



# PHYSICS

## BOOKS - BITSAT GUIDE

### PHYSICS FOR GASEOUS STATE

#### Practice Exercise

1. In an ideal gas without preferred direction of motion of molecules,

A.  $V_x = V_y = V_z$

B.  $V_x^2 = V_y^2 = V_z^2$

C.  $\bar{V}_x^2 = \bar{V}_y^2 = \bar{V}_z^2$

D. None of the above

**Answer: C**



**Watch Video Solution**

2. Two perfect gases at absolute temperatures  $T_1$  and  $T_2$  are mixed. The absolute temperature of the mixture is  $T$ . there is no

loss of energy. If  $m_1$  and  $m_2$  are masses of molecules and  $n_1$  and  $n_2$  are number of molecules, then

A.  $T = \frac{T_1 + T_2}{2}$

B.  $T = \frac{n_1 T_1 + n_2 T_2}{n_1 + n_2}$

C.  $T = \frac{n_1 T_1 + n_2 T_2}{T_1 + T_2}$

D. None of the above

**Answer: B**



**Watch Video Solution**

3. In troposphere, temperature varies linearly with elevation as  $T = T_0 - ay$ , where  $T_0$  is the temperature at the earth's surface, then

A. the pressure does not change with elevation in troposphere

B. the variation of pressure with elevation is linear

C. the dimension of  $a$  is  $[M^{\circ} L^{-1} \theta]$

D. the pressure is independent of variation with temperature in the given situation

**Answer: B,C**



**Watch Video Solution**

4. A vessel contains a mixture of nitrogen of mass 7 g and carbon dioxide of mass 11 g at temperature 290 K and pressure 1 atm. Find the density of the mixture.

A.  $1.1g/L$

B.  $1.2g/L$

C.  $1.515g/L$

D.  $1.6g/L$

**Answer: C**



**Watch Video Solution**

5. 12 g of gas occupy a volume of  $4 \times 10^{-3} m^3$  at a temperature of  $76^\circ C$ . After the gas is heated at constant pressure, its density becomes  $6 \times 10^{-4} g/cm^3$ . What is the temperature to which the gas was heated?

A. 1000 K

B. 1400 K

C. 1200 K

D. 800 K

**Answer: B**



**Watch Video Solution**

**6.** A closed vessel with a capacity of  $1m^3$  contains 0.9 kg of water and 1.6 kg of  $O_2$ . Find the pressure in the vessel at a temperature of

$500^{\circ}C$  at which all the water will be converted into steam.

A.  $3.2 \times 10^5 N/m^2$

B.  $6.4 \times 10^5 N/m^2$

C.  $1.6 \times 10^5 N/m^2$

D.  $9.6 \times 10^5 N/m^2$

**Answer: B**



**Watch Video Solution**



7. The pressure of a gas kept in an isothermal container is  $200\text{Kpa}$ . If half the gas is removed from it, the pressure will be

A. 100 kPa

B. 200 kPa

C. 400 kPa

D. 800 kPa

**Answer: A**



**Watch Video Solution**

8. The pressure inside a tyre is 4 atm at  $27^{\circ}C$

.If the tyre bursts suddenly, its final temperature will be

A.  $300 \frac{(4)^7}{2}$

B.  $300 \frac{(4)^2}{7}$

C.  $300 \frac{(2)^7}{2}$

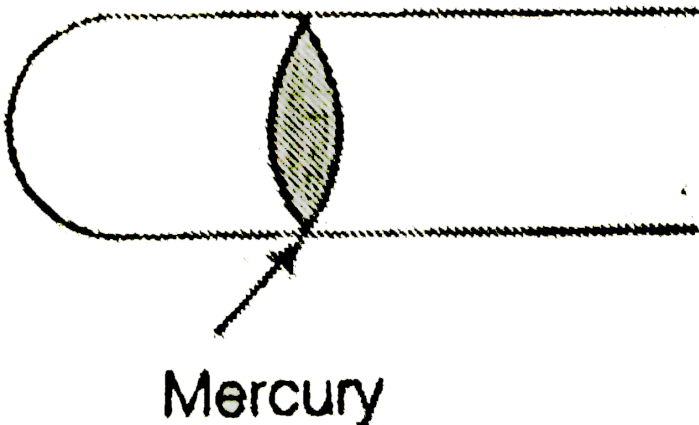
D.  $300 \frac{(4)^{-2}}{7}$

**Answer: D**



**Watch Video Solution**

9. A uniform tube is shown in figure, which is open at one end and closed at the other. To enclose a column of air inside the tube, a pellet of mercury is introduced. If the length of the air column at  $27^{\circ}\text{C}$  is 18 cm, at what temperature its length will be 21.6 cm?



