PHYSICS

AAKASH INSTITUTE ENGLISH

KINETIC THEORY

Example

1. State and explain law of multiple proportions with a suitable example.

Watch Video Solution

2. Define free path and mean free path.

Watch Video Solution

3. State Atomic hypothesis.

Watch Video Solution

4. The pressure of gas is increased 2 times. What should be the change in its volume so that the temperature and number of moles remains constant ?

Watch Video Solution

5. The pressure of a given mass of a gas filled in a vessel of volume V at constant temperature is reduced to $1/3$ rd of its initial value. Calculate the percentage change in its volume.

Watch Video Solution

6. The percentage change in the pressure of a given mass of a gas filled in a container at constant temperature is 100%. Calculate the percentage change in its volume.

Watch Video Solution

7. A gas is filled in a vessel at $27^{\circ}C$. To what temperature should it be heated in order that $\frac{1}{3}$rd of the gas may escape out of the vessel?

Watch Video Solution

8. A gas is filled in a container at $27^\circ C$. On increasing the temperature to $127^\circ C$, 1 litre (having $\frac{1}{4}$th mass) of the gas escape out of the container. Calculate the volume of the container.

Watch Video Solution

9. The pressure of a gas filled in a closed containeer increases by 1% when temperature is increased by $1^\circ C$. Find the initial temperature of the gas.

Watch Video Solution

10. One mole each of hydrogen, oxygen and nitrogen are mixed in a close container of volume 10 L and temperature $27^\circ C$. Calculate the pressure exerated by the mixture. $(R = .314 Jmol^{-1}K^{-1})$

Watch Video Solution

11. If the mass of each molecules of a gas is doubled and speed is halved, find the ratio of initial and final pressure.

Watch Video Solution

12. A gas is filled in a vessel at a certain temperature and at a pressure of $80 cm$ of Hg. At the same temperature, more gas is filled in the vessel so that its mean increases by $60\,\%$. Determine the resultant pressure in the vessel.

Watch Video Solution

13. if the pressure remains constant, find the temperature at which root mean square speed of a gas is half of its value at $27^\circ C$.

Watch Video Solution

14. The density of CO_2 gas at $0^\circ C$ and at a pressure of $1.0 \times 10^5 Nm^{-2}$ is 1.98 kgm^{-3}. Calculate the root mean square velocity of its molecules at $0^\circ C$ and $30^\circ C$. Assume the pressure to remain constant.

Watch Video Solution

15. Calculate the average kinetic energy of oxygen molecule at 0° C. $\left(R = 8.314 Jmol^{-1}\right.$ K^{-1}, N_A=6.02×10^{23})

Watch Video Solution

16. Calculate the ratio of KE of molecule of oxygen and neon gas at $27^{\circ} C$.

Watch Video Solution

17. Calculate the molar specific heat at constant volume of neon gas.

(R=8.314J $mol^{-1}K^{-1}$)

Watch Video Solution

18. The molar specific heats of an ideal gas at constant volume and constant pressure are respectively 4.98 and 6.96 cal $mol^{-1}K^{-1}$. If the molecular weight of the gas be 32, then calculate the root means square speed of the molecule of the gas at $120^{\circ}C$. (1 cal = 4.2 J)

Watch Video Solution

19. Calculate the ratio of the mean free path of molecules of two gases ig the ratio of the numbers density per cm^3 of the gases is $5:3$ and the ratio of the diameters of the molecules of the gases is $4:5$

Watch Video Solution

20. For a molecule of an ideal gas $n = 3 \times 10^8 cm^{-3}$ and mean free path is 10^{-2}

cm. Calculate the diameter of the molecule.

Watch Video Solution

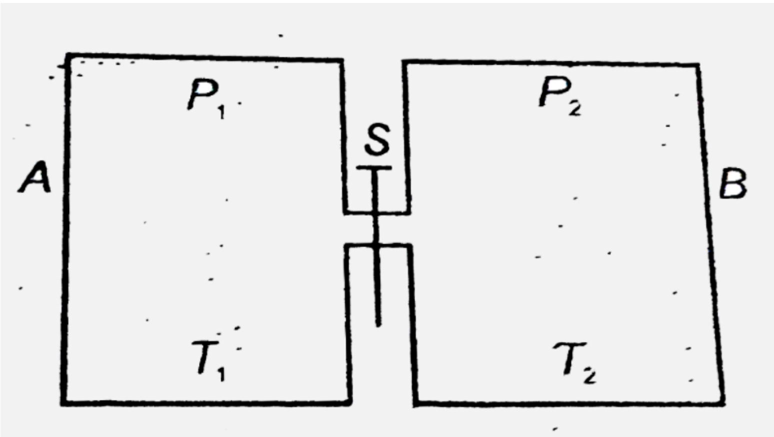
21. Estimate the number of air molecules that are in a room 4.00 m by 6.00 m by 3.00 m at standard pressure and room temperature (293K).

Watch Video Solution

22. A person's lungs might holds 6.0 L of air at body temperature (310K) and atmospheric pressure (101 kPa). Given that the air contains 21% oxygen, find the number of oxygen molecules in the lungs.

Watch Video Solution

23. Two identical containers A and B are connected by a tap S that is initially closed. A contains an ideal gas at a pressure P_1 and temperature T_1. B contains the same gas at a pressure P_2 and a temperature T_2. The tap is then opened. If the temperature of containers A and B are maintained and remains unchanged, find the molar ratio of the gas in the two containers. find also the pressure of the gas mixture.



View Text Solution

24. Find the temperature at which oxygen molecules would have the same rms speed as of hydrogen molecules at $300K$.

Watch Video Solution

25. Five gas molecules chosen at random are found to have speed of $500, 600, 700, 800$ and $900 m/s$. Find the rms speed. Is it the same as the average speed ?

Watch Video Solution

26. Two monoatomic ideal gases at temperatures T_1 and T_2 are mixed. There is no loss of energy. If number of their moles are n_1 and n_2 respectively. The temperature of the mixture will be

Watch Video Solution

27. The average kinetic energy of the molecules of an ideal gas at $10^\circ C$ has the value (E). The temperature at which the kinetic energy of the same gas becomes (2 E) is.

Watch Video Solution

28. When 1 mole of monatomic gas is mixed 1 mole of diatomic gas, then find C_p, C_v, γ and f for mixture of the gas.

Watch Video Solution

29. If 3 moles of H_2 gas is mixed with 2 moles of helium gas, then calculate equivalent molar mass of the gas and adiabatic exponent of the mixture?

Watch Video Solution

30. A cubical box containing 2 mole of He gas moves with constant speed u on a smooth horizontal surface. If the box suddenly stops, then determine the change in temperature of the gas by assuming mass of box to be negligible.

Watch Video Solution

31. A basketball at 290 K holds 0.92 mol of air molecules. What is the internal energy of the air in the ball?

Watch Video Solution

32. A fixed mass of gas at STP occupies a certain volume. The gas is heated and allowed to expand to a double its volume with its pressure doubled. What can you say about the average kinetic energy of the gas molecules?

Watch Video Solution

33. Find the kinetic energy of 1 g of nitrogen gas at $77^\circ C$. Given $R = 8.31 \text{ J } mol^{-1} K^{-1}$

Watch Video Solution

34. When a certain amount of heat is supplied to a diatomic gas at constant volume, rise in temperature is T_0. When same heat is supplied to the gas at constant pressure, find the rise in temperature

Watch Video Solution

Watch Video Solution

35. State and explain law of multiple proportions with a suitable example.

Watch Video Solution

36. Define mean free path .

Watch Video Solution

37. State Atomic hypothesis.

Watch Video Solution

38. The pressure of a gas is increased 2 times. What should be the change in its volume so that the temperature and number of moles remain constant?

Watch Video Solution

39. The pressure of a given mass of a gas filled in a vessel of volume V at constant temperature is reduced to $1/3$ rd of its initial value. Calculate the percentage change in its volume.

Watch Video Solution

40. The percentage change in the pressure of a given mass of a gas filled in a container at constant temperature is 100%. Calculate the percentage change in its volume.

Watch Video Solution

41. A gas is filled in a vessel at $27^\circ C$. To what temperature should it be heated in order that $\frac{1}{3}$rd of the gas may escape out of the vessel?

Watch Video Solution

42. A gas is filled in a container at $27^\circ C$. On increasing the temperature to $127^\circ C$, 1 litre (having $\frac{1}{4}$th mass) of the gas escape out of the container. Calculate the volume of the container.

Watch Video Solution

43. The pressure of a gas filled in a closed container increases by 1% when temperature is increased by $1^{\circ} C$. Find the initial temperature of the gas.

Watch Video Solution

44. One mole of each of hydrogen, oxygen and nitrogen and nitrogen are mixed in a close container of volume 10 litres and temperature $27^{\circ} C$. Calculate the pressure exerted by the mixture. (R=8.314 $mol^{-1} K^{-1}$)

Watch Video Solution

45. If the mass of each molecules of a gas is doubled and speed is halved, find the ratio of initial and final pressure.

Watch Video Solution

46. A gas is filled in a vessel at a certain temperature and at a pressure of $80cm$ of Hg. At the same temperature, more gas is filled in the vessel so that its mean increases by 60%.

Determine the resultant pressure in the vessel.

Watch Video Solution

47. if the pressure remains constant, find the temperature at which root mean square speed of a gas is half of its value at $27^{\circ}C$.

Watch Video Solution

48. The density of CO_2 gas at $0^\circ C$ and at a pressure of $1.0 \times 10^5 Nm^{-2}$ is 1.98 kgm^{-3}. Calculate the root mean square velocity of its molecules at $0^\circ C$ and $30^\circ C$. Assume the pressure to remain constant.

