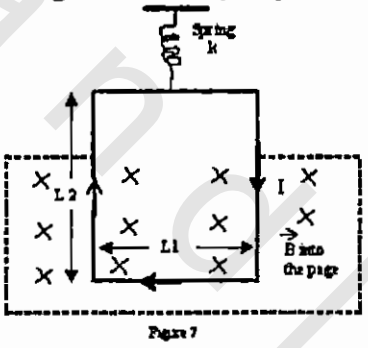


Figure 7

(a) 0.3 T.
(b) 0.4 T.
(c) 0.2 T.
(d) 0.1 T.
(e) 0.5 T.

29-8 Torque on a Current Loop

29-08

Question 847

A 100-turn circular coil of wire with radius 1 cm carries a current of 0.5 A. What torque will be exerted on the coil when it is placed in a magnetic field of 5 mT which makes an angle of 60 degrees with the plane of the coil?

(a) 8.33*10**-5 N.m.
(b) 3.93*10**-5 N.m.
(c) 5.63*10**-5 N.m.
(d) 1.34*10**-5 N.m.
(e) 2.96*10**-5 N.m.

29-08

Question 848 0.46-39%

A square loop, of side a = 5 cm and 200 turns, carries a current of 10 A. The loop is placed in an external magnetic field of 2.0 T. Determine the magnitude of the maximum torque exerted on the loop.

(a) 22 N*m
(b) 20 N*m
(c) 12 N*m
(d) 10 N*m
(e) 44 N*m

29-08

Question 849

A current of 17 mA is maintained in a circular loop of 2 m circumference which is parallel to the y-z plane (see Figure 4). A magnetic field B = (- 0.8 k) T is applied. Calculate the torque exerted on the loop by the magnetic field. (i, j and k are the unit vectors in x, y and z directions, respectively).

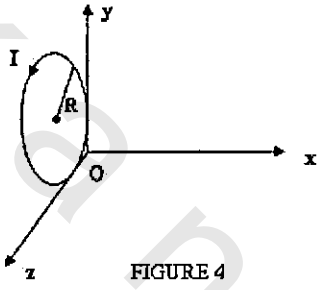


FIGURE 4

(a) (-4.33*10**(-3) j) N*m
(b) (-2.27*10**(-2) i) N*m
(c) (2.27*10**(-2) i) N*m
(d) (4.33*10**(-3) j) N*m
(e) (3.54*10**(-3) k) N*m

29-08

Question 850

A square loop (L=1.00 m) consists of 100 closely wrapped turns of 0.20 A. The loop is oriented as shown in figure (5) in a uniform magnetic field of 0.10 T directed in the positive x- direction. What is the torque (in N.m) on the loop? (j is a unit vector in the +y-direction.)

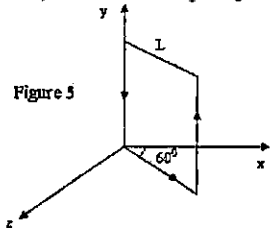


Figure 5

(a) 2.0 j.
(b) -1.0 j.
(c) 1.0 j.
(d) -1.2 j.
(e) 1.2 j.

29-08

Question 851

In figure (9), a loop of wire carrying a current, I, of 3.0 A is in the shape of a right triangle with two equal sides, each 2.0 m long. A 2.0 T uniform magnetic field is in the plane of the triangle and is parallel to the hypotenuse. The resultant torque on the loop is:

(a) 24 N*m.
(b) 15 N*m.
(c) 12 N*m.
(d) 3 N*m.
(e) 16 N*m.

29-08

Question 852 0.44-62%

The plane of area 4.0 cm**2 rectangular loop of wire is parallel to a 2.0 T magnetic field. The loop carries a current of 6.0 A. Calculate the magnitude of the torque acts on the loop.

(a) 2.4*10**(-3) N*m.
(b) 3.6*10**(-3) N*m.
(c) zero.
(d) 1.0*10**(-3) N*m.
(e) 4.8*10**(-3) N*m.

29-08

Question 853 0.37-23%

A circular coil of 160 turns has a radius of 1.90 cm and carries a current I. If the maximum torque that the coil can experience in a uniform 35.0 mT magnetic field is 0.08 N*m, what is the value of I.

(a) 22.0 A.
(b) 2.3 A.
(c) 9.6 A.
(d) 14.2 A.
(e) 12.6 A.

29-9 The Magnetic Dipole Moment

29-09

Question 854

Which one of the following statements is WRONG?

(a) It is impossible to isolate magnetic monopoles.
(b) The SI units of the magnetic moment is A*(m**2).
(c) A magnetic force acting on a moving negatively charged particle is always anti-parallel to its direction of motion.
(d) The work done by the magnetic force on a charge moving with a speed v in a static magnetic field B is always zero.
(e) The total magnetic force on any closed current loop in a uniform magnetic field is zero.

29-09

Question 855

The current loop in figure (5) consists of one loop with two semicircles of different radii. If the current in the circuit is 19 A, a = 3.0 cm and b = 5.0 cm, then the magnetic dipole moment of the current loop is:

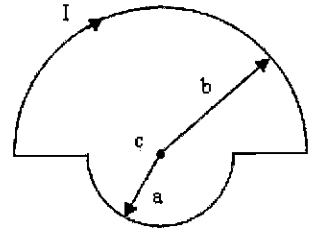


Figure 5

(a) 0.02 A*m**2, out of the page.
(b) 0.10 A*m**2, into the page.
(c) 1.15 A*m**2, into the page.
(d) 0.10 A*m**2, out of the page.
(e) 0.02 A*m**2, into the page.

29-09

Question 856

Which of the following statements are true?

(I) The magnetic field unit is the tesla.
(II) A magnetic field cannot change the kinetic energy of a charged particle.
(III) A charged particle moving parallel to a magnetic field will be deflected.
(IV) The unit of magnetic dipole moment is ampere/meter.

(a) II, and III.
(b) I, and II.
(c) II, III, and IV.
(d) III, and IV.
(e) I, III, and IV.

29-09

Question 857 0.25-41%

A closed loop has an area of 5.8*10**(-2) m**2 and carries a current of 3.0 A. It is placed in an external magnetic field, whose magnitude is 0.50 T, with its dipole moment initially making an angle of 90 degrees with the external magnetic field. How much work is done by the magnetic field as it rotates the loop from its initial orientation to the final orientation where the dipole moment is aligned with the field ?

(a) - 0.042 J
(b) + 0.042 J
(c) zero
(d) + 0.087 J
(e) - 0.087 J

Chapter 30 Magnetic Fields Due to Currents

30-1 Calculating the Magnetic Field Due to a Current

30-01

Question 858
A segment of wire is formed into the shape shown in Figure (5) and carries a current I. What is the magnitude of the resulting magnetic field at the point P?

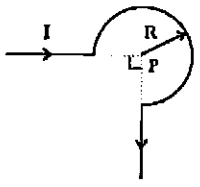


Figure # 5

(a) 3 mu I/(3R).
(b) 3 mu I/(6R).
(c) 3 mu I/(5R).
(d) 3 mu I/(9R).
(e) 3 mu I/(8R).

30-01

Question 859
Three long wires parallel to the x-axis carry currents as shown in Fig. 6. If I=20 A, what is the magnitude of the magnetic field at the origin?

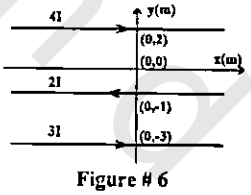


Figure # 6

(a) 58 micro T.
(b) 12 micro T.
(c) 37 micro T.
(d) 47 micro T.
(e) 25 micro T.

30-01

Question 860 0.58-47%
What is the magnitude of the magnetic field at point P due to the current carrying wire shown in Figure 7, if I = 2.0 A, a = 20 cm and b = 2a?

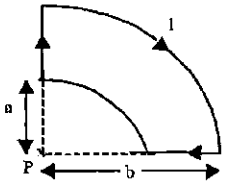


Figure 7

(a) 2.1 micro-T
(b) 0.8 micro-T
(c) 0.4 micro-T
(d) 2.8 micro-T
(e) 1.1 micro-T

30-01

Question 861

A segment of wire is formed into the shape shown in Figure 5 and carries a current I = 1.0 A. What is the magnitude of the resulting magnetic field at the point P if R = 10 cm?

