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
0.36-59%

Question 394
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?
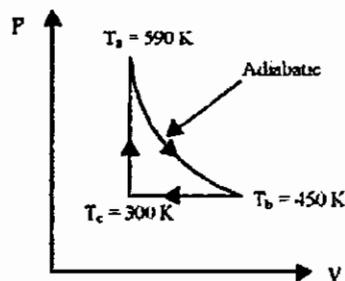(a)   20 kJ
(b)   76 kJ
(c)   18 kJ
(d)   12 kJ
(e)   38 kJ

21-04
0.33-37%

Question 395
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.
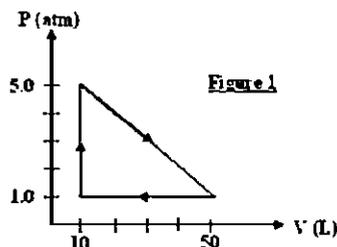

Figure 1

(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.

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

21-04

Question 397

).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

).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.
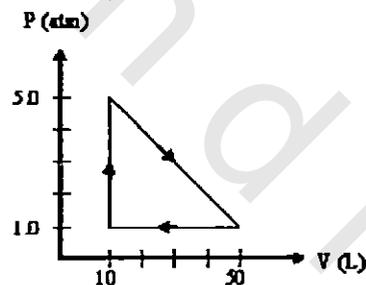
P (atm)

50

10

10   50   V (L)

FIGURE 1

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

21-04
0.49-39%

Question 403
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.

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.
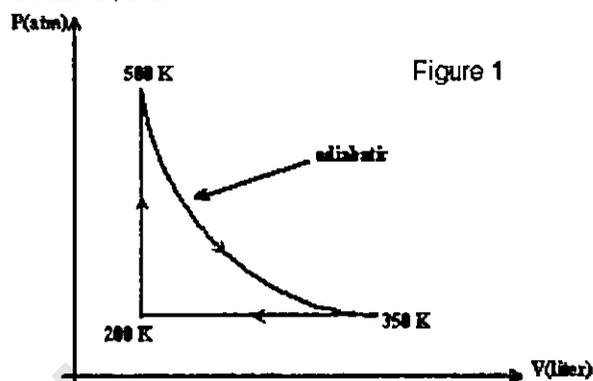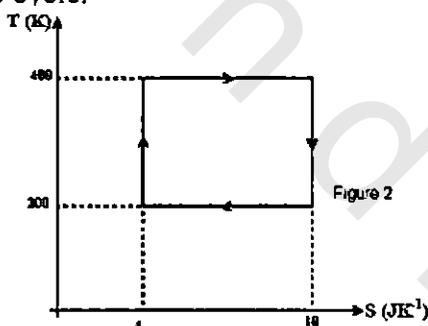

Figure 1

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

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.

Question 406
0.41-24%

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

Question 407
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
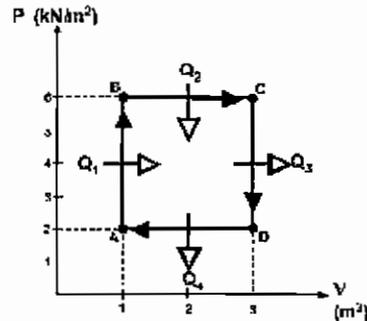
(a)   0.54
(b)   0.44
(c)   0.22
(d)   0.33
(e)   0.29

Question 408
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

Question 409
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.

Question 410
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.

Question 411
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?
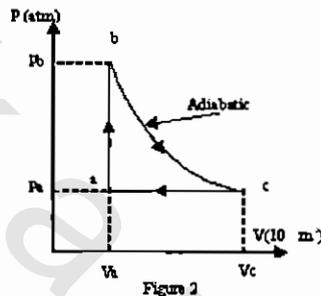(a)   6.31*10**3 J.
(b)   1.44*10**6 J.
(c)   1.93*10**5 J.
(d)   1.92*10**6 J.
(e)   5.46*10**6 J.

Question 412
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%.

Question 413
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.

Question 414
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