A.  $87^{\circ} C$

B.  $91^{\circ} C$

C.  $85^{\circ} C$

D.  $97^{\circ} C$

**Answer: A**



**Watch Video Solution**

**10.** Pressure of an ideal gas is increased by keeping temperature constant. What is its effect on kinetic energy of molecules?

A. Increase

B. decrease

C. No change

D. Cannot be determined

**Answer: C**



**Watch Video Solution**

**11.** How many cylinders of hydrogen at atmospheric pressure are required to fill a ballon whose volume is  $500\text{m}^3$  if hydrogen

is stored in cylinders of volume  $0.05 \text{ m}^3$  at an absolute pressure of  $15 \times 10^5 \text{ Pa}$ ?

A. 700

B. 675

C. 605

D. 710

**Answer: B**



**Watch Video Solution**

12. Two identical containers A and B have frictionless pistons. They contain the same volume of an ideal gas at the same temperature. The mass of the gas in A is  $m_A$  and that in B is  $m_B$ . The gas in each cylinder is now allowed to expand isothermally to double the initial volume. The changes in the pressure in A and B are found to be  $\Delta p$  and  $1.5\Delta p$  respectively.

A.  $4m_A = 9m_B$

B.  $2m_A = 3m_B$

C.  $3m_A = 2m_B$

D.  $9m_A = 4m_B$

**Answer: C**

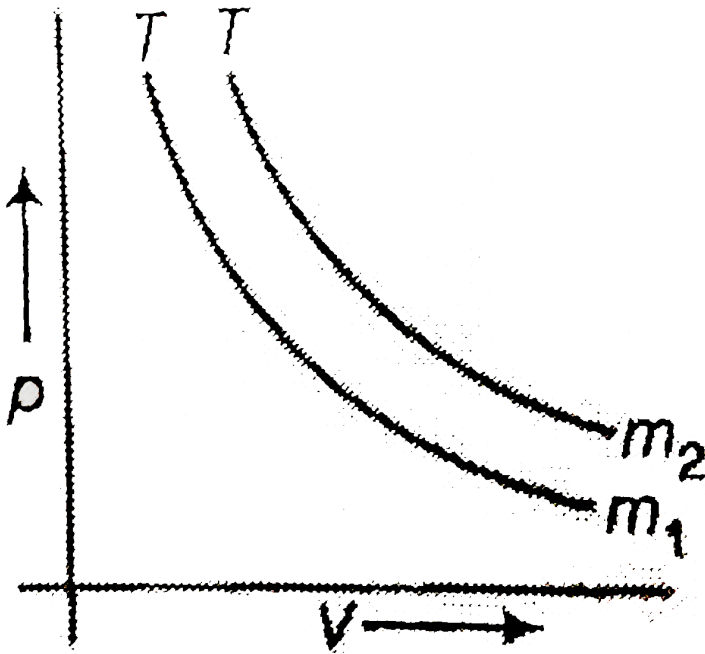


**Watch Video Solution**

**13.** The figure shown, the p-V diagram of two different masses  $m_1$  and  $m_2$  drawn at



constant temperature  $T$ , then  $1/b$ .