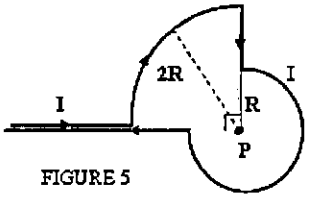


FIGURE 5

(a) 2.6 micro-T out of the page
(b) 1.8 micro-T into the page
(c) 5.5 micro-T into the page
(d) 5.5 micro-T out of the page
(e) 1.8 micro-T out of the page

30-01

Question 862

Two long wires parallel to the x-axis carry currents I1 and I2 as shown in Figure 6. If I1 = 5 A, what is the magnitude and direction of I2 if the net magnetic field at the origin is 0.35 micro-T and directed out the page.

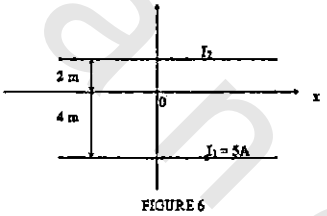


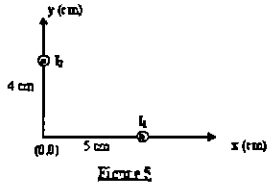
FIGURE 6

(a) I A to the left
(b) I A to the right
(c) 5 A to the left
(d) 5 A to the right
(e) 2 A to the right

30-01

Question 863 0.3?-36%

Two long straight wires carry currents perpendicular to the xy plane as shown in Figure 5. One carries a current I1= 50 A and passes through the point x= 5.0 cm on the x axis. The second wire has a current I2= 80 A and passes through the point y= 4.0 cm on the y axis. What is the magnitude of the resulting magnetic field at the origin?



(a) 250 micro-T
(b) 150 micro-T
(c) 300 micro-T
(d) 600 micro-T
(e) 450 micro-T

30-01

Question 864 0.57-36%

A segment of wire of total length 2.0 m is formed into a circular loop having 5.0 turns. If the wire carries a current of 1.2 A, determine the magnitude of the magnetic field at the center of the loop.

(a) 59 micro-T
(b) 14 micro-T
(c) 92 micro-T
(d) 75 micro-T
(e) 84 micro-T

30-01

Question 865

A conductor consists of a circular loop of radius R = 0.10 m and two straight, long sections, as in Figure (6). The wire lies in the plane of the paper (xy-plane) and carries a current of I = 5.3 A. Determine the magnetic field, in Tesla, at the center of the loop. (k is a unit vector in +z-direction)

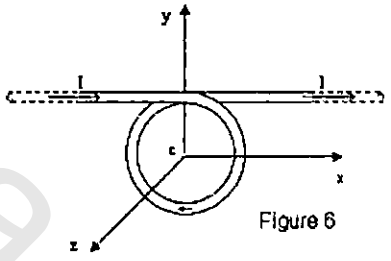


Figure 6

(a) -5.8*10**(-5) k.
(b) -4.4*10**(-5) k.
(c) 1.8*10**(-5) k.
(d) 4.4*10**(-5) k.
(e) 5.8*10**(-5) k.

30-01

Question 866

A long solid cylindrical conductor of radius R= 4.0 mm carries a current I parallel to its axis. The current density in the wire is 2*10**4 A/m**2. Determine the magnitude of the magnetic field at a point that is 5.0 mm from the axis of the conductor.

(a) 30 micro-T.
(b) 40 micro-T.
(c) 55 micro-T.
(d) 17 micro-T.
(e) 12 micro-T.

30-01

Question 867 0.45-36%

The magnitude of the magnetic field at 88.0 cm from the axis of an infinitely long wire is 7.30*10**(-6) T. What is the current in the wire?

(a) 22.2 A.
(b) 32.1 A.
(c) 5.30 A.
(d) 15.4 A.
(e) 42.8 A.

30-01

Question 868 0.45-36%

Figure (8) shows two wires carrying anti-parallel currents. If i2 is greater than i1, the point at which the resultant magnetic field of the two wires will be zero is located in the region (regions):

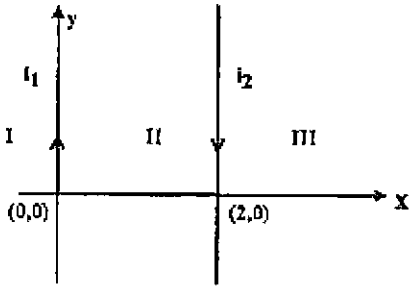


Figure (8)

(a) I.
(b) III.
(c) I and III.
(d) II and III.
(e) II.

30-01

Question 869

Figure (10) shows four long straight wires passing through the plane of the paper. They are fixed at the corners of a square of diagonal 2.0 cm. Each wire carries a current of 2 A. Three of them are out of the paper and one is into the paper. The magnitude of the magnetic field at the center "C" of the square has magnitude:

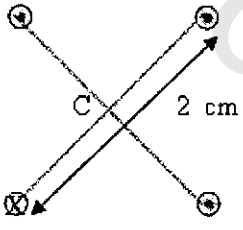


Figure 10

(a) 1.0*10**(-5) T.
(b) zero.
(c) 8.0*10**(-5) T.
(d) 3.0*10**(-5) T.
(e) 5.1*10**(-6) T.

30-01

Question 870

A circular loop of radius 0.1 m has a resistance of 6 Ohms. If it is attached to a 12 V battery, how large a magnetic field is produced at the center of the loop?

(a) 5.2*10**(-5) T.
(b) zero.
(c) 0.5*10**(-5) T.
(d) 1.3*10**(-5) T.
(e) 3.0*10**(-5) T.

30-01
0.50-54%

Question 871

Consider the current-carrying loop shown in figure 9 with a = 10.0 cm, b = 5.00 cm, theta = 60.0 degrees and I = 0.200 A. Find the magnitude and direction of the magnetic field at P.

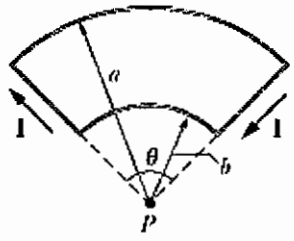


Figure 9

(a) 5.32*10**(-7) T into the page
(b) 6.28*10**(-7) T out of the page
(c) 2.09*10**(-7) T out of the page
(d) 6.98*10**(-7) T out of the page
(e) 4.18*10**(-7) T into the page

30-01
0.32-67%

Question 872

Four long conducting wires are parallel to each other. Their cross sections form the corners of a square of side a = 15 cm. The directions of the currents are as shown in figure 10. The magnitude of the current in each wire is 15 A. What is the magnitude of the magnetic field at the center of the square ?

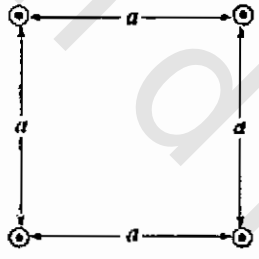


Figure 10

(a) 8.4*10**(-5) T
(b) 5.7*10**(-5) T
(c) 1.1*10**(-4) T
(d) zero
(e) 2.8*10**(-5) T

30-01
0.66-43%

Question 873

A solid cylindrical conducting wire has a radius of 15 cm. An electric current is uniformly distributed over the wire with a current density of 1.0*10**4 A/m**2. What is the magnitude of the magnetic field at a point 5.0 cm from the axis of the wire ?

(a) 6.3*10**(-4) T
(b) 9.0*10**(-4) T
(c) 7.5*10**(-4) T
(d) 3.1*10**(-4) T
(e) zero

30-01

Question 874 0.37-40%

The segment of wire is formed into the shape as shown in Figure 7 and carries a current I = 6 A. When R = 6.28 cm, what is the magnetic field at the point P?

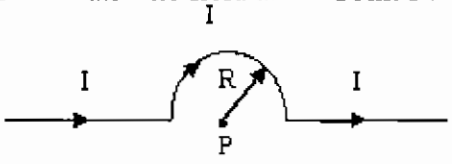


Figure 7

(a) Zero.
(b) 6.1*10**(-5) T into the page.
(c) 3.0*10**(-5) T into the page.
(d) 3.0*10**(-5) T out of the page.
(e) 6.1*10**(-5) T out of the page.

30-01

Question 875 0.34-72%

Figure 6 shows two current segments. In the upper segment, an arc of radius 4.0 cm subtends an angle of 120 degrees with its center at P. The lower segment includes a larger semicircle of radius 5.0 cm, also with center at P. The upper segment carries a current of 2I, whereas the lower segment carries a current I. If I = 0.40 A, what is the net magnetic field at point P due to these two current segments?

