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)?

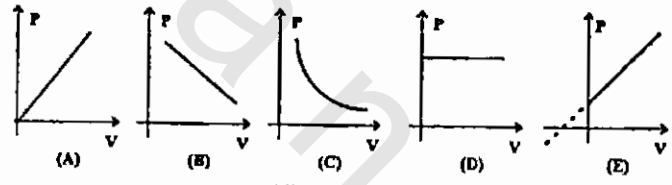

Figure # 1

(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?

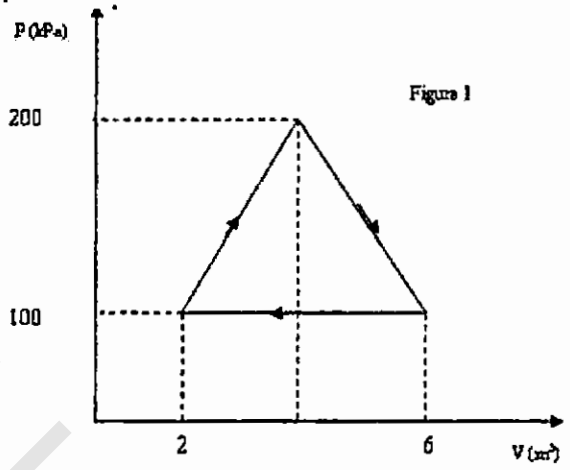

Figure 1

(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?

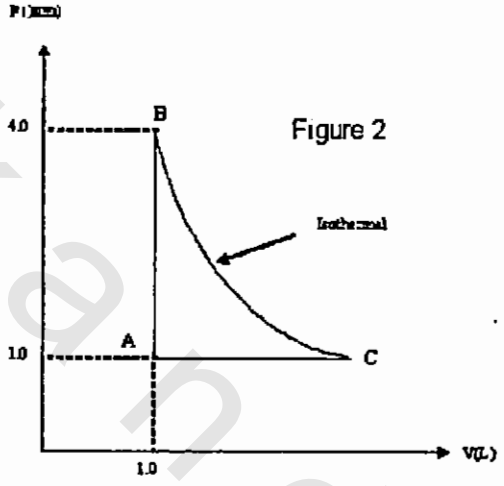

Figure 2

(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?

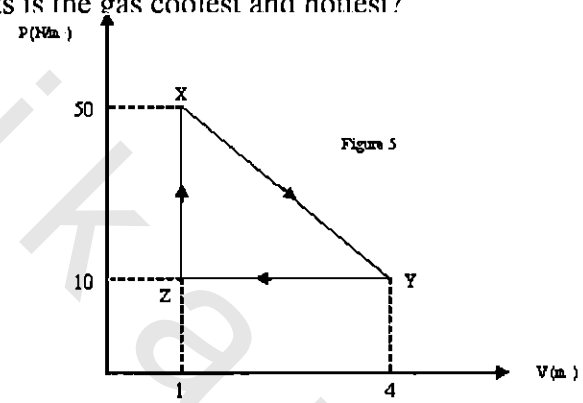

Figure 5

(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.