A.  $m_1 > m_2$

B.  $m_2 > m_1$

C.  $m_1 = m_2$

D. insufficient data

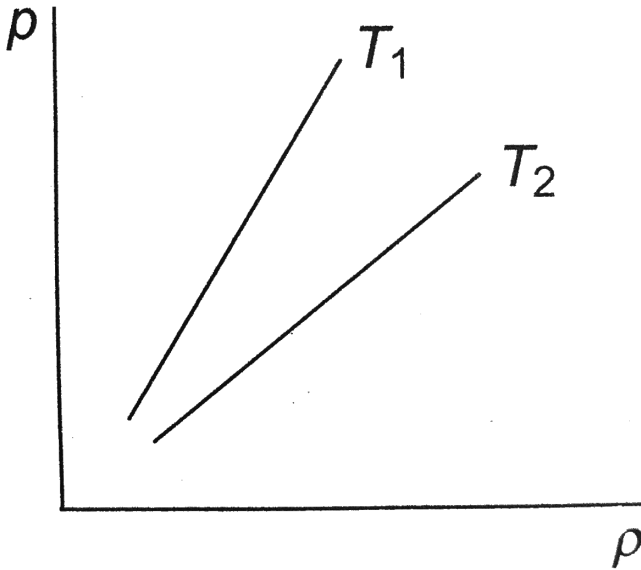
**Answer: B**



**Watch Video Solution**

**14.** Figure shows graphs of pressure vs density for an ideal gas at two temperature

$T_1$  and  $T_2$ . Which of the following is correct?



A.  $T_1 > T_2$

B.  $T_1 = T_2$

C.  $T_1 < T_2$

D. any three is possible

**Answer: A**



**Watch Video Solution**

**15.** A gas at the temperature 250 K is contained in a closed vessel. If the gas is heated through 1K, then the percentage increase in its pressure will be

A. 0.004

B. 0.006

C. 0.008

D. 0.01

**Answer: A**



**Watch Video Solution**

**16.** If the intermolecular forces vanish away, the volume occupied by the molecules contained in  $4.5\text{kg}$  water at standard temperature and pressure will be given by

A.  $5.6\text{m}^3$

B.  $4.5m^3$

C.  $11.2m^3$

D.  $5.6L$

**Answer: A**



**Watch Video Solution**

**17.** Find the pressure exerted by  $6 \times 10^{23}$  hydrogen molecules which will strike per second a wall of area  $10^{-4}km^2$  at  $60^\circ$  with normal. The mass of hydrogen molecules and

speed are  $3.32 \times 10^{-27}$  kg and  $10^{-27}$  kg and  $10^3$  m / s respectively.

A.  $19.92 \times 10^3$  N / m<sup>2</sup>

B.  $18.2 \times 10^3$  N / m<sup>2</sup>

C.  $1.992 \times 10^3$  N / m<sup>2</sup>

D.  $0.1992 \times 10^3$  N / m<sup>2</sup>

**Answer: A**



**Watch Video Solution**

18. Four molecules of gas have speeds 1,2,3 and 4  $km/s$ . The value of the root mean square speed of the gas molecules is

A.  $\frac{1}{2}\sqrt{15}km/s$

B.  $\frac{1}{2}\sqrt{10}km/s$

C.  $2.56km/s$

D.  $\sqrt{\frac{15}{2}}km/s$

**Answer: D**



**Watch Video Solution**



19. The temperature of  $H_2$  at which the rms velocity of its molecules is seven times the rms velocity of the molecules of nitrogen at 300 K is

A. 2100 K

B. 1700 K

C. 1350 K

D. 1050 K

**Answer: D**



**Watch Video Solution**

20. For gas at a temperature  $T$  the root-mean-square speed  $v_{rms}$ , the most probable speed  $v_{mp}$ , and the average speed  $v_{av}$  obey the relationship

A.  $V_{mp} > V_{av} > V_{ms}$

B.  $V_{ms} > V_{av} > V_{mp}$

C.  $V_{av} > V_{mp} > V_{ms}$

D.  $V_{mp} > V_{ms} > V_{av}$

**Answer: B**



**Watch Video Solution**

21. The average kinetic energy of gas molecule at  $27^{\circ}C$  is  $6.21 \times 10^{-21} J$ . Its average kinetic energy at  $127^{\circ}C$  will be

A.  $12.2 \times 10^{-21} J$

B.  $8.28 \times 10^{-21} J$

C.  $10.35 \times 10^{-21} J$

D.  $11.35 \times 10^{-21} J$

**Answer: B**



**Watch Video Solution**

22. Most probable speed,  $c_{mp}$ , average speed,  $c_{av}$  and root mean square speed  $c_{rms}$  of gas molecules are related as