Watch Video Solution

49. Calculate the average kinetic energy of oxygen molecule at 0°C. $\left(R = 8.314 Jmol^{-1} K^{-1}, N_A = 6.02 \times 10^{23}\right)$

Watch Video Solution

50. Calculate the ratio of KE of molecule of oxygen and neon gas at $27^{\circ} C$.

Watch Video Solution

51. Calculate the molar specific heat at constant volume of neon gas.

(R=8.314J $mol^{-1} K^{-1}$)

Watch Video Solution

52. The molar specific heats of an ideal gas at constant volume and constant pressure are respectively 4.98 and 6.96 cal $mol^{-1}K^{-1}$. If the molecular weight of the gas be 32, then calculate the root means square speed of the molecule of the gas at $120^{\circ}C$. (1 cal = 4.2 J)

Watch Video Solution

53. Calculate the ratio of the mean free path of the molecules of two gases if the ratio of the number density per cm^3 of the gases is 5:3 and the ratio of the diameters of the molecules of the gases is 4:5

Watch Video Solution

54. For a molecule of an ideal gas $n = 3 \times 10^8 cm^{-3}$ and mean free path is 10^{-2} cm. Calculate the diameter of the molecule.

Watch Video Solution

Try Yourself

1. State and explain Avogadro's hypothesis.

Watch Video Solution

2. State the law of definite proportion.

Watch Video Solution

3. How dalton explain the gay-lussac's law?

Watch Video Solution

4. State Gay-Lussac.s Law of combining volumes.

Watch Video Solution

5. State and explain law of multiple proportions with a suitable example.

Watch Video Solution

6. (a) State the various postulates of Dalton's atomic theory of matter.

(b) Which postulate of Dalton's atomic theory can explain the law of conservation of mass ?

(c) Which postulate of Dalton's atomic theory can explain the law of constant proportions ?

Watch Video Solution

7. The volume of a given mass of a gas in a vessel is reduced to half at constant temperature what is the change in pressure?

Watch Video Solution

8. The pressure of a given mass of a gas contained in a vessel at constant temperature is reduced to half. Calculte the change in volume of the gas

Watch Video Solution

9. The volume of a given mass of a gas is reduced to $\frac{1}{4}$th of its initial alue at constant temperature. Calculate the percentage change in the pressure of the gas.

Watch Video Solution

10. The pressure of a gas of given mass of constant temperature is reduced to half of its value. Calculate the percentage change in its volume.

Watch Video Solution

11. The percentage change in the pressure of gas at constant temperature is 200% (increases). Calculate the percentage change in the volume of the gas.

Watch Video Solution

12. A gas is filled in a container of volume V at $121^{\circ} C$. To what temperature should it be heated in order that $\frac{1}{4}$ th of the gas may escape out of the vessel?

Watch Video Solution

13. A gas is filled in a vessel of volume V at $35^{\circ} C$. To what temperature should it be heated in order that half of the gas may escape out?

Watch Video Solution

14. A gas is filled in a vessel at $7^{\circ}C$. If x fractional part escapes out at $27^{\circ}C$, fid x. (assuming pressure constant).

Watch Video Solution

15. A gas is filled in a container of volume V at constant pressure and at $27^{\circ}C$ temperature. Find out the amount of gas that will escape out of the container if temperature rises to $37^{\circ}C$

Watch Video Solution

16. The pressure of a gas filled in a closed jar increases by 0.2%, when temperature is increased by $2^{\circ}C$. Find the initial temperature of the gas.

Watch Video Solution

17. The temperature of a gas filled in closed vessel reduces by $1^{\circ}C$. Calculate the ratio of change in pressure to the original pressure of the gas.

Watch Video Solution

18. 2 moles of each of hydrogen, carbon dioxide and chlorine are mixed in a close vessel of volume 3 litres and temperature $0^\circ C$. Calculate the pressure exerted by the mixture. $(R = 8.31 \text{ J } mol^{-1}K^{-1})$

Watch Video Solution

19. The total pressure exerted by the mixture of equal moles of two gases is $5 \times 10^3 NM^{-2}$ in a container of volume 2 litres at 273K. Calculate the number of moles of the gases mixed.

Watch Video Solution

20. If the mass of each molecule of a gas is reduced to $\frac{1}{3}$rd of its previous value and speed is doubled, find the ratio of initial and final pressure.

Watch Video Solution

21. Calculate the ratio of change in the mass of the molecules of a gas to the initial mass, if its speed is reduced to half and the ratio of initial and final pressure is 3:4

Watch Video Solution

22. A gas is filled in a vessel at a certain temperature and pressure. At the same temperature more gas is filled in the vessel so that its mass increases by 40%. Calculate the ratio of initial and finial pressures.

Watch Video Solution

23. A gas is filled in a container at certain temperature and pressure. At the same temperature more gas is filled in the vessel. Calculate the percentage increase in the mass of the gas. If the ratio of initial and final pressure is 1:2.

Watch Video Solution

24. At constant pressure, calculate the temperatrue at which root mean square speed of a gas becomes double of its value at 0°

Watch Video Solution

25. At constant pressure, calculate the root mean square velocity of a gas molecule at temperature $27^{\circ}C$ if its rms speed at $0^{\circ}C$ is 4km/s

Watch Video Solution

26. The density of carbon dioxide gas at $27^\circ C$ and at pressure 1000 N/m^2 is 1 kg m^{-3}. Find the root mean square speed of its molecule at $0^\circ C$. (pressure is constant)

Watch Video Solution

27. The root mean square speed of the molecule at constant pressure at temperature T is v, what is its root mean square speed, if temperature is reduced to $\frac{T}{2}$.

Watch Video Solution

28. Calculate the average kinetic energy of hydrogen molecule at $0^\circ C$. Given $k_B = 1.38 \times 10^{-23} JK^{-1}$.

Watch Video Solution

29. Calculate the average kinetic energy of neon molecule at $27^\circ C$. Given $k_B = 1.38 \times 10^{-23} JK^{-1}$

Watch Video Solution

30. Calculate the ratio of average K.E. of one molecule of hydrogen (H_2) gas and oxygen (O_2) gas at $0^\circ C$

Watch Video Solution

31. Calculate the ratio of average K.E.of one molecule of diatomic (rigid) and diatomic (elastic) at temperature $150^\circ C$

Watch Video Solution

32. Calculate the molar specific heat of diatomic gas at constant volume.

$\left(R = 8.314 \text{ J } mol^{-1} K^{-1}\right)$

Watch Video Solution

33. Calculate the molar specific heat of oxygen gas at constant volume.

$\left(R = 8.314 \text{ J } mol^{-1} K^{-1}\right)$

Watch Video Solution

34. Calculate the rms speed of an ideal monoactomic gas having molecular weight 28 gm/mol at $27^{\circ} C$. if the specific heats at constant pressure and volume are respectively 6.3 J $mol^{-1}K^{-1}$ and 3.14J $mol^{-1}K^{-1}$ respectively

Watch Video Solution

35. Calculate the rms speed of an ideal diatomic gas having molecular weight 32 gm/mol at $0^{\circ} C$. If the specific heats at constant pressure and volume are respectively 8.3 cal $mol^{-1}K^{-1}$ and 6.34 cal $mol^{-1}K^{-1}$ respectively.

Watch Video Solution

36. Calculate themean free path of molecule of a gas having number density (number of molecules per cm^3) 2×10^8 and the diameter of the molecule is 10^{-5}cm

Watch Video Solution

37. The mean free path of molecules of a gas is 10^{-8} cm. if number density of gas is $10^{9} / cm^{3}$ calculate the diameter of the molecule

Watch Video Solution

38. Calculate the diameter of one molecule of an ideal gas having number density $2 \times 10^{8} cm^{-3}$ and mean free path of the molecule is $10^{-8} cm$.

Watch Video Solution

39. if the mean free path of a molecule of an ideal gas having diameter $10^{-8} cm$ is 10^{-4}cm, calculate the number density of the gas molecule.

Watch Video Solution

40. What is the relationship between average kinetic energy and the temperature of a gas ?

Watch Video Solution

41. Explain how boiling takes place on the basis of kinetic theory.

Watch Video Solution

42. Four particles have velocities $1, 0, 2, \text{ and } 3m/s$. The root mean square velocity of the particles (definition wise) is.

Watch Video Solution

43. When one mole of monoatomic gas is mixed with one mole of triatomic gas, then the equivalent value of γ for the mixture will be (vibration mode neglected)

A. $\frac{13}{9}$

B. $\frac{9}{2}$

C. $\frac{5}{2}$

D. $\frac{7}{6}$

Answer:

Watch Video Solution

Assignment Section A Objective Type Questions One Option Is Correct

1. The root-mean square speeds of the molecules of different ideal gases, maintained at the same temperature are

A. The same

B. Inversely proportional to the square root of the molecular weight

C. Directly proportional to the molecular weight

D. Inversely proportional to the molecular weight

Answer: B

Watch Video Solution

2. Which of the following gases has maximum rms speed at a given temperature?

A. Oxygen

B. Nitrogen

C. Hydrogen

D. Carbodioxide

Answer: C

Watch Video Solution

3. We write the relation for Boyle's law in the form, $PV = K_B$ when the temperature remains constant. In this relation, the magnitude of K_B depends upon the

A. The nature of the gas used in the experiment

B. the molecular mass of gas in the laboratory

C. the atmospheric pressure

D. the quantity of gas enclosed

Answer: D

Watch Video Solution

4. If masses of all molecule of a gas are halved and their speed doubled then the ratio of initial and final pressure will be

A. $2:1$

B. $1:2$

C. $4:1$

D. $1:4$

Answer: B

Watch Video Solution

5. Two vessels have equal volums. One of them contains hydrogen at one atmosphere and the other helium at two atmosphere. If both the samples are at the same temperature, the rms velocity of the hydrogen molecules is

A. Equal to that of helium

B. Twice that of helium

C. Half that of helium

D. $\sqrt{2}$ times that of helium

Answer: D

Watch Video Solution

6. At a given volume and temperature the pressure of a gas

A. varies inversely as its mass

B. varies inversely as the square of its mass

C. varies linearly as its mass

D. is independent of its mass

Answer: C

Watch Video Solution

7. A closed vessel A having volume V contains N_2 at pressure P and temperature T. another closed vessel B having the same volume V contains. He at the same pressure P. but temperature 2T. The ratio of masses of N_2 and He in the vesses A and B is

A. $1:2$

B. $3:2$

C. $5:2$

D. $14:1$

Answer: D

Watch Video Solution

8. By what percentage should the pressure of a given mass of a gas be increased so as to decrease its volume by 10% at a constant temperature?