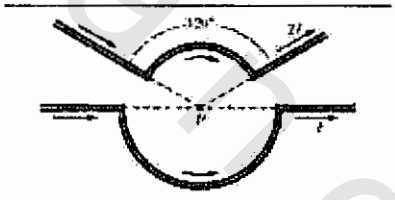


Figure 6

(a) 1.7 micro-Tesla into the page
(b) 0.42 micro-Tesla into the page
(c) 4.6 micro-Tesla into the page
(d) 4.6 micro-Tesla out of the page
(e) 2.5 micro-Tesla out of the page

30-01

Question 876 0.35-75%

Figure 8 shows two long, thin wires that carry currents in the positive z direction. Both wires are parallel to the z axis. The 50-A wire is in the xz plane and is 5.0 m from the z axis. The 40-A wire is in the yz plane and is 4.0 m from the z axis. What is the magnitude of the magnetic field at the origin?

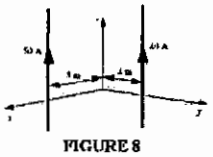


FIGURE 8

(a) 2.8 micro-Tesla
(b) zero
(c) 5.7 micro-Tesla
(d) 1.2 micro-Tesla
(e) 6.8 micro-Tesla

30-01
0.60-36%

Question 877

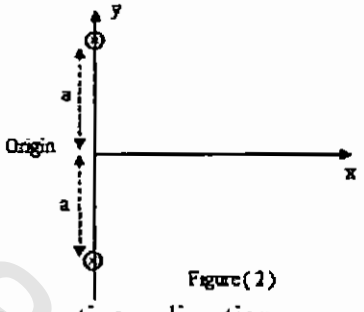
A long, straight, hollow conductor, that has an inner radius of 1.0 mm and an outer radius of 3.0 mm, carries a current of 15 A uniformly distributed over its cross section. What is the magnitude of the magnetic field at a distance of 4.0 mm from the axis of the wire?

(a) 0.75 mT
(b) 0.64 mT
(c) 0.71 mT
(d) 0.79 mT
(e) 0.24 mT

30-01
0.35-30%

Question 878

Two long wires are parallel to the z-axis as shown in figure 2. Find the resultant magnetic field at the origin, given that the wires carry equal current I and moves in the same direction. [Take I= 1.0 A and a=0.5 m]



Figure(2)

(a) 8.0*10**(-4) Tesla, In the negative x-direction.
(b) 3.2*10**(-4) Tesla, In the positive z-direction.
(c) 3.2*10**(-3) Tesla, In the positive z-direction.
(d) Zero.
(e) 8.0*10**(-7) Tesla, In the positive x-direction.

30-01
0.45-55%

Question 879

Part of a long, flexible, current-carrying wire is made into a circular loop, while the rest of it lies in a straight line as shown in figure 3. What is the magnetic field strength at point C, the center of the loop? [Take I= 1.0 A and a=0.5 m]

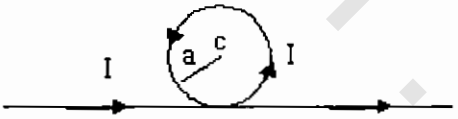


Figure (3)

(a) 3.4*10**(-6) T, out of the page.
(b) 1.7*10**(-6) T, out of the page.
(c) 1.7*10**(-6) T, into the page.
(d) zero.
(e) 3.4*10**(-6) T, into the page.

30-01
0.25-66%

Question 880

A copper wire is of total length 1.0 m. You want to make N-turn circular current loop, using the entire wire, that generates a 1.0 mT magnetic field at the center of the coil when the current is 1.0 A. What will be the diameter of your coil?

(a) 0.50 m.
(b) 0.12 m.
(c) 0.02 m.
(d) 0.22 m.
(e) 0.01 m.

30-01

Question 881 0.49-45%

Figure 10 shows two concentric, circular wire loops, of radii r1=15 cm and r2=30 cm, are located in the xy plane. The inner loop carries a current of 8.0 A in the clockwise direction, and the outer loop carries a current of 10.0 A in the counter clockwise direction. Find the net magnetic field at the center.

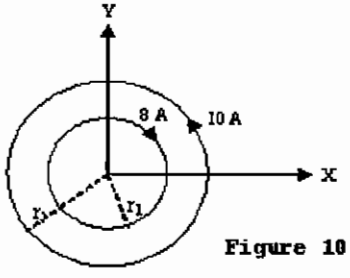


Figure 10

(a) 12.6*10**(-6) T, directed out of the page.
(b) zero.
(c) 33.5*10**(-6) T, directed out of the page.
(d) 33.5*10**(-6) T, directed into the page.
(e) 12.6*10**(-6) T, directed into the page.

30-01

Question 882 0.55-40%

How strong is the magnetic field at a distance of 10.0 cm from a long straight wire, of radius 3.0 cm carrying a current of 5.0 A?
(a) 1.0*10**(-5) T.
(b) 9.0*10**(-5) T.
(c) 2.1*10**(-7) T.
(d) 7.1*10**(-5) T.
(e) 3.4*10**(-5) T.

30-01

Question 883 0.55-29%

Two long parallel wires, a distance d apart, carry currents of I and 5*I in the same direction. Locate the point r, from I, at which their magnetic fields cancel each other.
(a) r=d/6.
(b) r=3*d/2.
(c) r=2*d.
(d) r=d/4.
(e) r=d/2.

30-2 Force Between Two Parallel Currents

30-02

Question 884

Given two parallel current-carrying wires, the force between them:
(a) is attractive if the currents are in opposite directions.
(b) is repulsive if the currents are in the same direction.
(c) is attractive if the currents are in the same direction.
(d) decreases as the distance between them decreases.
(e) increases as the distance between them increases.

30-02

Question 885 0.49-47%

Figure 8 shows a cross section of three long parallel wires each carrying a current of 15 A. The currents in the wires A and C are out of the paper, while that in wire B is into the paper. If the distance a = 5.0 mm, what is the magnitude of the force per unit length on wire C?

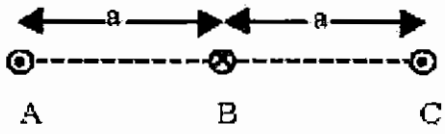


Figure 8

(a) 5.4 milli-N/m
(b) 3.6 milli-N/m
(c) 9.2 milli-N/m
(d) 2.1 milli-N/m
(e) 4.5 milli-N/m

30-02

Question 886 0.36-47%

Two long parallel wires carrying equal currents of 10 A in opposite directions. The force per unit length of one wire on the other is 1 milli-N/m. If both currents are doubled, the force per unit length of one wire on the other will be:

(a) 1 milli-N/m, repulsive
(b) 4 milli-N/m, attractive
(c) 2 milli-N/m, repulsive
(d) 4 milli-N/m, repulsive
(e) 2 milli-N/m, attractive

30-02

Question 887

Suppose that the identical currents I in figure (7) are all out of the page. The magnitude of the force per unit length on the wire at the origin is: [take I = 10.0 A, and a = 1.0*10**(-4) m.]

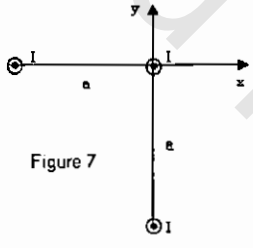


Figure 7

(a) 0.28 N/m.
(b) 0.18 N/m.
(c) 0.55 N/m.
(d) 0.17 N/m.
(e) 0.30 N/m.

30-02

Question 888

Three parallel wires lie in the xy-plane. The separation between adjacent wires is 0.1 m, and each wire carries a 10-A current in the same direction. Find the magnitude of the net force per unit length on one of the outer wires.

(a) 7.5*10**(-4) N.
(b) 3.0*10**(-4) N.
(c) 1.1*10**(-4) N.
(d) 5.0*10**(-7) N.
(e) 6.0*10**(-4) N.

30-02

Question 889 0.40-57%

Two parallel wires, carrying equal currents of 10 A, attract each other with a force F. If both currents are doubled, and the distance between them reduced by 50%, the new force will be:

(a) 16*F.
(b) 4*F.
(c) F.
(d) 8*F.
(e) F/4.

30-02

Question 890 0.27-68%

Four long straight wires carry equal currents into page as shown in Figure 6. The magnetic force exerted on wire A is:

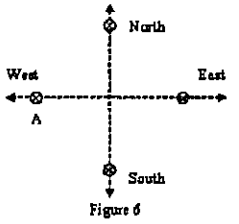


Figure 6

(a) East.
(b) North.
(c) West.
(d) South.
(e) Zero.

30-02

Question 891 0.35-57%

Two long parallel wires, D and B, are separated by 2.0 cm. The current in D is THREE times the current in B. If the magnitude of the force on 2.0 m length of one of the wires is equal to 60 micro-N, find the current in B.