A.  $\sqrt{3} : \sqrt{2} : \sqrt{\frac{8}{\pi}}$

B.  $2 : \sqrt{3} : \sqrt{\frac{\pi}{8}}$

C.  $\sqrt{2} : \sqrt{3} : \sqrt{\frac{8}{\pi}}$

D.  $\sqrt{2} : \sqrt{\frac{8}{\pi}} : \sqrt{3}$

**Answer: D**



**Watch Video Solution**

**23.** Five gas molecules chosen at random are found to have speeds of 500,600m,700,800 and 900  $m / s$  Then,

A. the rms speed and the average speed are the same

B. the rms speed is  $14m / s$  higher than the average speed

C. the rms speed is  $14m/s$  higher than the average speed

D. the rms speed is  $\sqrt{14}m/s$  lower than the average speed

**Answer: B**



**Watch Video Solution**

**24.** In case of molecules of an ideal gas, which of the following , average velocities cannot be zero?

A.  $\langle \bar{V}l \rangle$

B.  $\langle \bar{V}^3 \rangle$

C.  $\langle \bar{V}^4 \rangle$

D.  $\langle \bar{V}^5 \rangle$

**Answer: C**



**Watch Video Solution**

**25.** Choose the correct relation between the rms speed ( $V_{rms}$ ) of the gas molecules and the velocity of sound in that gas ( $V_s$ ) in

identical situations of pressure and temperature.

A.  $V_{ms} = V_s$

B.  $V_{ms} = \sqrt{\left(\frac{3}{\gamma}\right)^{v_s}}$

C.  $C. V_{rms} = \sqrt{\left(\frac{\gamma}{3}\right)^{v_s}}$

D.  $\gamma v_{rms} = 3V_s$

**Answer: B**



**Watch Video Solution**



26. At what temperature is the "effective" speed of gaseous hydrogen molecules (molecular weight = 2) equal to that of oxygen molecules (molecular weight = 32) at  $47^{\circ}C$ ?

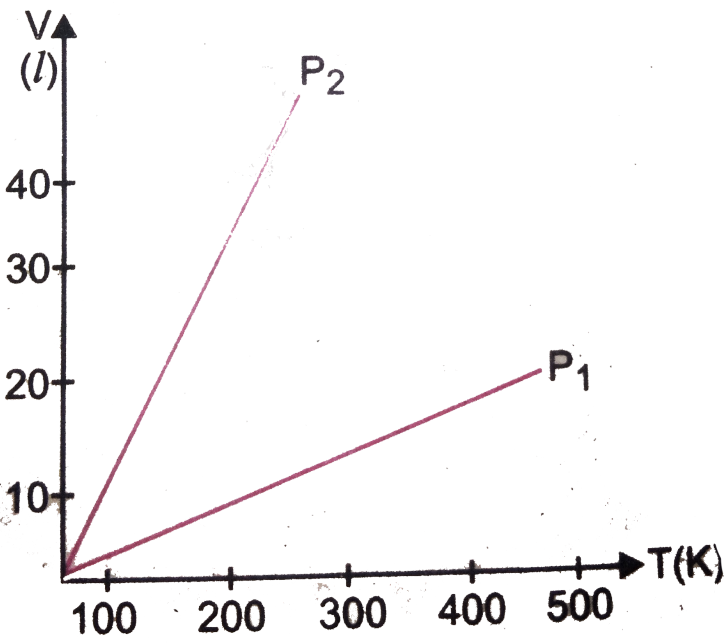
- A. 50 K
- B. 20 K
- C. 40 K
- D. 100 K

**Answer: B**



Watch Video Solution

27. Volume versus temperature graphs for a given mass of an ideal gas are shown in Fig. at two different values of constant pressure. What can be inferred about relation between  $P_1$  and  $P_2$ ?