A. 8.1%

B. 9.1%

C. 10.1%

D. 11.1%

Answer: D

Watch Video Solution

9. A sample of gas is at $0^{\circ}C$. To what temperature it must be raised in order to double the rms speed of the molecule.

A. $100^{\circ}C$

B. $273^{\circ}C$

C. $819^{\circ}C$

D. $919^\circ C$

Answer: C

Watch Video Solution

10. The root mean square velocity of the gas molecule is 300 m/s. What will be the root mean square speed of he molecule if the atomic weight is doubled and absolute temperature is halved ?

A. 300m/s

B. 200m/s

C. 150m/s

D. 100m/s

Answer: C

Watch Video Solution

11. RMS speed of a particle is V_{rms} at pressure P. if pressure is increased to two times, then at constant temperature rms speed becomes

A. $2V_{rms}$

B. $3V_{rms}$

C. V_{rms}

D. zero

Answer: C

Watch Video Solution

12. For Boyle's law to be hold good, the gas should be

A. Perfect and at constant temperature and mass

B. real and at constant temperature and mass

C. Perfect and at constant temperature but variable mass

D. real and at constant temperature but variable mass

Answer: A

Watch Video Solution

13. Boyle's law is applicable for an

A. isobaric process

B. isochoric process

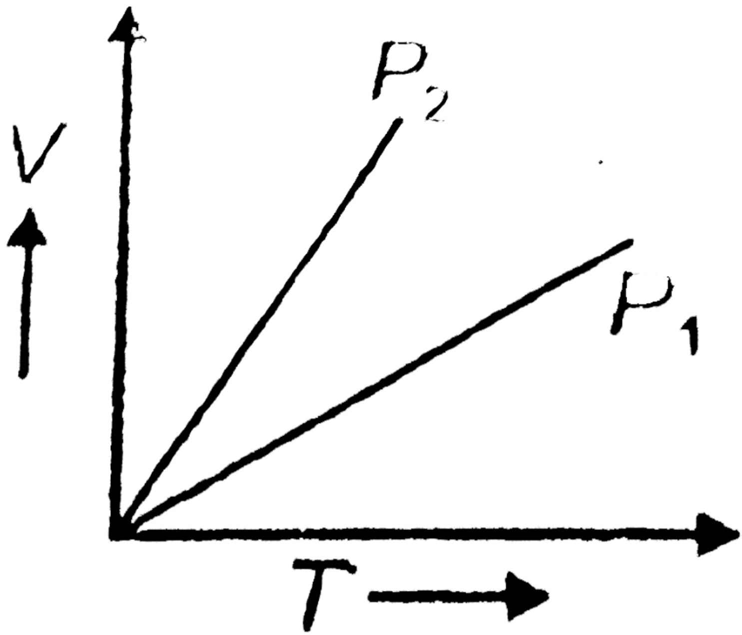
C. isothermal process adiabatic process

D.

Answer: C

Watch Video Solution

14. For V versus T curves at constant pressure P_1 and P_2 for an ideal gas are shown in the figure given below



A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. $P_1 \geq P_2$

Answer: A

Watch Video Solution

15. Two identical cylinders contains helium at 1.5 atm and argon at 1 atm respectively. If both the gases are filled in one of the cylinder, the pressure would be

A. 1 atm

B. 1.75 atm

C. 2.5 atm

D. 0.5 atm

Answer: C

Watch Video Solution

16. Two gases A and B having the same temperature T, same pressure P and same volume V are mixed. If the mixture is at the same temperature and occupies a volume V. The pressure of the mixture is

A. 2P

B. P

C. P/2

D. 4P

Answer: A

Watch Video Solution

17. A perfect gas at $27^\circ C$ is heated at constant pressure so as to duble its volume. The tmemperature of th gas will be

A. $300^\circ C$

B. $200^\circ C$

C. $327^\circ C$

D. $600^\circ C$

Answer: C

Watch Video Solution

18. Which of the following methods will enable the volume of an ideal gas to be made four times

A. Double the temperature and reduce the pressure to half

B. double the temperature and also double the pressure

C. reduce the temperature to half and double the pressure

D. reduce the temperature to half and reduce the pressure to half

Answer: A

Watch Video Solution

19. Four molecules of a gas have speeds $2, 4, 6$ and $8kms^{-1}$ respectively. Calculate their root mean square speed.

A. $\sqrt{30}m/s$

B. $120m/s$

C. $2\sqrt{30}m / s$

D. $60m / s$

Answer: A

Watch Video Solution

20. The rms speed of a gas molecule is

A. $\sqrt{\frac{M}{3RT}}$

B. $\frac{M}{3RT}$

C. $\sqrt{\frac{3RT}{M}}$

D. $\left(\frac{3RT}{M}\right)^2$

Answer: C

Watch Video Solution

21. The temperature of a gas is raised while its volume remains constant, the pressure exerted by the gas on the walls of the container increases because its molecules

A. The molecules have higher average speed, so strike the walls more often

B. the molecules lose more energy each time they strike the walls

C. the molecules are now in contact with the walls for small intervals

D. the molecules collide with each other more often

Answer: A

Watch Video Solution

22. If the pressure in a closed vessel is reduced by drawing out some gas, the mean free path of the molecules

A. is increased

B. is decreased

C. remains unchanged

D. increases or decreases according to the nature of the gas

Answer: A

Watch Video Solution

23. The pressure P, volume V and temperature T of a gas in the jar A and the othere gas in the jar B at pressure 2P, volume V/4 and temperature 2T, then the ratio of the number of molecules in the jar A and B will be :

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: D

Watch Video Solution

24. A container has N molecules at absolute temperature T. If the number of molecules is doubled but kinetic energy in box remains the same as before, the absolute temperature of the gas is

A. T

B. $\frac{T}{2}$

C. $3T$

D. $4T$

Answer: B

Watch Video Solution

25. 2000 small balls, each weighing 1 g, strike one square cm of area per second with a velocity of 100 m/s normal to the surface and rebounds with the same velocity. The pressure on the surface is

A. $2 \times 10^3 N/m^2$

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

C. $4 \times 10^3 N/m^2$

D. $4 \times 10^6 N/m^2$

Answer: D

Watch Video Solution

26. Some gas at 300 K 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. rise above 100 K

B. falls below 100 K

C. remains the same

D. becomes unsteady

Answer: C

Watch Video Solution

27. During an experiment, an ideal gas is found to obey an additional law VP^2 =constant. The gas is initially at a temperatur T and volume V. When it expands to a volume $2V$, the temperature becomes__________.$^\circ C$.

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

B. $2T$

C. $\sqrt{2}T$

D. $\frac{T}{\sqrt{2}}$

Answer: C

Watch Video Solution

28. Two gases A and B having the same pressure P, volume V and temperature T are mixed. If mixture has volume and temperature as V and T respectively, then the pressure of the mixture will be

A. 4P

B. 3P

C. 2P

D. P

Answer: C

Watch Video Solution

29. A gas is heated through $2^\circ C$ in a closed vessel. Its pressure is increased by 0.4%. The initial temperature of the gas is

A. $250^\circ C$

B. $100^\circ C$

C. $-75^\circ C$

D. $-23^\circ C$

Answer: D

Watch Video Solution

30. A balloon contains $1500m^3$ of helium at $27^\circ C$ and 4 atmospheric pressue. The volume of helium at $-3^\circ C$temprature and 2 atmospheric pressure will be

A. $1500m^3$

B. $1700m^3$

C. $1800m^3$

D. $2700m^3$

Answer: D

Watch Video Solution

31. A gas at pressure p_0 is contained in a vessel. If the masses of all the molecules are halved and their speeds doubled, the resulting pressure would be

A. Remains constant

B. Becomes half

C. becomes two times

D. becomes four times

Answer: B

Watch Video Solution

32. A gas at pressure p_0 is contained in a vessel. If the masses of all the molecules are halved and their speeds doubled, the resulting pressure would be