(a) 5.0 A.
(b) 1.5 A.
(c) 2.0 A.
(d) 1.0 A.
(e) 0.5 A.

30-02

Question 892 0.35-46%

Figure 4 shows a cross section of three parallel wires each carrying a current of 12 A. The currents in wires A and C are out of the page, while that in wire B is into the page. If the distance R = 4.0 mm, what is the magnitude of the magnetic force on a 3.0-m length of wire B?

FIGURE 4

(a) 11 mN
(b) 51 mN
(c) 22 mN
(d) 17 mN
(e) 32 mN

30-02
Question 893 0.48-33%
Two infinite parallel wires are separated by 2.5 cm and carry current 10 A and 12 A in the same direction. What is the force per unit length on each wire?
(a) 0.5*10**(-3) N/m, repulsive.
(b) 1.0*10**(-3) N/m, attraction.
(c) 1.0*10**(-3) N/m, repulsive.
(d) 0.5*10**(-3) N/m, attraction.
(e) 2.0*10**(-3) N/m, attraction.

30-02
Question 894 0.48-48%
Three long parallel wires are arranged as shown in figure 8. Wires 1 and 3 each carries a current of 5.0 A in the directions shown. If the net magnetic force on wire 3 is zero, what is the magnitude and direction of the current in wire 2?

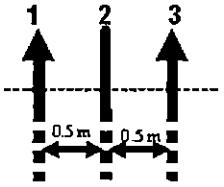


Figure 8

(a) 2.5 A, downwards.
(b) 5.5 A, upwards.
(c) 2.5 A, upwards.
(d) 30 A, downwards.
(e) 5.5 A, downwards.

30-3 Ampere's Law

30-03
Question 895 0.49-50%
A long cylindrical wire has a radius R = 2.0 cm and carries a current I = 40 A that is uniformly distributed through the cross-section of the wire. What is the magnitude of the magnetic field at a point which is 1.5 cm from the axis of the wire?
(a) 6*10**(-3) T
(b) 5*10**(-4) T
(c) 2*10**(-3) T
(d) 3*10**(-4) T
(e) 4*10**(-5) T

30-03
Question 896
What must be the radius R of a long current-carrying wire if the magnetic field at r1 = 2.0 cm (inside the wire) is equal to three times the magnetic field at r2 = 8.0 cm (outside the wire).
(a) 3.8 cm
(b) 4.4 cm
(c) 5.2 cm
(d) 2.3 cm
(e) 7.3 cm

30-03
Question 897 0.57-41%
A long solid cylindrical conductor of radius R= 4.0 mm carries a current I parallel to its axis. The current density in the wire is 2*10**4 A/m**2. Determine the magnitude of the magnetic field at a point that is 5.0 mm from the axis of the conductor.
(a) 30 micro-T
(b) 12 micro-T
(c) 17 micro-T
(d) 40 micro-T
(e) 55 micro-T

30-03
Question 898 0.45-36%
Consider an infinitely long straight wire carrying a current I. If the magnetic field at r1 = 2.5 mm inside the wire and at r2 = 10 mm outside the wire are equal, then the radius of the wire is:
(a) 4.0 mm.
(b) 6.0 mm.
(c) 5.0 mm.
(d) 7.0 mm.
(e) 3.0 mm.

30-03
Question 899 0.51-55%
A cylindrical conductor of radius R = 2.50 cm carries a current of I = 2.50 A along its length. This currents is uniformly distributed throughout the cross section of the conductor. Calculate the magnitude of the magnetic field at a point that is 1.25 cm from the axis of the conductor.
(a) 8.00 microTesla
(b) 10.0 microTesla
(c) 20.0 microTesla
(d) 15.3 microTesla
(e) zero

30-03
Question 900 0.67-56%
The radius R of a long current-carrying wire is 2.3 cm. If the magnetic field at r1 = 2.0 cm is equal to THREE times the magnetic field at r2, r2 > R, calculate the distance r2.
(a) 5.2 cm.
(b) 7.9 cm.
(c) 4.4 cm.
(d) 2.0 cm.
(e) 3.8 cm.

30-03
Question 901 0.50-33%
A hollow cylindrical conductor of inner radius 3.0 mm and outer radius 5.0 mm carries a current of 80 A parallel to its axis. The current is uniformly distributed over the cross section of the conductor. Find the magnitude of the magnetic field at a point that is 2.0 mm from the axis of the conductor.
(a) 5.3 mT.
(b) 0.7 mT
(c) 8.0 mT.
(d) 10 mT.
(e) zero.

30-03
Question 902 0.54-49%
Figure 4 shows four circular loops concentric with a wire whose current is directed out of the page. The current is uniform across the cross section of the wire. Rank the loops according to the magnitude of the enclosed current, greatest first [loops a and b inside the wires, c and d are outside]

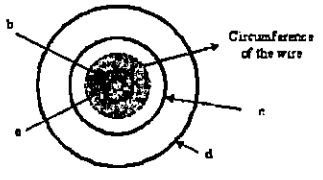


Figure (4)

(a) a > c > b > d.
(b) a > c > b > d.
(c) a = b > c > d.
(d) d = c > b > a.
(e) d > c > b > a.

30-03
0.50-38%

Question 903
Five long, straight, insulated wires are closely bound together to form a small cable of diameter 1.0 cm. Currents carried by the wires are I1=20A, I2=-6A, I3=12A, I4=-7A, and I5= 8A (negative currents are opposite in direction to the positive). Find the magnitude of the magnetic field at a distance 10 cm from the cable.
(a) 32 micro-T.
(b) zero.
(c) 29 micro-T.
(d) 10 micro-T.
(e) 74 micro-T.

30-04 Solenoids and Toroids

30-04

Question 904
What current in a solenoid 15-cm long wound with 100 turns would produce a magnetic field equal to that of the earth, which is 5.1*10**-5 T?
(a) 13*10**-3 A.
(b) 61*10**-3 A.
(c) 22*10**-3 A.
(d) 82*10**-3 A.
(e) 76*10**-3 A.

30-04

Question 905
A solenoid is formed by tightly winding a single layer of wire. The wire is 1.0 mm in diameter. What is the magnitude of the magnetic field inside the solenoid when there is a current of 0.081 A in the windings?
(a) 102 micro-T.
(b) 51 micro-T.
(c) 81 micro-T.
(d) 212 micro-T.
(e) 10 micro-T.

30-04

Question 906
A 500 turns solenoid is 30 cm long, has a radius of 0.5 cm and carries a current of 2.0 A. The magnitude of the magnetic field at the center of the solenoid is:
(a) 8.2*10**(-3) T
(b) 9.9*10**(-8) T
(c) 1.3*10**(-3) T
(d) 5.6*10**(-8) T
(e) 4.2*10**(-3) T

30-04

Question 907
A solenoid is 3.0 m long and has a circumference of 9.4*10**(-2) m. It carries a current of 12.0 A. The magnetic field inside the solenoid is 25.0*10**(-3) T. The length of the wire forming the solenoid is:
(a) 410 m.
(b) 245 m.
(c) 900 m.
(d) 467 m.
(e) 233 m.

30-04

Question 908 0.45-36%

A current of 2.5 A passes in a solenoid of length L = 50 cm. It produces a magnetic field of 2.3*10**(-3) T at its center. The number of turns in the solenoid is:

(a) 372.
(b) 645.
(c) 366.
(d) 781.
(e) 554.

30-04

Question 909 0.23-55%

Which of the following statements is CORRECT ?

(a) It is impossible for a constant magnetic field to change the speed of a charged particle.
(b) The magnetic field at the center of a current carrying conducting tube is non-zero.
(c) A magnetic field exerts a force on an electron at rest.
(d) The magnetic field inside an ideal solenoid depends on the radius of the solenoid.
(e) An emf can be induced by a constant magnetic field in a fixed conducting loop.

30-04

Question 910 0.48-41%

Consider two solenoids, A and B, having the same current. Solenoid B has twice the radius and six times the number of turns per unit length as solenoid A. The ratio of the magnetic field in the interior of solenoid B to that in the interior of solenoid A is:

(a) 6.
(b) 4.
(c) 3.
(d) 1.
(e) 2 .

30-04

Question 911 0.17-82%

A long solenoid has 1000 turns/m and carries current I. An electron moves within the solenoid in a circle of radius 2.30 cm perpendicular to the solenoid axis. The speed of the electron is 1.35*10**7 m/s. What is the current in the solenoid?

