CHAPTER = 15 MOLECULAR THEORY OF GASES

MULTIPLE CHOICE QUESTIONS (BOOK XII)

1 The relationship between temperature and average kinetic energy of particles in a gas is:

(a) temperature is inversely proportional to the average kinetic energy

(b) temperature is directly proportional to the average kinetic energy

(c) temperature is independent of the average kinetic energy

(d) temperature is proportional to the square of the average kinetic energy

2 Standard conditions of temperature and pressure (STP) refers to a gas at.

(a) 0°C and 1 atm, (b) 20 ^{0}C and 1 atm,

(c) 25 ^{0}C and 1 atm (d) 30 ^{0}C and 101.3 Kpa(1 atm)

3 If the temperature is kept constant and the volume of a gas is doubled, the pressure of a gas is;

(a) Reduced to $\frac{1}{2}$ of the original value. (b) Doubled

(c) Reduced to $\frac{1}{4}$ of the original value (d) Quadrupled

4. The Avogadro's number is the number of molecules in:

(a) One mole of a substance (b) One kg of a substance

(c) One m^3 of a gas (d) One kilogram of hydrogen gas

5 The mean translational K.E. of a molecule of an ideal at temperature T is:

(a) $\frac{3}{2}$ KT (b) $\frac{1}{2}KT$

(c) $\frac{2}{3}KT$ (d) KT^4

6. The normal human body temperature is:

(a) 98.6 ^{0}F (37 °C) (b) 99.6 °F (37.4 °C)

(c) 100.4 ^{0}F (38 °C) (d) 101 ^{0}F (38.3 °C)

7 The pressure P, the density ρ and the average speed of molecules of an ideal gas are related by the equation.

(a) $P = \frac{2}{3} m\rho^2$ (b) $P = \frac{1}{3} m\rho^2$

(c) $P = \frac{1}{3} \rho \overline{v^2}$ (d) $P = \frac{2}{3} \rho^2$

8. In air at S.T.P, the average speed of the:

(a) Oxygen molecules are greater than nitrogen molecules

(b) Nitrogen molecules are greater than Oxygen molecules

(c) Oxygen molecules are approximately Nitrogen molecules

(d) Helium atoms are greater than both Oxygen and nitrogen molecules

9. If the absolute temperature of a gas is increased 3 times, the r m s velocity of the molecules will be:

(a) 3 times (b) 9 times

(c) √3 times (d) 5

10. A gas is enclosed in an isolated container and then placed on a fast-moving train uniformly. The temperature of the gas:
(a) increase due to the motion of the train
(b) Decrease due to the motion of the train
(c) Remain unchanged
(d) Fluctuate, depending on the train's speed and direction

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EXAMS PRACTICE MULTIPLE CHOICE QUESTIONS

1 Evaporation occurs when molecules escape from a liquid surface into the air above it. During this process, the temperature of the liquid falls. Why does the temperature of the liquid fall?
(a) The molecules in the vapour expand because the pressure is less.
(b) The molecules left in the liquid have more space to move around.
(a) The molecules move more slowly when they escape into the air.
(d) The molecules with the highest energies escape into the air.

2 At what temperature will the root mean square velocity of oxygen molecules suffice to escape from the Earth?
(a) 1.6×10^5 K (b) 16×10^5K
(c) 16×10^5 K (d) 160×10^5 K

3 The first excited state of the hydrogen atom is 10.2 eV above its ground state. What temperature is needed to excite hydrogen atoms to the first excited level –
(a) 7.88×10^4K (b) $.788 \times 10^4$ K
(c) 78.8×10^4 K (d) 788×10^4 K

K.E. of the hydrogen atom = 10.2 eV

$\therefore$ 10.2 eV = $10.2 \times (1.6 \times 10^{-19})$ Joule

$$T = \frac{2}{3} \times \frac{\text{K.E. per atom}}{K}$$

$$\therefore T = \frac{2}{3} \times \frac{10.2 \times 1.6 \times 10^{-19}}{1.38 \times 10^{-23}}$$

Where, $k = 1.38 \times 10^{-23}$ J/mole. °K

$\Rightarrow T = 7.88 \times 10^4$ K

4 Which of the following parameters is the same for molecules of all gases at a given temperature?
(a) Mass (b) Speed
(c) Momentum **(d) Kinetic energy**