A. $4P_0$

B. $2P_0$

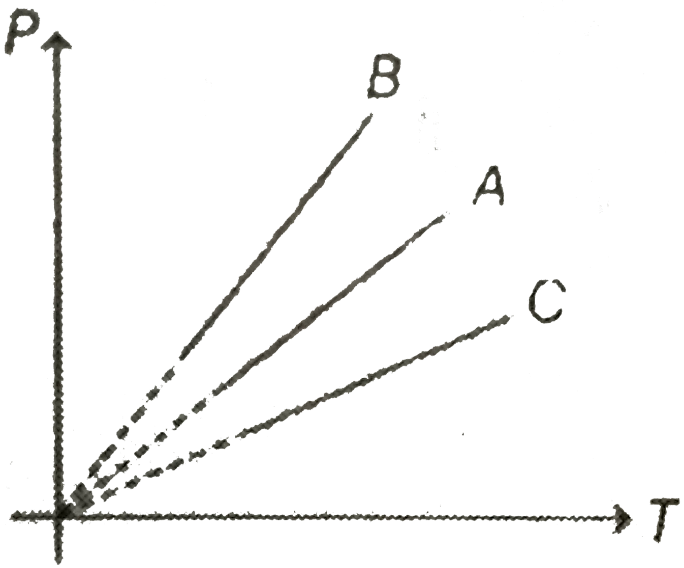
C. P_0

D. $\frac{P_0}{2}$

Answer: B

Watch Video Solution

33. Pressure versus temperature graph of an ideal gas at constant volume V is shown by the straight line A. Now mass of the gas is doubled and the volume is halved, then the corresponding pressure versus temperature graph will be shown by the line



A. A

B. B

C. C

D. D

Answer: B

Watch Video Solution

34. The root mean spuare (rms) speed of hydrogen molecules at a certain temperature is 300m/s. If the temperature is doubled and hydrogen gas dissociates into atomic hydrogen the rms speed will become

A. 424.26m/s

B. 300 m/s

C. 600 m/s

D. 150 m/s

Answer: C

Watch Video Solution

35. If gas molecules undergo inelastic collision with the walls of the container

A. The temperature of the gas will decrease

B. the pressure of the gas will increase

C. neigher the temperature nor the presure will change

D. The temperature of the gas will increase

Answer: C

Watch Video Solution

36. Two balloons are filled one with pure He gas and the other with air respectively. If the pressure and temperature of these balloons are same, then the number of molecules per unit volume is

A. More is the He filled balloon

B. same in both balloons

C. more in air filled balloons

D. In the ratio of 1:4

Answer: B

Watch Video Solution

37. The temperature of a gas contain in a closed vessel increased by $2^{0}C$ when the pressure is increased by 2% the intial temperature of the gas is

A. 200K

B. 100K

C. $200^{\circ}C$

D. $100^{\circ}C$

Answer: B

Watch Video Solution

38. If the rms velocity of gas is v , then

A. $V^2T = \text{constant}$

B. $\frac{V^2}{T} = \text{constant}$

C. VT^2=constant

D. V and T are independent

Answer: B

Watch Video Solution

39. Choose the correct statement . When the temperature of a gas is increased

A. its molecular kinetic energy increases

B. Molecular kinetic energy and potential energy decreases, total energy remaining constant

C. molecular potential energy increases and molecular kinetic energy decreases, total energy remaining constant

D. its molecular-potential energy increases

Answer: A

Watch Video Solution

40. The temperature of an ideal gas is increased from 120 K to 480 K. If at 120 K, the rms velocity of the gas molecules is v_{rms} then at 480 K, it becomes

A. 4V

B. 2V

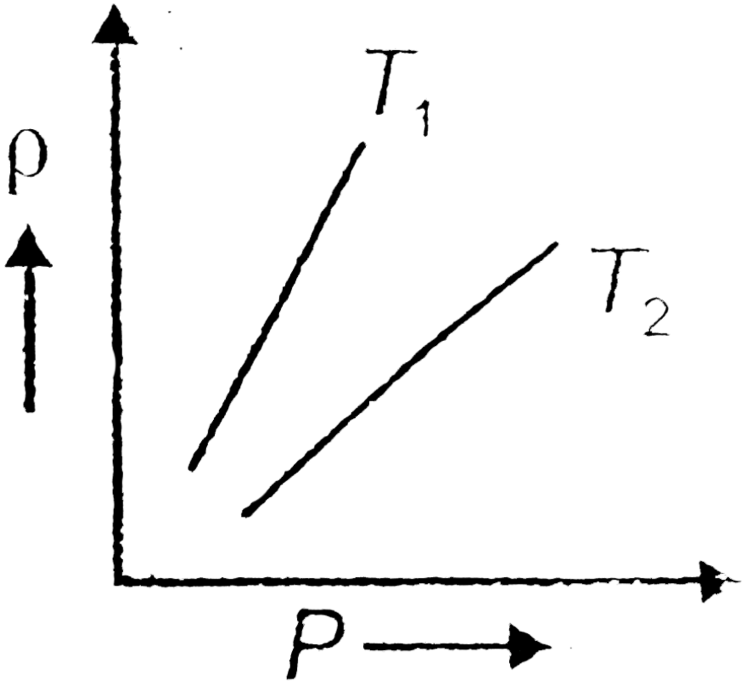
C. $\frac{V}{2}$

D. $\frac{V}{4}$

Answer: B

Watch Video Solution

41. The density (ρ) versus pressure (P) graphs of a given mass of an ideal gas is shown at two temperatures T_1 and T_2. Then relation between T_1 and T_2 may be



A. $T_1 > T_2$

B. $T_2 > T_1$

C. $T_1 = T_2$

D. None of these

Answer: B

Watch Video Solution

42. The mean kinetic energy of one mole or gas per degree of

A. $\frac{1}{2}kT$

B. $\frac{3}{2}kT$

C. $\frac{3}{2}kT$

D. $\frac{1}{2}RT$

Answer: D

Watch Video Solution

43. if average velocity becomes 4 times, then what will be the effect on rms velocity at the temperature?

A. 1.4 times

B. 4 times

C. 2 times

D. $\frac{1}{4}$ times

Answer: B

Watch Video Solution

44. If both the temperature and the volume of an ideal gas are doubled, the pressure

A. Increases by a factor of 4

B. Is also doubled

C. Remains unchanged

D. Is diminished by a factor of 4

Answer: C

Watch Video Solution

45. Mean kinetic energy of a perfect gas is proportional to

A. $\frac{1}{T}$

B. T°

C. T^{2}

D. T

Answer: A

Watch Video Solution

46. Pressure of an ideal gas is increased by keeping temperature constant. What is the effefct on kinetic energy of molecules?

A. Increases

B. Decreases

C. No change

D. Cannot be determined

Answer: C

Watch Video Solution

47. At what temperature, pressure remaining constant will the r.m.s. speed of a gas molecules increase by 10% of the r.m.s speed at STP?

A. $57.3K$

B. $57.3^{\circ}C$

C. $557.3K$

D. $-57.3^{\circ}C$

Answer: B

Watch Video Solution

48. The temperature of a gas is due to

A. The potential energy of its molecules

B. The kinetic energy of its molecules

C. The atttractive force between its molecules

D. the repulsive force between its molecules

Answer: B

Watch Video Solution

49. Two thermally insulated vessels (1) and (2) are filled with air at temperature (T_1, T_2) volumes (V_1, V_2) and pressures (p_1, p_2) respectively. If the valve joining the two vessela is opened, the temperature inside the vessel at equilibrium will be $(P = commonpressure)$.

A. $T_1 + T_2$

B. $\dfrac{(T_1 + T_2)}{2}$

C. $\dfrac{T_1T_2(P_1V_1 + P_2V_2)}{P_1V_1T_2 + P_2V_2T_1}$

D. $\dfrac{T_1T_2(P_1V_1 + P_2V_2)}{P_1V_1T_1 + P_2V_2T_2}$

Answer: C

Watch Video Solution

Assignment Section B Objective Type Questions One Option Is Correct

1. In a process, the pressure of a gas remains constant. If the temperature is doubles, then the change in the volume will be.

A. 100%

B. 200%

C. 50%

D. 25%

Answer: A

Watch Video Solution

2. The temperature of an ideal gas is increased from $27^\circ C$ to $927^\circ C$. The rms speed of its molecules becomes.

A. twice

B. half

C. four times

D. one fourth

Answer: A

Watch Video Solution

3. A gas is found to obey the law p^2V=constant. The initial temperature and volume are T_0 and V_0. If the gas expands to a volume $3V_0$, then

A. $\sqrt{3}T_0$

B. $\sqrt{2}T_0$

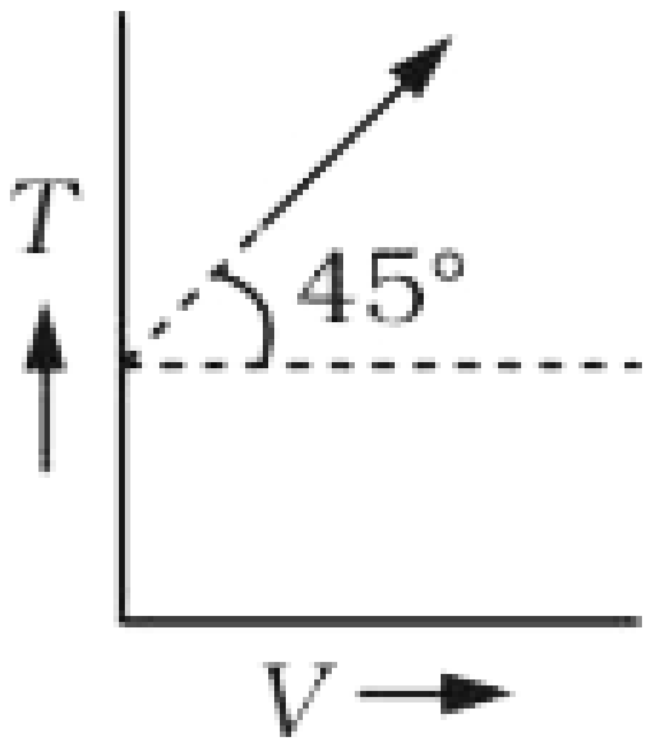
C. $\frac{T_0}{\sqrt{3}}$

D. $\frac{T_0}{\sqrt{2}}$

Answer: A

Watch Video Solution

4. The given curve represents the variation of temperature as a function of volume for one mole of an ideal gas. Which of the following curves best represents the variation of pressure as a function of volume ?