(a) 2.66 A
(b) 5.32 A
(c) 3.99 A
(d) 7.98 A
(e) 1.33 A

30-04

Question 912 0.47-43%

A solenoid has length L=2.0 m and diameter d=4.0 cm, and it carries a current I=6.0 A. It consists of seven closed packed layers, each with 90 turns along length L. What is B at its center?

(a) 2.4*10**(-3) Tesla.
(b) 8.0*10**(-7) Tesla.
(c) 5.0*10**(-3) Tesla.
(d) 3.5*10**(-3) Tesla.
(e) 8.0*10**(-4) Tesla.

30-04
0.28-79%

Question 913

A proton is moving along the axis of a solenoid carrying a current. Which of the following statement is CORRECT about the magnetic force acting on the proton?

(a) The force acts radially outwards.
(b) No force acts.
(c) The force acts in the direction of motion.
(d) The force acts radially inwards.
(e) The force acts in the opposite direction of motion.

30 All Sections

30

Question 914

Which one of the following statements is True?

(a) The magnetic field due to a long straight wire increases with increasing distance from the wire.
(b) The magnetic field is smallest where the field lines are closest.
(c) The torque on a magnetic dipole is zero when it is in a uniform magnetic field.
(d) If the current in each of two parallel current-carrying wires is doubled, the force between them will be doubled.
(e) A uniform magnetic field can be found at the center of a solenoid.

Chapter 31 Induction and Inductance

31-3 faraday's Law of Induction

31-03

Question 915 0.39-41%

Consider a circular loop of radius R = 20 cm lying in the x-y plane. There is throughout the region a uniform magnetic field given by

B = (5.0i + 4.0j + 3.0k) T.

Calculate the magnetic flux though the loop.

(a) 0.15 T*m**2
(b) 0.38 T*m**2
(c) 0.62 T*m**2
(d) 0.21 T*m**2
(e) 0.92 T*m**2

31-03

Question 916

A uniform magnetic field B = (2.0 i + 4.0 j + 5.0 k) T intersects a circular surface of radius 2 cm lying in the yz plane. What is the magnetic flux through this surface?

(a) zero
(b) 8.4*10**(-3) T*m**2
(c) 6.3*10**(-3) T*m**2
(d) 5.0*10**(-3) T*m**2
(e) 2.5*10**(-3) T*m**2

31-03

Question 917 0.29-31%

Consider a cube of side L= 10 cm positioned as shown in Figure 6. Throughout the regior, There is a magnetic field B= (4.0*i + 5.0*j - 6.0*k) T. Calculate the magnetic flux throug1 the shaded face of the cube.

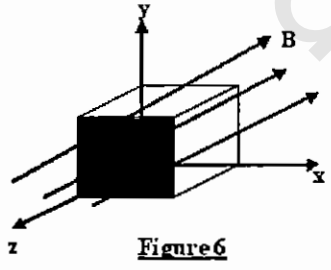


Figure6

(a) -0.04 T*m**2
(b) -0.06 T*m**2
(c) 0.05 T*m**2
(d) 0.04 T*m**2
(e) 0.06 T*m**2

31-03

Question 918

A constant magnetic flux of 4.0*10**(-5) Wb is maintained through a coil for 0.5 s. What emf is induced in the coil by this flux during that period?

(a) -2.0*10**(-5) V.
(b) 2.0*10**(-5) V.
(c) 4.0*10**(-5) V.
(d) Zero.
(e) -4.0*10**(-5) V.

31-03

Question 919

Faraday's law states that an induced emf is proportional to:

(a) the rate of change of magnetic flux.
(b) the rate of change of electric flux.
(c) the rate of change of gravitational field.
(d) the rate of change of magnetic field.
(e) the rate of change of electric field.

31-03

Question 920

Consider a circular loop of wire within which the magnetic flux, Phi, is given as a function of time, t, as

Phi = a*t**2 + b,

where a and b are constants. If the induced emf is measured as 48 V at t=3 s, what is the value of a?

(a) - 8.0 V/s.
(b) - 6.0 V/s.
(c) - 2.1 V/s.
(d) - 4.0 V/s.
(e) - 3.2 V/s.

31-03
0.45-36%

Question 921

A 2.0 Tesla uniform magnetic field makes an angle of 60 degrees with the xy-plane. The magnetic flux through an area of 3 m**2 portion of the xy-plane is:

(a) 5.2 Wb.
(b) 2.0 Wb.
(c) 6.0 Wb.
(d) 12 Wb.
(e) 3.0 Wb.

31-03
0.49-57%

Question 922

A 2.0-T uniform magnetic field (in the x-y plane) makes an angle of 30 degrees with the y-axis The magnetic flux through a 4.0-m**2 portion of the xz plane is:

(a) 6.9 Wb
(b) 12 Wb
(c) 3.0 Wb
(d) 4.0 Wb
(e) 8.0 Wb

31-03
0.55-39%

Question 923

Figure 12 shows a conducting loop consisting of a half circle of radius 0.20 m and three straight sections. The loop lies in a uniform magnetic field that is directed as shown in the figure and is given by:

B = (4.5*t**2) - (10*t) ,

with B in tesla and t in seconds. What is the magnitude of the induced emf at t = 10 s ?

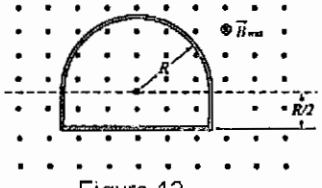


Figure 12

(a) 5.0 V
(b) 10 V
(c) 8.2 V
(d) 6.3 V
(e) 4.1 V

31-03

Question 924 0.53-55%

A 400-turn coil of total resistance 6.0 ohm has a cross sectional area of 30 cm**2. How rapidly should a magnetic field parallel to the coil axis change in order to induce a current of 0.3 A in the coil?

(a) 0.67 T/s.
(b) 1.5 T/s.
(c) 0.25 T/s.
(d) 0.04 T/s.
(e) 2.8 T/s.

31-03

Question 925 0.34-61%

A circular wire loop of area 0.5 m**2 is perpendicular to a magnetic field of 0.8 T. If the coil is removed completely from the field in 0.1 s, the average emf induced in the loop has a magnitude

(a) 5.0 V.
(b) 8.0 V.
(c) 4.0 V.
(d) 2.0 V.
(e) 1.0 V.

31-03

Question 926 0.40-40%

A circular area with a radius of 8.0 cm lies in the xy-plane. What is the magnitude of the magnetic flux through this circle due to a uniform magnetic field of 0.5 T at an angle of 30 degrees from the positive z-axis?.

(a) 8.7*10**(-3) Wb.
(b) zero.
(c) 4.3*10**(-3) Wb.
(d) 2.3*10**(-3) Wb.
(e) 1.1*10**(-3) Wb.

31-03

Question 927 0.45-66%

A circular wire loop, of an area 0.10 m**2, is initially oriented so that its plane is perpendicular to a 0.40 T magnetic field. When the loop is rotated so that its plane is parallel to the field, a 25 V average potential difference is induced across the loop. The time (in seconds) required to make this rotation of the loop is

(a) 4.5*10**(-3).
(b) 1.0*10**(-3).
(c) 1.6*10**(-3).
(d) 1.2*10**(-3).
(e) 3.3*10**(-3).

31-4 Lenz's Law

31-04

Question 928

A plane loop of wire consisting of a single turn of cross- sectional area 0.20 m**2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.25 T to 3.25 T in a time of 2.0 s. What is the resistance of the coil if the induced current has a value of 2.0 A?

(a) 0.15 Ohm.
(b) 0.35 Ohm.
(c) 0.07 Ohm.
(d) 0.11 Ohm.
(e) 0.70 Ohm.

31-04

Question 929

Lenz's law states that "Induced currents always flow in a direction such that they oppose any change in magnetic flux through a conductor". If the above statement is not true, this would lead to a violation of

(a) the law of conservation of energy.
(b) Entropy.
(c) Ampere's law.
(d) Coulomb's law.
(e) the law of conservation of momentum.

31-04

Question 930

Each turn of a 100-turn coil, whose resistance is 60 Ohm, encloses an area of 80 cm**2. What should be the rate of change of a magnetic field parallel to its axes in order to induce a current of 1 mA in the coil?

(a) 0.235 T/s.
(b) Zero.
(c) 0.125 T/s.
(d) 0.075 T/s.
(e) 0.347 T/s.