5 The density of carbon dioxide gas at 0°C and at a pressure of 1.0×10^5 newton/metre^2 is 1.98kg/m^3. Find the root mean square velocity of its molecules at 0°C. Pressure is constant
(a) 39 metre/sec (b) 3.09 metre/sec
(c) 389 metre/sec (d) 38.9 metre/sec

6. Heat energy cannot be measured in:
(a) Joule (b) B.T.U.
(c)Kelvin (d) Calories

7. The SI unit of heat is:
(a) joule (b) Calorie
(c) Centigrade (d) Fahrenheit

8. The kinetic energy per mole of a gas is:
(a) 3/2 kT (b) 2/3 kT
(c) 3/2 RT (d) nRT

9. If the volume of a given mass of a gas is doubled without changing its temperature, the pressure of the gas is:
(a) reduced to ½ of the initial value (b) the same as the initial value
(c) reduced to 1.4 of the initial value (d) double of the initial value

10. Fahrenheit and Celsius scales of temperature coincide at
(a) 0° (b) 273°
(c) –273° **(d) – 40°**

11. The volume of a given gas at constant pressure becomes zero at:
(a) 273K (b) 273°
(c) –273 K (a) –273°

12. According to the Kinetic theory of gases the absolute temperature of a perfect gas is:
(a) inversely proportional to the KE of the molecules
(b) independent of the kinetic energy of the molecules
(c) equal to the KE of the molecules
(d) directly proportional to the average translational KE of the molecule

13. 273 K is equal to
(a) 0°F (b) –32°F
(c) –273°F **(d) 32°F**

14. In Celsius scale 1°C in magnitude is equal to:
(a) 32°F (b) 16°F
(c) 0°F **(d) 1.8°F**

15 Which of the following assumptions explains the great compressibility of gases?
(a) the actual volume of the gas molecules is negligible
(b) there is no force of attraction
(c) particles are always in random motion
(d) different particles have different speeds

16 The temperature of a gas is 100 K it is heated until it is 200 k then, what do you understand regarding kinetic energy in this process?
(a) halved (b) tripled
(c) quadrupled **(d) doubled**

17 Which of the following is not a postulate of Kinetic molecular theory of gases?
(a) the actual volume of gas molecules is negligible
(b) there are high forces of attraction between the gas molecules
(c) collisions are elastic in gas molecules
(d) kinetic energy of gas molecules is directly proportional to the absolute temperature

18 Calculate the root mean square speed of hydrogen in m/s at 27°C.

(a) 2835.43 m/s (b) 2635.43 m/s

(c) 2735.43 m/s (d) 2731.43 m/s

19 The speed of three particles is recorded as 3 m/s, 4 m/s, and 5 m/s. What is a root mean square speed of these particles?

(a) 4.082 m/s (b) 2.07 m/s

(c) 3.87 m/s (d) 3.082 m/s

20 What is the ratio of root mean square speed of 16 grams of Oxygen to 4 grams of hydrogen?

(a) 2 (b) 3

(c) 4 (d) 1

Answer: a

Explanation: The formula of root mean square speed of particles is given as $\sqrt{3RT/M}$. We know that the velocity of gas molecules is inversely proportional to the root over the mass of the gas here the mass of oxygen to the mass of hydrogen ratio is the answer. So $\sqrt{16/4} = 2$.

21 Which among the following options do you think has the highest average speed?

(a) chlorine **(b) hydrogen**

(c) neon (d) oxygen

22 What is the shape of the graph that is drawn between pressure and volume?

(a) A straight line (b) Circular

(c) Parabola **(d) Hyperbola**

23 There is a balloon filled with a gas at 26 degrees centigrade and has a volume of about 2 liters when the balloon is taken to a place which is at 39 degrees centigrade, what would be the volume of the gas that is inside the balloon?

(a) 2 liters **(b) 2.08 liters**

(c) 1.5 liters (d) 0.67 liters

24 According to Kinetic Molecular Theory gas molecules move in_____path?

(a) Straight (b) Parabolic

(c) Zig-zag (d) Hyperbolic

25 Moon has no atmosphere because

(a) It is far away from the surface of the earth

(b) Its surface temperature is 10°C

(c) The r.m.s. the velocity of all the gas molecules is more than the escape velocity of the surface of the moon

(d) The escape velocity of the surface of the moon is more than the r.m.s velocity of all molecules