A.

B.

C.

D.

Answer: A

Watch Video Solution

5. Two closed vessels A,B are at the same temperature T and contain gases which obey Maxwellian distribution of velocities. Vessel A contains O_2, and B contain mixture of H_2 and O_2. If the average speed of the O_2 molecule in vessel A is V_1, then average speed of H_2 in container B is

A. Zero

B. $\frac{V_1}{4}$

C. $\frac{V_1}{2}$

D. $4V_1$

Answer: D

Watch Video Solution

6. A vessel contains $28g$ of N_2 and $32g$ of O_2 at temperature $T = 1800K$ and pressure $2atm.$ What would be the pressure when N_2 dissociates $30\,\%$ and O_2 dissociates $50\,\%$ and temperature remains constant ?

A. 2 atm

B. 1 atm

C. 2.8 atm

D. 1.4 atm

Answer: C

Watch Video Solution

7. A container of volume $1m^3$ is divided into two equal parts by a partition. One part has an ideal gas at 300K and the other part is vacuum. The whole system is thermally isolated from the surroundings. When the partition is removed, the gas expands to occupy the whole volume. Its temperature will now be............

A. 300K

B. 150K

C. 100K

D. 200K

Answer: A

Watch Video Solution

8. If a gas of a volume V_1 at pressure p_1 is compressed adiabatically to volume V_2 and pressure p_2, calculate the work done by the gas.

A. zero

B. negative

C. positive

D. May be negative or positive

Answer: C

Watch Video Solution

9. Find the average momentum of molecules of hydrogen gas in a container at temperature $300K$.

A. $2 \times \sqrt{900R}\ \text{g}\ cms^{-1}$

B. $1800\ \text{R}\,\text{g}\ cms^{-1}$

C. $\sqrt{900R}$ g cms^{-1}

D. zero

Answer: D

Watch Video Solution

10. If 2 mol of an ideal monatomic gas at temperature T_0 are mixed with 4 mol of another ideal monatoic gas at temperature $2T_0$ then the temperature of the mixture is

A. $\frac{5}{3}T_0$

B. $\frac{3}{2}T_0$

C. $\frac{4}{3}T_0$

D. $\frac{5}{4}T_0$

Answer: A

Watch Video Solution

Assignment Section C Objective Type Questions More Than One Option Are Correct

1. During an experiment, an ideal gas is found to obey a condition $\frac{p^2}{\rho} = \text{constant}$. ($\rho$ = density of the gas). The gas is initially at temperature (T), pressure (p) and density ρ. The gas expands such that density changes to $\rho/2$.

A. the pressure of the gas changes to $\sqrt{2}P$

B. the temperature of the gas changes to $\sqrt{2}T$

C. the temperature of the gas gas changes to 2T

D. the graph of the above process on P-T diagram is hyperbola.

Answer: B::D

Watch Video Solution

2. Choose the wrong statement

A. Translational kinetic energy of all ideal gases at same temperature is same

B. In one degree of freedom all ideal gases has internal energy $= \frac{1}{2}RT$

C. translational kinetic energy of all ideal gases is three

D. Translational kinetic energy of all ideal gases is $\frac{3}{2}RT$

Answer: A::B

Watch Video Solution

3. Which of the following quantities is the same for all ideal gases at the same temperature?

A. The average translational kinetic energy of 1 mole

B. the kinetic energy of 1 g

C. the number of molecules in 1 mole

D. The number of molecule in 1 g

Answer: A::C

Watch Video Solution

4. From the following statements concerning ideal gas at any given temperature T, select the correct one (s)

A. The coefficient of volume expansion of constant pressure is the same for all ideal gases

B. the average transaltional kinetic energy per molecule of oxygen gas is 3KT, K being boltzmann constant

C. the mean free path of molecules decreases with increase in the pressure

D. in a gaseous mixture, the average translational kinetic energy of the molecules of each component is different

Answer: A::C

Watch Video Solution

5. If E is the total energy, U is the potential enegy and K is the kinetic energy of a mole of an ideal gas

A. E=U

B. E=K

C. U=0

D. E=K+U

Answer: D

Watch Video Solution

6. A real gas deviates from perfect gas behaviour as its molecule

A. have definite size

B. attract each other

C. show browriian motion

D. are not spherical

Answer: B

Watch Video Solution

7. The root mean square velocity of a perfect gas molecule will be doubled if

A. pressure is doubled at constant volume

B. pressure is made 4 times at constant volume

C. volume is made 4 times at constant pressure

D. volume is increased by 41.4% at constant pressure

Answer: B

Watch Video Solution

8. If the atoms in a diatomic molecule can vibrate, the molecule has

A. 2 rotational degree of freedom

B. 3 rotational degrees of freedom

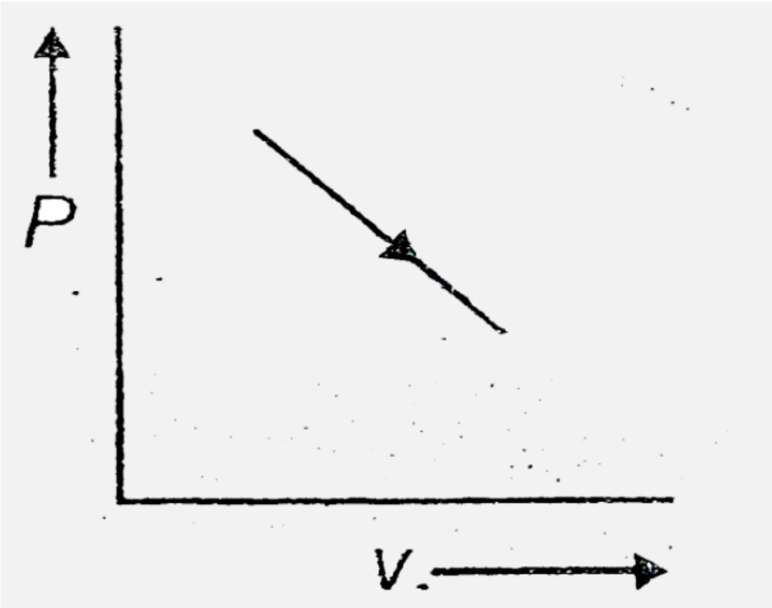
C. 1 vibrational degree of freedom

D. 2 vibrational degree of freedom

Answer: A::D

Watch Video Solution

9. If the indicator diagram for expansion of gas is as shown, the gas



A. May be heated

B. May be cooled

C. May be first cooled and then heated

D. May be first heated and then cooled

Answer: A::B::D

Watch Video Solution

Assignment Section D Linked Comprehension Type Questions

1. One mole of an ideal gas undergoes a process

$$P = P_0 - \alpha V^2$$

where α and P_0 are positive constant and V is the volume of one mole of gas

Q. When temperature is maximum, volume is

A. $\sqrt{\dfrac{P_0}{3\alpha}}$

B. $\sqrt{\dfrac{P_0}{\alpha}}$

C. $\sqrt{\dfrac{P_0}{2\alpha}}$

D. $\sqrt{P_0\alpha}$

Answer: A

Watch Video Solution

2. One mole of an ideal gas undergoes a process

$P = P_0 - \alpha V^2$

where α and P_0 are positive constant and V is the volume of one mole of gas

Q. The maximum attainable temperature is

A. $\frac{P_0}{R}\sqrt{\frac{P_0}{3\alpha}}$

B. $\frac{2}{3}\frac{P_0}{R}\sqrt{\frac{P_0}{3\alpha}}$

C. $\sqrt{\frac{P_0}{3\alpha}}$

D. $\sqrt{\frac{P_0}{R}}$

Answer: B

Watch Video Solution

3. One mole of an ideal gas undergoes a process

$$P = P_0 - \alpha V^2$$

where α and P_0 are positive constant and V is the volume of one mole of gas

Q. When temperature is maximum, volume is

A. $\frac{2}{3}P_0$

B. P_0

C. $\frac{P_0}{3}$

D. $\frac{3}{2}P_0$

Answer: A

Watch Video Solution

4. A cubical box of side $1m$ contains helium gas (atomic weight 4) at a pressure of $100N/m^2$. During an observation time of $1\sec ond$, an atom travelling with the root - mean - square speed parallel to one of the edges of the cube, was found to make $500hits$ with a particular wall, without any collision with other atoms . Take

$R = \frac{25}{3} j / mol - K$ and $k = 1.38 \times 10^{-23} J / K$

.

Evaluate the total mass of helium gas in the box.

Watch Video Solution

5. A cubical box of side 1 meter contains helium gas (atomic weight 4) at a pressure of $100 N / m^2$. During and observation time of 1 second, an atom travelling with the root-mean-square speed parallel to one of the edges of the cube, was found to make 500 hits with a particular wall, without any collision with other atoms. Take

$$R = \frac{25}{3} Jmo \leq \; - K \text{ and } k = 1.38 \times 10^{-23} J/K$$

Evaluate the average kinetic energy per atom.

Watch Video Solution

6. A cubical box of side $1m$ contains helium gas (atomic weight 4) at a pressure of $100N/m^2$. During an observation time of $1 \sec ond$, an atom travelling with the root - mean - square speed parallel to one of the edges of the cube, was found to make $500 hits$ with a particular wall, without any collision with other atoms .

Take

$$R = \frac{25}{3} j / mol - K \text{ and } k = 1.38 \times 10^{-23} J / K$$

.

Evaluate the temperature of the gas.

Watch Video Solution

Assignment Section E Assertion Reason Type Question

1. Straight line on (p - T) graph for an ideal gas represents isochoric process.

If $p \propto T, V = cons\tan t.$

Watch Video Solution

2. Statement-1: In kinetic theory of gases, we do not take into account the change in gravitational potential energy of the molecules.