31-04
0.54-49%

Question 931

A flat coil of wire consisting of 20 turns, each with an area of 50 cm**2, is positioned perpendicularly to a uniform magnetic field that increases its magnitude at a constant rate from 2.0 T to 6.0 T in 2.0 s. If the coil has a total resistance of 0.4 ohms, what is the magnitude of the induced current in the coil?

(a) 0.8 A
(b) 0.5 A
(c) 0.7 A
(d) 0.2 A
(e) 0.6 A

31-04

Question 932

A single turn plane loop of wire of cross sectional area 40 cm**2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.5 T to 5.5 T in 2.0 seconds. What is the resistance of the wire if the induced current has a value of 1.0 mA.

(a) 40 Ohms
(b) 50 Ohms
(c) 10 Ohms
(d) 20 Ohms
(e) 30 Ohms

31-04

Question 933 0.36-40%

The square circuit shown in Figure 8 is in a uniform magnetic field directed into the page and is decreasing at a rate of 1.5 T/s. Calculate the induced current in the circuit if the resistance of the wire 10 ohms.

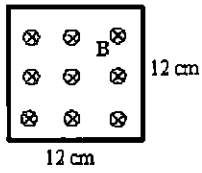


Figure 8

(a) 2.16 milli-A
(b) 2.16 micro-A
(c) 40.1 milli-A
(d) 40.1 micro-A
(e) 5.7 micro-A

31-04

Question 934

Each turn of a 100-turn coil, whose resistance is 60.0 Ohm, encloses an area of 80.0 cm**2. What should be the rate of change of a magnetic field parallel to its axis in order to induce a current of 1.00*10**(-3) A in the coil?

(a) 0.235 T/s.
(b) 0.075 T/s.
(c) 7.51 T/s.
(d) 0.125 T/s.
(e) Zero.

31-04

Question 935

A magnet is taken towards a metallic ring in such a way that a constant current of 10**(-2) A is induced in it. The total resistance of the ring is 0.25 Ohm. In 10 seconds, the flux of the magnetic field through the ring changes by:

(a) 2.5*10**(-9) Wb.
(b) 2.5*10**(-3) Wb.
(c) 2.5*10**(-2) Wb.
(d) 2.5*10**(-1) Wb.
(e) 2.5*10**(-6) Wb.

31-04

Question 936 0.45-36%

A single turn plane loop of wire of cross sectional area 40 cm**2 is perpendicular to a magnetic field that increases uniformly in magnitude from 0.5 T to 5.5 T in 2.0 seconds. What is the resistance of the wire if the induced current has a value of 1.0*10**(-3) A?

(a) 30 Ohms.
(b) 20 Ohms.
(c) 50 Ohms.
(d) 40 Ohms.
(e) 10 Ohms.

31-04

Question 937

A rectangular loop of wire is placed midway between two long straight parallel conductors as shown in figure (11). The conductors carry currents i1 and i2 as indicated. If i1 is increasing and 2 is constant, then the induced current in the loop is:

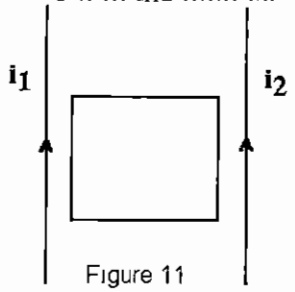


Figure 11

(a) counterclockwise.
(b) depends on i1 - i2.
(c) depends on i1 + i2.
(d) zero.
(e) clockwise.

31-04
0.43-59%

Question 938

A 200-turn coil has a cross sectional area of 0.20 m**2 and a resistance of 20 ohms. The coil is placed in a magnetic field perpendicular to the plane of the coil. The magnitude of the magnetic field decreases from 1.6 milli-T to zero in 0.020 seconds. What is the current induced in the coil ?

(a) 160 mA
(b) 3.20 mA
(c) 32.0 mA
(d) 16.0 mA
(e) 0.800 mA

31-04
0.48-59%

Question 939

A square loop of wire lies in the plane of the page. A decreasing magnetic field is directed into the page. The induced current in the loop:

(a) is zero.
(b) is clockwise in two of the loop sides and counterclockwise in the other two.
(c) is counterclockwise.
(d) depends upon whether or not B is decreasing at a constant rate
(e) is clockwise.

31-04
0.34-67%

Question 940

A long straight wire is in the plane of a rectangular conducting loop as shown in Figure 8. The straight wire carries an increasing current i in the direction shown. The current in the rectangular is:

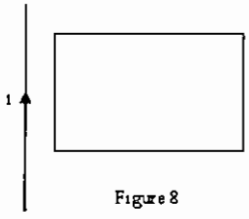


Figure 8

(a) counter clockwise.
(b) counter clockwise in the left side and clockwise in the right side.
(c) clockwise in the left side and counter clockwise in the right side.
(d) zero.
(e) clockwise.

31-04
0..6-62%

Question 941

The circuit shown in figure 9 is in a uniform magnetic field that is into the page and is decreasing in the magnitude at the rate of 150 T/s. The current in the circuit is:

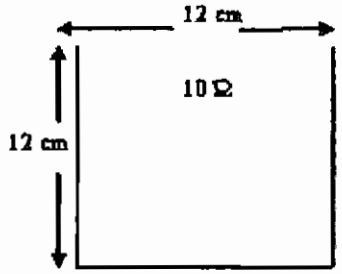


Figure 9

(a) 0.18 A.
(b) 0.22 A.
(c) 0.15 A.
(d) 0.62 A.
(e) 0.40 A.

31-04
0.53-45%

Question 942

A long straight wire carrying a constant current I is in the plane of a circular conducting loop as shown in figure (9). If the wire is moved away from the loop toward point A, the current induced in the loop is

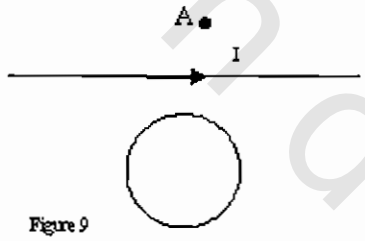


Figure 9

(a) zero.
(b) into the page.
(c) out of the page.
(d) counterclockwise.
(e) clockwise.

31-04
0.59-45%

Question 943

The area of a 333-turn conducting coil is 78.5*10**(-4) m**2 and its resistance is 10.4 ohms. The coil lies in the xy plane and is placed in a magnetic field that points in the z direction. At what rate should the magnetic field change to induce a current of 2.50 mA in the coil?

(a) 3.31 T/s
(b) 0.757 T/s
(c) 0.228 T/s
(d) 0.00995 T/s
(e) 1.52 T/s

31-04
0.67-54%

Question 944

A long, straight wire is in the same plane as a square metallic loop (see figure 9). The wire carries a steady current I in the direction shown in the figure. Now, the loop is moved upward parallel to the wire. Which of the following statements is CORRECT?

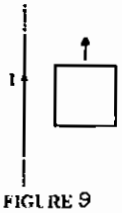


FIGURE 9

(a) The magnetic flux through the loop will decrease.
(b) No current will be induced in the loop.
(c) A clockwise current will be induced in the loop.
(d) The magnetic flux through the loop will increase.
(e) A counter-clockwise current will be induced in the loop.

31-04
0.48-47%

Question 945

A 2.0 m long copper wire, with resistance 5.0 Ohm, is formed into a square loop and placed perpendicular to a uniform magnetic field that is increasing at the constant rate of 10.0 mT/s, at what rate is thermal energy generated in the loop?

(a) 2.1*10**(-4) W.
(b) 4.5*10**(-6) W.
(c) 1.3*10**(-6) W.
(d) 3.2*10**(-3) W.
(e) 0.1*10**(-6) W.

31-04
0.43-30%

Question 946

A small circular loop of area 0.50 cm**2 is placed in the plane of, and concentric with, a large circular loop of radius 2.0 m. The current in the large loop is changed uniformly from +100 A to 100 A in a time of 0.50 s. Find the emf induced in the small loop in this time interval (Assume the field is uniform through the smaller loop).

(a) 7.5*10**(-6) V.
(b) 3.1*10**(-8) V.
(c) 9.2*10**(-9) V.
(d) 5.0*10**(-8) V.
(e) 6.3*10**(-9) V.

31-04
0.39-61%

Question 947

A long straight wire is in the plane of a circular conducting loop as shown in figure 9. The straight wire carries a constant current I in the direction shown. The circular loop starts moving to the left. The induced current in the circular loop is:

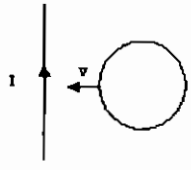


Figure 9

(a) zero.
(b) counter clockwise.
(c) 4*I.
(d) clockwise.
(e) 2*I.