A.  $P_1 > P_2$

B.  $P_1 < P_2$

C.  $P_1 = P_2$

D. Data is insufficient

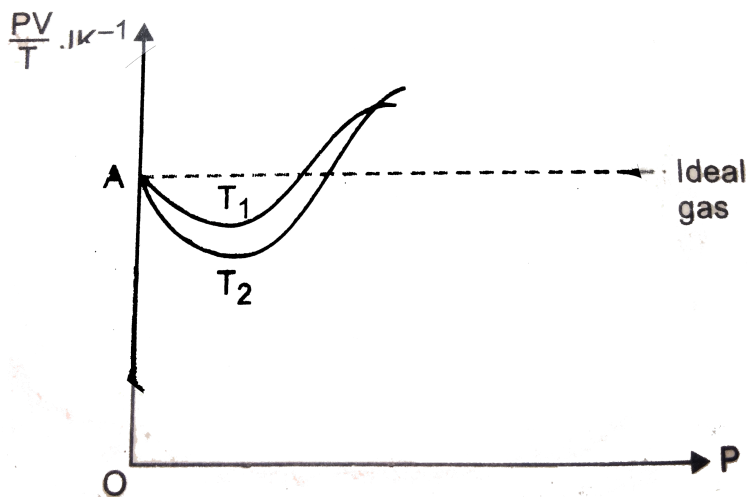
**Answer: A**



**Watch Video Solution**

**28.** Given is the graph between  $\frac{PV}{T}$  and  $P$  for 1 gm of oxygen gas at two different temperatures  $T_1$  and  $T_2$  Fig. Given, density of

oxygen =  $1.427 \text{kgm}^{-3}$ . The value of  $(PV)/(T)$  at the point A and the relation between  $T_1$  and  $T_2$  are respectively :



- A.  $0.256 \text{JK}^{-1}$  and  $T_1 < T_2$
- B.  $8.314 \text{Jmol}^{-1} \text{K}^{-1}$  and  $T_1 < T_2$
- C.  $0.256 \text{JK}^{-1}$  and  $T_1 > T_2$
- D.  $4.28 \text{JK}^{-1}$  and  $T_1 < T_2$

**Answer: C**



**Watch Video Solution**

**29.** Which of the following quantities is zero on an average for the molecules of an ideal gas in equilibrium?

A. Kinetic energy

B. Momentum

C. Density

D. Speed

**Answer: B**



**Watch Video Solution**

**30.** Some gas at 300K is enclosed in a container. Now the container is placed on a fast moving train. While the train is in motion, the temperature of the gas

A. rises above 300 K

B. falls below 300 K

C. remains unchanged

D. becomes unsteady

**Answer: A**



**Watch Video Solution**

31. If at a pressure of  $10^6 \text{ dy} \neq / \text{cm}^2$ , one gram mole of nitrogen occupies  $2 \times 10^4$  cc volume, the calculate the average energy of a nitrogen molecules in erg.(Given avogadro's number =  $6 \times 10^{23}$ )

A.  $14 \times 10^{-13}$

B.  $10 \times 10^{-12}$

C.  $10^6$

D.  $2 \times 10^6$

**Answer: A**



**View Text Solution**

**32.** At what temperature does the average translational kinetic energy of molecule in a gas become equal to kinetic energy of an electron accelerated from rest through a



potential difference of 1 volt?

$$(K = 1.38 \times 10^{-23} J/k)$$

A.  $T = 7729K$

B.  $T = 8879K$

C.  $T = 7.72K$

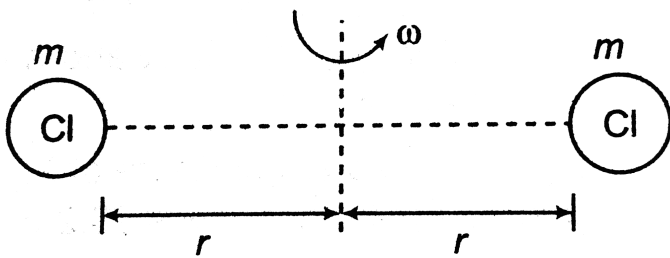
D.  $T = 772.9K$

**Answer: A**



**Watch Video Solution**

33. In a crude model of a rotating diatomic molecule of chlorine ( $Cl_2$ ), the two ( $Cl$ ) atoms are  $2.0 \times 10^{-10} m$  apart and rotate about their centre of mass with angular speed  $\omega = 2.0 \times 10^{12} \text{ rad/s}$ . What is the rotational kinetic energy of one molecule of  $Cl_2$ , which has a molar mass of  $70.0 \text{ g/mol}$ ?



A.  $2.32 \times 10^{-20} J$

B.  $2.32 \times 10^{-21} J$

C.  $2.32 \times 10^{-19} J$

D.  $2.32 \times 10^{-22} J$

**Answer: B**



**Watch Video Solution**

**34.** At  $20^{\circ}C$  temperature, an argon gas at atmospheric pressure is confined in a vessel with a volume of  $1m^3$  The effective hard sphere

diameter of argon atom is  $3.10 \times 10^{-10}$  m.

determine mean free path.