Statement-2: The internal energy of a gas depends on the interaction between gas molecules. This interaction is not affected by the change in gravitational potential energy of the molecules.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

Watch Video Solution

3. If the forces of attraction between the molecules of a gas suddently disappear, will there be any change in pressure inside a gas container ?

Watch Video Solution

4. Mention the degree of freedom for diatomic gas molecules without vibration.

A. 2

B. 3

C. 5

D. 7

Answer: C

Watch Video Solution

5. Statement-1: Temperature of gas increases when its container is moved at constant speed.

Statement-2: The temperature of the gas is due to the random motion of its molecule.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: D

Watch Video Solution

6. Statement-1: Moon has no atmosphere.

Statement-2: Due to less gravity moon is unable to retain its atmosphere.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is not a correct explanation for statement-1

C. statement-1 is true, statement-2 is false

D. statement-1 is false, statement-2 is true

Answer: A

Watch Video Solution

Assignment Section F Matrix Match Type Questions

1. Match all the entries in column-I to all the entries in column-II

Column-I	Column-II
(A) Perfect gas	(p) Temperature
(B) Degree of freedom	(q) Low pressure and high temperature
(C) Brownian motion increase with	(r) Boyle's Law
(D) $PV =$ constant	(s) Independent ways to possess energy

Watch Video Solution

2. A container having some gas was kept in a moving train. The temperature of the gas in the container will

A. increase slightly

B. decrease

C. remain the same

D. become infinite

A. increase slightly

B. decrease

C. remain the same

D. become infinite

Answer: A::B::C::D

Watch Video Solution

3. Match the following

Column-I	Column-II
(A) $Na < Mg < Al$	(p) True for electropositive character
(B) $Mg < Ca < Sr$	(q) False for size
(C) $Fe > Cu > Zn$	(r) True in reverse order for electropositive character
(D) $Fe\ (I) < Fe\ (II) < Fe\ (III)$	(s) True for electronegativity
	(t) False for electronegativity

Watch Video Solution

Assignment Section G Integer Answer Type Question

1. A gaseous mixture enclosed in a vessel consists of $1g$ mole of a gas A with $\gamma - 5/3$ and another B with $\gamma = 7/5$ at a temperature

T. The gases A and B do not react with each other and are assumed to be ideal. Find the number of gram moles of gas if γ of the gaseous mixture is $19/13$.

Watch Video Solution

2. Find the rotational kinetic energy of 2 kg of oxygen gas molecules (in joules) at 1 atm pressure. The density of O_2 is $2.03 \times 10^5 kg/m^3$

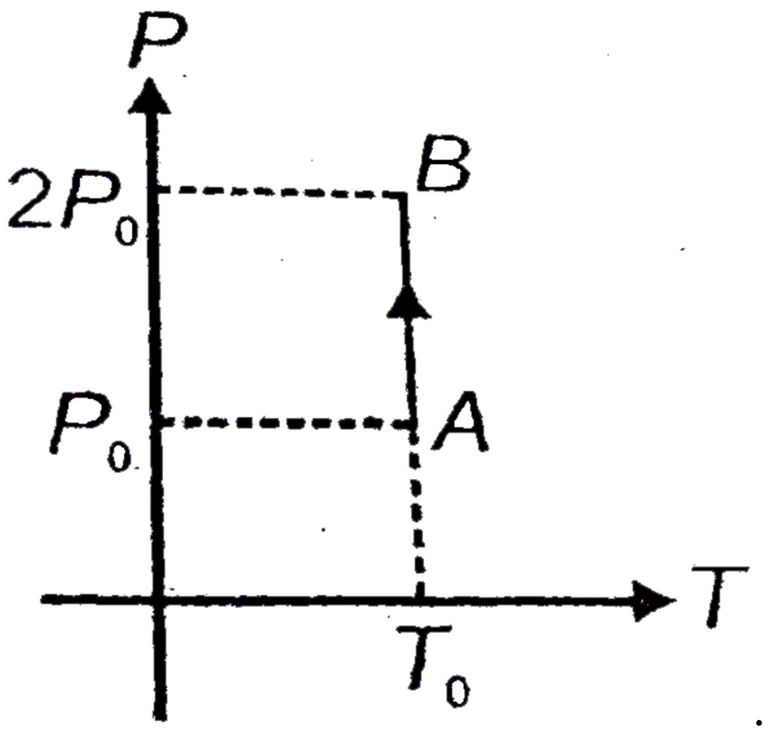
.

Watch Video Solution

3. A uniform tube closed at one end, contains a pallet of mercury 4 cm long. When the tube is kept vertically with closed end upwards, the length of air column between closed end and mercury pallet is 10 cm. the tube is inverted so that open end becomes upwards. find the length of trapped air column (in cm) trapped. take atmospheric pressure 76 cm of Hg.

Watch Video Solution

4. For a given mass of gas the variation of pressure versus temperature is shown in the figure. What is the ratio of volume of the gas at points A and B.



Watch Video Solution

Assignment Section H Multiple True False Type Questions

1. Prove that the pressure of an ideal gas is numerically equal to two third of the mean translational kinetic energy per unit volume of the gas.

A. TTT

B. TFT

C. FTF

D. FFF

Answer: A

Watch Video Solution

2. Statement-1: A reas gas nearly behaves like an ideal gas at low pressure and high temperature.

Statement-2: If the ratio of translational and rotational degree of freedom is 1.5 the gas must be diatomic

Statement-3: Most probable speed of a gas is proportional to absolute temperature of the gas.

A. FFF

B. FTF

C. TFF

D. TTT

Answer: C

Watch Video Solution

3. Statement-1: In equation $P=\frac{1}{3}\alpha V_{rms}^2$, the term α represents density of gas. ltBrgt

Statement-2: $V_{rms}=\sqrt{\frac{3RT}{M}}$

Statement-3: Rotational kinetic energy of a monoatomic gas is zero.

A. FFF

B. TTT

C. TFF

D. FFT

Answer: B

Watch Video Solution

Assignment Section I Subjective Type Questions

1. Given, Avogadro's number $N = 6.02 \times 10^{23}$ and Boltzmann's constant $k = 1.38 \times 10^{-23} J/K$.

(a) Calculate the average kinetic energy of translation of the molecules of an ideal gas at $0^{\circ} C$ and $at 100^{\circ} C$.

(b) Also calculate the corresponding energies per mole of the gas.

Watch Video Solution

2. In a certain $\left(\frac{2}{5}\right)th$ of the energy of molecules is associated with the ratation of molecules and the rest of it is associated with the motion of the centre of mass.

(a) What is the average translational energy of one such molecule when the temperature id $27^{\circ}C$?

(b) How much energy must be supplied to one mole of thsi gas constant volume to raise the temperature by $1^{\circ}C$?

Watch Video Solution

3. The temperature of a gas consisting of rigid diatomic moleculoes is T = 300 K. Calculate the angular root-mean square velocity of a rotating molecules if its moment of inertia is $I = 2.0 \times 10^{-40} kgm^2$.

Watch Video Solution

4. A spherical vessel of radius r = 5 cm contains hydrogen (H_2) at a temperature T=300 K and pressure$p = 10^5$ Pa. How many molecules collide on the vessel in 1 s ?

Watch Video Solution

5. $1g$ mole of oxygen at $27^\circ C$ and 1 atmosphere pressure is enclosed in a vessel.

(a) Assuming the molecules to be moving with v_{rms}, find the number of collisions per second which the molecules make with one square metre area of the vessel wall.

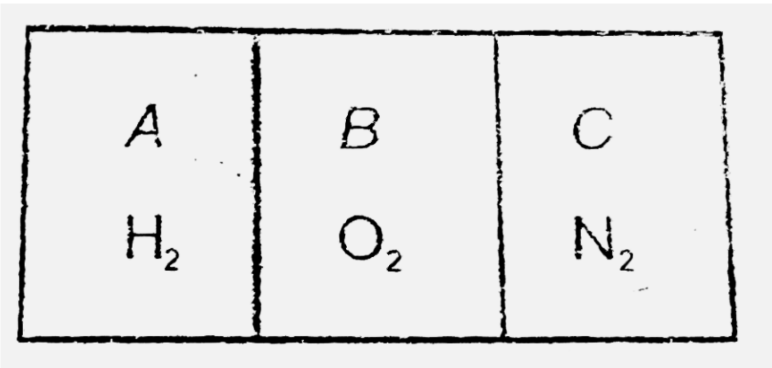
(b) The vessel is next thermally insulated and moves with a constant speed v_0. It is then suddenly stoppes. The process results in a rise of temperature of the gas by $1^{\circ} C$. Calculate the speed v_0. $\left[k = 1.38 \times 10^{-23} J / K\right.$ and $\left.N_A = 6.02 \times 10^{23} / mol\right]$.

Watch Video Solution

Assignment Section J Aaksh Challengers Questions

1. A container of capacity $30 \times 10^{-3} m^3$ is divided in three parts of equal vlume by two fixed semipermeable membranes. The part A contains 30 g of hydrogen gas, part B contains

160 g of oxygen and part C contains 70 g of nitrogen. The membrane separating A and B is permeable only to hydrogen while the other membrane is permeable to hydrogn as codlus nitrogen. if the temperature of the entire container remains fixed at 300K, what will be final pressure in each part well as?



View Text Solution

2. Consider an ideal gas model with an addition assumption. Instead of Maxwellian distribution of speed, all gas molecules at a certain level (say sea level) move with same speed equal to root mean square speed at a given temperature. If the temperature at sea level is 300 K, upto what height the oxygen gas would exist in atmosphere. take $g = 10m/s^2$ as constant.