31-5 Induction and Energy Transfers

31-05

Question 948

In the arrangement shown in Figure (7), a conducting bar moves to the right. Assume R=10-Ohm, L=0.5 m, and that a uniform 3.5 T magnetic field is directed into the page. Neglect the mass of the bar, find the power dissipated in the resistor such that the bar moves to the right with a constant speed of 4.0 m/s?

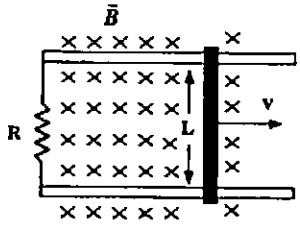


Figure # 7

(a) 1.3 W.
(b) 4.9 W.
(c) 8.6 W.
(d) 2.4 W.
(e) 7.6 W.

31-05

Question 949 0.51-51%

A conducting rod of length 1.2 m is moving with a speed of 10 m/s as shown in Figure 9. If the magnetic field is 0.55 T into the page. Calculate the potential difference between the ends of the rod.

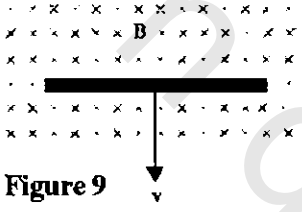


Figure 9

(a) 5.5 V
(b) ZERO
(c) 2.2 V
(d) 8.8 V
(e) 6.6 V

31-05

Question 950

Figure 7 shows a conducting bar moving with a constant speed of 5.0 m/s to the right. Assume that R = 5.0 Ohms, L = 0.20 m, and that a uniform magnetic field of 3.5 T is directed into the page. Calculate the magnitude of the applied force pulling the bar.(Neglect the mass of the bar.)

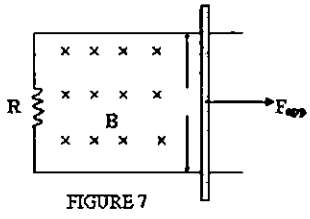


FIGURE 7

(a) 0.25 N
(b) 0.92 N
(c) 1.5 N
(d) 0.73 N
(e) 0.49 N

31-05

Question 951

The square coil shown in figure(12) is 20 cm on a side and has 15 turns of wire on it. It is moving to the right at 2 m/s. Find the induced emf in it at the instant shown, and the direction of the induced current in the coil. (The magnetic field is 0.2 T and its direction is out of the page.)

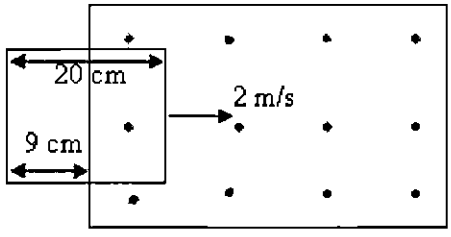


Figure 12

(a) 1.2 V, clockwise
(b) 3.6 V, clockwise
(c) 1.2 V, counter-clockwise
(d) zero
(e) 3.6 V, counter-clockwise

31-05

Question 952 0.45-46%

A metal rod of resistance 12 ohms is forced to move with constant velocity along two parallel metal rails as shown in figure 13. A magnetic field of magnitude 0.35 T is directed as shown in the figure. The separation between the rails is 25.0 cm and the speed of the rod is 45.0 cm/s. What is the current in the rod ? Neglect the resistance of the rails.

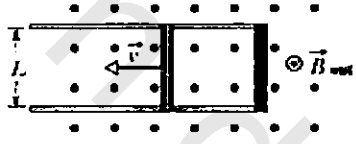


Figure 13

(a) 1.43 mA counterclockwise
(b) 3.28 mA clockwise
(c) 2.32 mA clockwise
(d) 1.43 mA clockwise
(e) 3.28 mA counterclockwise

31-05

Question 953 0.09-69%

Figure 10 shows a bar moving to the right on two conducting rails. To make an induced current in the direction indicated, a constant magnetic field in region A should be in what direction?

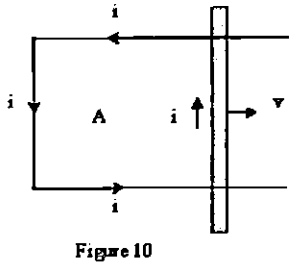


Figure 10

(a) Out of the page.
(b) Impossible; this cannot be done with a constant magnetic field.
(c) Right.
(d) Into the page.
(e) Left.

31-05
0.13-49%

Question 954

A circuit is pulled to the right at constant speed in a uniform magnetic field with a 16-N force as in figure 10. As the circuit moves, a 6.0-A current flows through the 4.0-ohm resistor. With what speed does the circuit move?

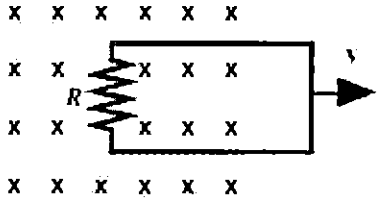


FIGURE 10

(a) 6.4 m/s
(b) 12 m/s
(c) 9.0 m/s
(d) 1.5 m/s
(e) 3.0 m/s

1 - b	51 - c	101 - b	151 - a	201 - c	251 - b	301 - b	351 - a
2 - d	52 - e	102 - e	152 - d	202 - e	252 - a	302 - a	352 - e
3 - e	53 - b	103 - d	153 - d	203 - c	253 - a	303 - e	353 - c
4 - c	54 - c	104 - a	154 - a	204 - b	254 - d	304 - b	354 - d
5 - c	55 - a	105 - c	155 - b	205 - a	255 - b	305 - b	355 - d
6 - b	56 - d	106 - b	156 - e	206 - d	256 - e	306 - c	356 - d
7 - b	57 - b	107 - c	157 - e	207 - c	257 - c	307 - c	357 - d
8 - a	58 - a	108 - e	158 - e	208 - c	258 - b	308 - b	358 - d
9 - c	59 - a	109 - d	159 - a	209 - b	259 - e	309 - b	359 - c
10 - e	60 - c	110 - d	160 - a	210 - a	260 - c	310 - e	360 - e
11 - c	61 - c	111 - d	161 - a	211 - c	261 - d	311 - e	361 - d
12 - e	62 - e	112 - c	162 - d	212 - e	262 - b	312 - a	362 - b
13 - a	63 - c	113 - b	163 - c	213 - a	263 - c	313 - b	363 - d
14 - d	64 - a	114 - a	164 - b	214 - d	264 - e	314 - e	364 - c
15 - c	65 - b	115 - d	165 - d	215 - e	265 - e	315 - e	365 - e
16 - d	66 - c	116 - b	166 - e	216 - c	266 - c	316 - d	366 - d
17 - a	67 - c	117 - a	167 - d	217 - b	267 - b	317 - c	367 - e
18 - a	68 - d	118 - b	168 - d	218 - c	268 - e	318 - e	368 - e
19 - a	69 - b	119 - c	169 - d	219 - d	269 - d	319 - e	369 - b
20 - c	70 - c	120 - e	170 - d	220 - c	270 - c	320 - a	370 - a
21 - c	71 - a	121 - d	171 - b	221 - e	271 - d	321 - a	371 - c
22 - c	72 - c	122 - e	172 - e	222 - c	272 - e	322 - e	372 - c
23 - e	73 - d	123 - e	173 - b	223 - b	273 - d	323 - c	373 - b
24 - a	74 - d	124 - d	174 - d	224 - c	274 - e	324 - d	374 - b
25 - b	75 - e	125 - a	175 - e	225 - e	275 - e	325 - c	375 - e
26 - c	76 - c	126 - b	176 - a	226 - e	276 - a	326 - b	376 - c
27 - c	77 - d	127 - b	177 - d	227 - b	277 - c	327 - a	377 - a
28 - a	78 - c	128 - d	178 - d	228 - b	278 - b	328 - c	378 - c
29 - c	79 - a	129 - c	179 - d	229 - c	279 - e	329 - b	379 - d
30 - b	80 - c	130 - b	180 - b	230 - e	280 - e	330 - a	380 - e
31 - b	81 - e	131 - e	181 - a	231 - b	281 - e	331 - d	381 - c
32 - c	82 - e	132 - d	182 - e	232 - d	282 - e	332 - d	382 - b
33 - a	83 - b	133 - a	183 - c	233 - b	283 - a	333 - a	383 - e
34 - a	84 - d	134 - c	184 - e	234 - d	284 - e	334 - c	384 - e
35 - d	85 - b	135 - a	185 - e	235 - b	285 - c	335 - d	385 - e
36 - c	86 - e	136 - c	186 - a	236 - a	286 - d	336 - c	386 - a
37 - a	87 - b	137 - c	187 - a	237 - e	287 - b	337 - e	387 - d
38 - e	88 - e	138 - d	188 - b	238 - e	288 - d	338 - c	388 - d
39 - a	89 - c	139 - d	189 - b	239 - d	289 - b	339 - b	389 - d
40 - b	90 - a	140 - d	190 - c	240 - b	290 - e	340 - e	390 - d
41 - b	91 - e	141 - e	191 - d	241 - d	291 - e	341 - c	391 - a
42 - c	92 - c	142 - d	192 - d	242 - d	292 - a	342 - c	392 - b
43 - c	93 - d	143 - d	193 - d	243 - b	293 - c	343 - d	393 - a
44 - d	94 - d	144 - c	194 - c	244 - b	294 - d	344 - d	394 - e
45 - a	95 - c	145 - a	195 - e	245 - a	295 - d	345 - d	395 - e
46 - a	96 - c	146 - d	196 - a	246 - d	296 - d	346 - c	396 - e
47 - c	97 - d	147 - b	197 - c	247 - e	297 - b	347 - a	397 - c
48 - a	98 - c	148 - a	198 - e	248 - e	298 - a	348 - e	398 - a
49 - c	99 - d	149 - d	199 - c	249 - c	299 - e	349 - d	399 - e
50 - e	100 - d	150 - d	200 - a	250 - e	300 - c	350 - d	400 - e