A. 100 nm

B. 90 nm

C. 93.6 nm

D. 95 nm

**Answer: C**



**Watch Video Solution**

**35.** In the case of saturated vapour,

A. pressure depends upon volume at constant temperature

B. pressure varies non linearly with temperature at constant volume

C. pressure becomes less than one atmosphere at boiling point

D. pressure varies linearly with temperature at constant volume

**Answer: B**



**Watch Video Solution**

**Bitsat Archives**

1. Two ballons are filled, one with pure He gas and other by air, repectively. If the pressure and temperature of these ballons are same then the number of molecules per unit volume is:

- A. more in He filled ballon
- B. same in both balloons
- C. more in air filled ballon
- D. in the ratio 1:4

**Answer: B**



**Watch Video Solution**

2. A vessel containing 1 mole of  $O_2$  gas (molar mass 32) at temperature T. The pressure of the gas is P. An identical vessel containing one

mole of He gas (molar mass 4) at temperature

2 T has a pressure of [2013]

A.  $P/8$

B.  $P$

C.  $P$

D.  $8P$

**Answer: C**



**Watch Video Solution**



3. The temperature of an ideal gas is increased from  $27^{\circ}C \rightarrow 127^{\circ}C$ , the percentage increase in  $V_{rms}$  is [2013]

A. 0.37

B. 0.11

C. 0.33

D. 15.5%

**Answer: D**



**Watch Video Solution**

4. The ratio of the adiabatic bulk modulus to the isothermal bulk modulus of a perfect gas with  $f$  degrees of freedom is [2010]

A.  $\frac{2}{f}$

B.  $1 + \frac{1}{f}$

C.  $1 + \frac{2}{f}$

D.  $1 + \frac{f - 1}{4}$

**Answer: C**



**Watch Video Solution**

5. If  $V$  is the molecular speed and  $l$  is the mean free path of molecule of gas, then the collision frequency is "[2010]

A.  $Vl$

B.  $\frac{V}{l}$

C.  $\frac{l}{V}$

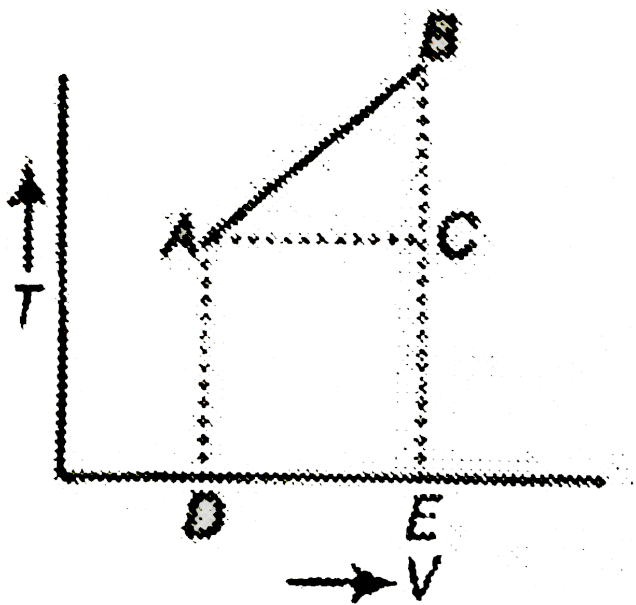
D.  $\sqrt{Vl}$

**Answer: B**



**Watch Video Solution**

6. From the following V-T diagram, what is true about pressure?" "[2009]



A.  $P_1 < P_2$

B.  $P_1 > P_2$

C.  $P_1 = P_2$

D. Cannot predict

**Answer: A**



**Watch Video Solution**

7. One litre of oxygen at a pressure of 1 atm and two litres of nitrogen at a pressure of 0.5 atm are introduced into a vessel of volume 1 litre. If there is no change in temperature, the final pressure of the mixture of gas (in atm) is

A. 1.5

B. 2.5

C. 2

D. 4

**Answer: C**



**Watch Video Solution**

**8.** The ratio of velocity of sound in hydrogen and oxygen at STP is "[2005]

A. 16:1

B. 8:1

C. 4:1

D. 2:1

**Answer: C**



**Watch Video Solution**