Watch Video Solution

3. The pressure of confined air is p. If the atmospheric pressure is P, then :-

Watch Video Solution

Exercise Try Yourself

1. State Avogadro's hypothesis

Watch Video Solution

2. State the law of definite proportion.

Watch Video Solution

3. State the main postulates of Dalton's atomic theory

Watch Video Solution

4. State Gay-Lussac.s Law of combining volumes.

Watch Video Solution

5. State and explain law of multiple proportions with a suitable example.

Watch Video Solution

6. How does Dalton's hypothesis explain the Gay-Lussac's law?

Watch Video Solution

7. The volume of a given mass of a gas in a vessel is reduced to half at constant temperature what is the change in pressure?

Watch Video Solution

8. The pressure of a given mass of a gas contained in a vessel at constant temperature is reduced to half. Calculte the change in volume of the gas

Watch Video Solution

9. The volume of a given mass of a gas is reduced to $\frac{1}{4}$th of its initial alue at constant temperature. Calculate the percentage change in the pressure of the gas.

Watch Video Solution

10. The pressure of a gas of given mass of constant temperature is reduced to half of its value. Calculate the percentage change in its volume.

Watch Video Solution

11. The percentage change in the volume of the given mass of a gas at constant temperature is 50% (increases). Calculate the percentage change in the presure of the gas.

Watch Video Solution

12. The percentage change in the pressure of gas at constant temperature is 200% (increases). Calculate the percentage change in the volume of the gas.

Watch Video Solution

13. A gas is filled in a container of volume V at $121^{\circ}C$. To what temperature should it be heated in order that $\frac{1}{4}$ th of the gas may escape out of the vessel?

Watch Video Solution

14. A gas is filled in a vessel of volume V at $35^{\circ}C$. To what temperature should it be heated in order that half of the gas may escape out?

Watch Video Solution

15. A gas is filled in a vessel at $7^{\circ} C$. If x fractional part escapes out at $27^{\circ} C$. Find x. (Assuming pressure constant).

Watch Video Solution

16. A gas is filled in a container of volume V at constant pressure and at $27^{\circ} C$ temperature. Find out the amount of gas that will escape out of the container if temperature rises to $37^{\circ} C$

Watch Video Solution

17. The pressure of a gas filled in a closed jar increases by 0.2%, when temperature is increased by $2^\circ C$. Find the initial temperature of the gas.

Watch Video Solution

18. The temperature of a gas filled in closed vessel reduces by $1^\circ C$. Calculate the ratio of

change in pressure to the original pressure of the gas.

Watch Video Solution

19. 2 moles each of hydrogen, carbon dioxide and chlorine are mixed in a close vessel of volume 3 litres and temperature $0^{\circ} C$. Calculate the pressure exerted by the mixture. ($R = 8.31 J mol^{-1} K^{-1}$)

Watch Video Solution

20. The total pressure exerted by the mixture of equal moles of two gases is $5 \times 10^3 NM^{-2}$ in a container of volume 2 litres at 273K. Calculate the number of moles of the gases mixed.

Watch Video Solution

21. If the mass of each molecule of a gas is reduced to $\frac{1}{3}$rd of its previous value and speed is doubled, find the ratio of initial and final pressure.

Watch Video Solution

22. Calculate the ratio of change in the mass of the molecules of a gas to the initial mass, if its speed is reduced to half and the ratio of initial and final pressure is 3:4

Watch Video Solution

23. A gas is filled in a vessel at a certain temperature and pressure. At the same temperature more gas is filled in the vessel so that its mass increased by 40%. Calculate the ratio of initial and final pressures.

Watch Video Solution

24. A gas is filled in a container at certain temperature and pressure. At the same temperature more gas is filled in the vessel. Calculate the percentage increase in the mass of the gas. If the ratio of initial and final pressure is $1:2$.

Watch Video Solution

25. The temperature at which the root mean square velocity of the gas molecules would becomes twice of its value at $0^{\circ} C$ is

Watch Video Solution

26. At constant pressure, calculate the root mean square velocity of a gas molecule at temperature $27^{\circ} C$ if its rms speed at $0^{\circ} C$. Is 4 km/s.

Watch Video Solution

27. The density of carbon dioxide gas at $27^\circ C$ and at pressure 1000 N/m^2 is 1 kg m^{-3}. Find the root mean square speed of its molecule at $0^\circ C$. (pressure is constant)

Watch Video Solution

28. The root mean square speed of the molecule at constant pressure at temperature T is v, what is its rms speed, if temperature is reduced to $\frac{T}{2}$?

Watch Video Solution

29. Calculate the average kinetic energy of hydrogen molecule at $0^\circ C$. Given $k_B = 1.38 \times 10^{-23} JK^{-1}$.

Watch Video Solution

30. Calculate the average kinetic energy of neon molecule at $27^\circ C$. Given $k_B = 1.38 \times 10^{-23} JK^{-1}$

Watch Video Solution

31. Calculate the ratio of average K.E. of one molecule of hydrogen (H_2) gas and oxygen (O_2) gas at $0^\circ C$

Watch Video Solution

32. Calculate the ratio of average K.E.of one molecule of diatomic (rigid) and diatomic (elastic) at temperature $150^\circ C$

Watch Video Solution

33. Calculate the molar specific heat of diatomic gas at constant volume. $(R = 8.314 \text{ J } mol^{-1} K^{-1})$

Watch Video Solution

34. Calculate the molar specific heat of oxygen gas at constant volume. $(R = 8.314 \text{ J } mol^{-1} K^{-1})$

Watch Video Solution

35. Calculate the rms speed of an ideal monoactomic gas having molecular weight 28 gm/mol at $27^{\circ} C$. if the specific heats at constant pressure and volume are respectively 6.3 J $mol^{-1} K^{-1}$ and 3.14J $mol^{-1} K^{-1}$ respectively

Watch Video Solution

36. Calculate the rms speed of an ideal diatomic gas having molecular weight 32 gm/mol at $0^{\circ} C$. If the specific heats at constant pressure and

volume are respectively 8.3 cal $mol^{-1}K^{-1}$ and 6.34 cal $mol^{-1}K^{-1}$ respectively.

Watch Video Solution

37. Calculate themean free path of molecule of a gas having number density (number of molecules per cm^3) 2×10^8 and the diameter of the molecule is 10^{-5}cm

Watch Video Solution

38. The mean free path of molecules of a gas is 10^{-8} cm. if number density of gas is $10^9 / cm^3$ calculate the diameter of the molecule

Watch Video Solution

39. Calculate the diameter of one molecule of an ideal gas having number density $2 \times 10^8 cm^{-3}$ and mean free path of the molecule is $10^{-8} cm$.

Watch Video Solution

40. if the mean free path of a molecule of an ideal gas having diameter $10^{-8}cm$ is 10^{-4}cm, calculate the number density of the gas molecule.

Watch Video Solution

Exercise

1. Each molecule of a gas has F degrees of freedom . The ratio $\frac{C_p}{C_V}=\gamma$ for the gas is

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

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

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

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

Answer: C

Watch Video Solution

2. At constant pressure the r.m.s. velocity c is related to density d as

A. $c \propto d$

B. $c \propto \frac{1}{d}$

C. $c \propto \sqrt{d}$

D. $c \propto \frac{1}{\sqrt{d}}$

Answer: D

Watch Video Solution

3. The mean rotational kinetic energy of a diatomic molecule at temperature T is :

A. $\frac{1}{2}kT$

B. $\frac{5}{2}kT$

C. kT

D. $\frac{3}{4}kT$

Answer: C

Watch Video Solution

4. A jar has a mixture of hydrogen and oxygen gas in the ratio of 1 : 5. The ratio of mean kinetic energies of hydrogen and oxygen molecules is

A. $1:16$

B. $1:4$

C. $1:5$

D. $1:1$

Answer: D

Watch Video Solution

5. The root mean square speed of the molecules of an enclosed gas is 'v'. What will be the root mean square speed if the pressure is doubled, the temperature remaining the same?

A. $3v$

B. $4v$

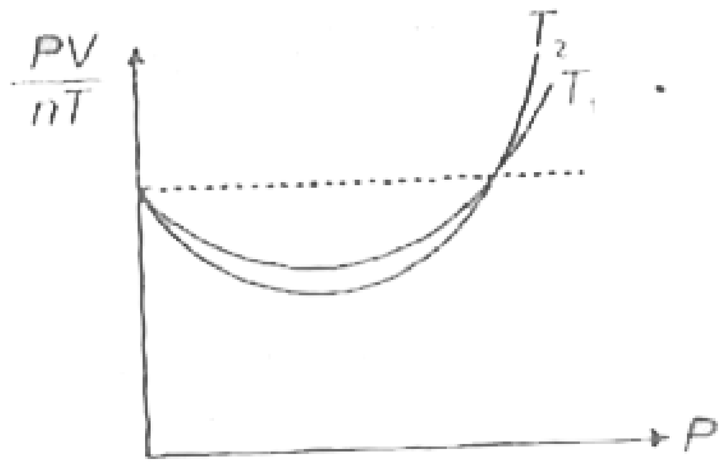
C. v

D. $5v$

Answer: C

Watch Video Solution

6. The figure shows the plot of $\frac{PV}{nT}$ vs P, for oxygen gas at two different temperatures then



A. $T_1 > T_2$

B. $T_2 > T_1$

C. $T_1 = T_2$

D. may be (1) & (2)

Answer: A

Watch Video Solution

7. The temperature of an ideal gas is increased from $27^\circ C$ to $927^\circ C$. The rms speed of its molecules becomes.