Answers

401 - e	451 - a	501 - e	551 - d	601 - e	651 - b	701 - e	751 - e
402 - d	452 - d	502 - e	552 - c	602 - d	652 - e	702 - d	752 - a
403 - b	453 - c	503 - b	553 - b	603 - c	653 - c	703 - b	753 - c
404 - e	454 - b	504 - c	554 - e	604 - b	654 - b	704 - d	754 - b
405 - e	455 - b	505 - e	555 - c	605 - e	655 - b	705 - e	755 - e
406 - a	456 - b	506 - a	556 - e	606 - b	656 - c	706 - a	756 - a
407 - c	457 - b	507 - c	557 - c	607 - e	657 - c	707 - c	757 - d
408 - d	458 - a	508 - e	558 - b	608 - d	658 - b	708 - c	758 - a
409 - e	459 - e	509 - a	559 - e	609 - e	659 - b	709 - d	759 - c
410 - b	460 - c	510 - e	560 - c	610 - a	660 - c	710 - d	760 - a
411 - b	461 - b	511 - a	561 - c	611 - c	661 - b	711 - c	761 - a
412 - b	462 - d	512 - c	562 - a	612 - b	662 - d	712 - b	762 - e
413 - a	463 - c	513 - d	563 - a	613 - a	663 - a	713 - c	763 - a
414 - d	464 - c	514 - b	564 - a	614 - d	664 - e	714 - c	764 - c
415 - d	465 - d	515 - e	565 - b	615 - a	665 - d	715 - e	765 - a
416 - e	466 - d	516 - d	566 - c	616 - a	666 - a	716 - a	766 - c
417 - b	467 - e	517 - d	567 - d	617 - b	667 - d	717 - c	767 - c
418 - c	468 - a	518 - c	568 - a	618 - d	668 - d	718 - e	768 - b
419 - e	469 - b	519 - a	569 - c	619 - a	669 - d	719 - c	769 - c
420 - b	470 - a	520 - b	570 - e	620 - d	670 - b	720 - a	770 - a
421 - d	471 - d	521 - b	571 - c	621 - c	671 - c	721 - e	771 - b
422 - b	472 - b	522 - c	572 - b	622 - e	672 - c	722 - d	772 - e
423 - d	473 - b	523 - d	573 - d	623 - e	673 - d	723 - d	773 - c
424 - e	474 - e	524 - a	574 - c	624 - b	674 - a	724 - d	774 - a
425 - d	475 - d	525 - c	575 - c	625 - b	675 - e	725 - c	775 - e
426 - e	476 - a	526 - e	576 - c	626 - d	676 - d	726 - c	776 - e
427 - a	477 - a	527 - c	577 - d	627 - b	677 - b	727 - b	777 - b
428 - a	478 - c	528 - d	578 - a	628 - e	678 - a	728 - c	778 - a
429 - d	479 - d	529 - c	579 - c	629 - b	679 - d	729 - c	779 - d
430 - d	480 - b	530 - b	580 - b	630 - d	680 - e	730 - d	780 - a
431 - d	481 - d	531 - a	581 - d	631 - a	681 - d	731 - b	781 - c
432 - b	482 - b	532 - a	582 - c	632 - b	682 - e	732 - b	782 - c
433 - e	483 - a	533 - e	583 - e	633 - c	683 - e	733 - e	783 - e
434 - d	484 - a	534 - b	584 - b	634 - d	684 - e	734 - a	784 - d
435 - d	485 - e	535 - d	585 - e	635 - e	685 - d	735 - d	785 - e
436 - e	486 - e	536 - c	586 - d	636 - c	686 - a	736 - b	786 - d
437 - c	487 - b	537 - e	587 - c	637 - b	687 - d	737 - b	787 - c
438 - b	488 - a	538 - d	588 - d	638 - b	688 - d	738 - d	788 - c
439 - b	489 - d	539 - c	589 - a	639 - e	689 - e	739 - c	789 - b
440 - b	490 - a	540 - e	590 - e	640 - c	690 - b	740 - d	790 - d
441 - a	491 - b	541 - c	591 - e	641 - e	691 - e	741 - a	791 - e
442 - a	492 - e	542 - b	592 - d	642 - b	692 - c	742 - c	792 - b
443 - b	493 - c	543 - e	593 - c	643 - b	693 - c	743 - d	793 - b
444 - a	494 - e	544 - e	594 - b	644 - e	694 - e	744 - e	794 - a
445 - e	495 - d	545 - d	595 - e	645 - e	695 - e	745 - a	795 - a
446 - e	496 - c	546 - a	596 - d	646 - c	696 - c	746 - d	796 - b
447 - e	497 - a	547 - b	597 - c	647 - b	697 - a	747 - b	797 - e
448 - d	498 - e	548 - b	598 - c	648 - b	698 - d	748 - a	798 - e
449 - e	499 - b	549 - a	599 - a	649 - a	699 - d	749 - a	799 - d
450 - e	500 - c	550 - e	600 - a	650 - d	700 - c	750 - c	800 - d

801 - a	851 - c	901 - e	951 - a
802 - e	852 - e	902 - d	952 - b
803 - c	853 - e	903 - e	953 - d
804 - c	854 - c	904 - b	954 - c
805 - a	855 - b	905 - a	
806 - a	856 - b	906 - e	
807 - b	857 - d	907 - d	
808 - d	858 - e	908 - c	
809 - c	859 - b	909 - a	
810 - b	860 - b	910 - a	
811 - b	861 - c	911 - a	
812 - b	862 - a	912 - a	
813 - d	863 - e	913 - b	
814 - b	864 - a	914 - e	
815 - e	865 - b	915 - b	
816 - c	866 - b	916 - e	
817 - e	867 - b	917 - b	
818 - c	868 - a	918 - d	
819 - c	869 - c	919 - a	
820 - d	870 - d	920 - a	
821 - a	871 - c	921 - a	
822 - a	872 - d	922 - a	
823 - c	873 - d	923 - c	
824 - e	874 - c	924 - b	
825 - b	875 - a	925 - c	
826 - b	876 - a	926 - a	
827 - d	877 - a	927 - c	
828 - c	878 - d	928 - a	
829 - c	879 - b	929 - a	
830 - e	880 - c	930 - d	
831 - b	881 - e	931 - b	
832 - c	882 - a	932 - c	
833 - a	883 - a	933 - a	
834 - d	884 - c	934 - b	
835 - d	885 - e	935 - c	
836 - b	886 - d	936 - e	
837 - b	887 - a	937 - a	
838 - d	888 - b	938 - a	
839 - a	889 - d	939 - e	
840 - d	890 - a	940 - a	
841 - b	891 - d	941 - b	
842 - b	892 - a	942 - e	
843 - e	893 - b	943 - d	
844 - c	894 - a	944 - b	
845 - c	895 - d	945 - c	
846 - b	896 - d	946 - e	
847 - b	897 - d	947 - b	
848 - d	898 - c	948 - b	
849 - d	899 - b	949 - e	
850 - c	900 - b	950 - e	