A. Twice

B. Half

C. Four times

D. One fourth

Answer: A

Watch Video Solution

8. Which of the following has possesses maximum rms velocity? All being at same temperature

A. Oxygen

B. Carbon dioxide

C. Hydrogen

D. Helium

Answer: C

Watch Video Solution

9. A container is filled with a simple of gas having molecules with speed $\alpha, 2\alpha, 3\alpha, \ldots.. n\alpha$. The ratio of average speed to root mean square speed is

A. $\sqrt{\dfrac{3(n+1)}{2(2n+1)}}$

B. $\sqrt{\dfrac{(n+1)}{2(2n+1)}}$

C. $\sqrt{\dfrac{5(2n+2)}{7(3n+1)}}$

D. $\sqrt{\dfrac{3(n+2)}{5(3n+2)}}$

Answer: A

Watch Video Solution

10. A vessel contains a non-linear triatomic. If 50% of gas dissociate into individual atom, then find new value of degree of freedom by ignoring the vibrational mode and any further dissociation.

A. 2.15

B. 3.75

C. 5.25

D. 6.35

Answer: B

Watch Video Solution

Exercise Assignment Section A Objective Type Questions

1. Select the appropriate property of an ideal gas

A. its molecules are infinitesimally small

B. There are no forces of interaction between its molecules

C. It strictly obeys the ideal gas laws

D. All of these

Answer: D

Watch Video Solution

2. A real gas behaves like an ideal gas if its

A. Very low pressure and high temperature

B. High pressure and low temperature

C. High pressure and high temperature

D. Low pressure and low temperature

Answer: A

Watch Video Solution

3. A gas at pressure p_0 is contained in a vessel. If the masses of all the molecules are halved and their speeds doubled, the resulting pressure would be

A. $4P_0$

B. $2P_0$

C. P_0

D. $\frac{P_0}{2}$

Answer: B

Watch Video Solution

4. If E is the energy density in an ideal gas, then the pressure of the ideal gas is

A. $P = \frac{2}{3}E$

B. $P = \frac{3}{2}E$

C. $P = \frac{5}{2}E$

D. $P = \frac{2}{5}E$

Answer: A

Watch Video Solution

5. A sample of gas in a box is at pressure P_0 and temperature T_0. If number of molecules is doubled and total kinetic energy of the gas is kept constant, then final temperature and pressure will be

A. $T_0 . P_0$

B. $T_0, 2P_0$

C. $\frac{T_0}{2}, 2P_0$

D. $\frac{T_0}{2}, P_0$

Answer: D

Watch Video Solution

6. By increasing temperature of a gas by $6^\circ C$ its pressure increases by 0.4%, at constant volume. Then initial temperature of gas is

A. 1000 K

B. 1500 K

C. 2000 K

D. 750 K

Answer: B

Watch Video Solution

7. Boyle's law is obeyed by

A. Real gas of constant mass and temperature

B. Ideal gas of constant mass and temperature

C. Both ideal and real gases at constant temperature and variable mass

D. Both ideal and real gases of constant mass and variable temperature.

Answer: B

Watch Video Solution

8. For an ideal gas the fractional change in its volume per degree rise in temperature at constant pressure is equal to [T is absolute temperature of gas]

A. T^{0}

B. T

C. T^{-1}

D. T^2

Answer: C

Watch Video Solution

9. The raise in the temperature of a given mass of an ideal gas at constant pressure and at temperature 27° to double its volume is

A. $327^{\circ} C$

B. $54^{\circ} C$

C. $300^{\circ} C$

D. $600^{\circ} C$

Answer: C

Watch Video Solution

10. The average velocity of the molecules in a gas in equilibrium is

A. Proportional to $\sqrt{T}$

B. Proportional to T

C. Zero

D. Not possible to determine

Answer: C

Watch Video Solution

11. Which of the following methods will enable the volume of an ideal gas to be made four times

A. Double the temperature and reduce the pressure to half

B. Double the temperature and also double the pressure

C. Reduced the temperature to half and double the pressure

D. Reduce the temperature to half and reduce the pressure to half

Answer: A

12. A container has N molecules at absolute temperature T. If the number of molecules is doubled but kinetic energy in box remains the same as before, the absolute temperature of the gas is

A. T

B. $\frac{T}{2}$

C. 3T

D. 4T

Answer: B

Watch Video Solution

13. During an experiment, an ideal gas is found to obey an additional law VP^2 =constant. The gas is initially at a temperatur T and volume V. When it expands to a volume $2V$, the temperature becomes__________$.^\circ C$.

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

B. 2T

C. $\sqrt{2}T$

D. $\frac{T}{\sqrt{2}}$

Answer: C

Watch Video Solution

14. At what temperature, pressure remaining constant will the r.m.s. speed of a gas molecules increase by 10% of the r.m.s speed at STP?

A. $57.3K$

B. $57.3^\circ C$

C. $557.3K$

D. $-57.3^{\circ}C$

Answer: B

Watch Video Solution

15. Two thermally insulated vessels (1) and (2) are filled with air at temperature (T_1, T_2) volumes (V_1, V_2) and pressures (p_1, p_2) respectively. If the valve joining the two vessela is opened, the temperature inside the vessel at equilibrium will be $(P = common pressure)$.

A. $T_1 + T_2$

B. $\dfrac{(T_1 + T_2)}{2}$

C. $\dfrac{T_1 T_2 (P_1 V_1 + P_2 V_2)}{P_1 V_1 + P_2 V_2 T_1}$

D. $\dfrac{T_1 T_2 (P_1 V_1 + P_2 V_2)}{P_1 V_1 T_1 + P_2 V_2 T_2}$

Answer: C

Watch Video Solution

16. The average speed of gas molecules is v at pressure P, If by keeping temperature constant the pressure of gas is doubled, then average speed will become

A. $\sqrt{2}V$

B. v

C. $2v$

D. $\frac{v}{\sqrt{2}}$

Answer: B

Watch Video Solution

17. 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. 2.5 km/s

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

Answer: D

Watch Video Solution

18. The rms speed of the molecule of enclosed gas is v. What will be the rms speed if pressure is doubled keeping the temperature same?

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

B. V

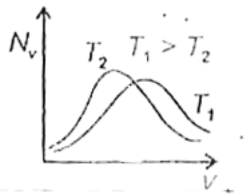
C. $2V$

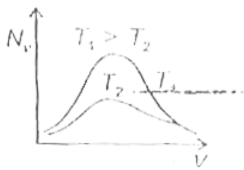
D. $4V$

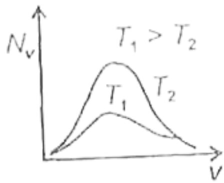
Answer: B

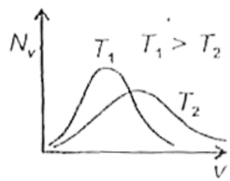
Watch Video Solution

19. The effect of temperature on Maxwell's speed distribution is correctly shown by

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

20. Select the incorrect statement about Maxwell's speed distribution.

A. The distribution function depends only on the absolute temperature

B. $V_{\mathrm{rms}} > V_{\mathrm{av}} > V_{\mathrm{mp}}$

C. The area under the distribution curve gives total number of molecules of the gas

D. The distribution curve is symmetric about the most probable speed.

Answer: D

Watch Video Solution

21. The ratio of number of collisions per second at the walls of containers by He and O_2 gas molecules kept at same volume and temperature is (assume normal incidence on walls)

A. $2:1$

B. $1:2$

C. $2\sqrt{2}:1$

D. $1:2\sqrt{2}$

Answer: C

Watch Video Solution

22. An ant is moving on a plane horizontal surface. The number of degrees of freedom of the ant will be

A. 1

B. 2

C. 3

D. 6

Answer: B

Watch Video Solution

23. If a gas has n degrees of freedom ratio of specific heats of gas is

A. $\dfrac{1+f}{2}$

B. $1+\dfrac{f}{2}$

C. $1+\dfrac{1}{f}$

D. $1+\dfrac{2}{f}$

Answer: D

Watch Video Solution

24. The molar specific heat at constant volume, for a non linear triatomic gas is

A. $3R$

B. $4R$

C. $2R$

D. R

Answer: A

Watch Video Solution

25. A mixture of ideal gases has 2 moles of He, 4 moles of oxygen and 1 mole of ozone at absolute temperature T. The internal energy of mixture is

A. 13 RT

B. 11 RT

C. 16 RT

D. 14 RT

Answer: C

Watch Video Solution

26. E_0 and E_n respectively represent the average kinetic energy of a molecule of oxygen and hydrogen. If the two gases are at the same temperature, which of the following statements is true?

A. $E_O > E_H$

B. $E_O = E_H$

C. $E_O < E_H$

D. Data insufficient

Answer: B

Watch Video Solution

27. 14 g of CO at $27^{\circ}C$ is mixed with 16'g of O_2 at $47^{\circ}C$. The temperature of mixture is (vibartion mode neglected)

A. $-5^{\circ}C$

B. $32^{\circ}C$

C. $37^{\circ}C$

D. $27^{\circ}C$

Answer: C

Watch Video Solution

28. When one mole of monoatomic gas is mixed with one mole of triatomic gas, then the equivalent value of γ for the mixture will be (vibration mode neglected)

A. 1.33

B. 1.40

C. 1.50

D. 1.6

Answer: C

Watch Video Solution

29. A box of negligible mass containing 2 moles of an ideal gas of molar mass M and adiabatic exponent γ moves with constant speed v on a smooth horizontal surface. If the box suddenly stops, then change in temperature of gas will be :

A. $\frac{(\gamma - 1)Mv^2}{4R}$

B. $\frac{\gamma M v^2}{2R}$

C. $\frac{M v^2}{2(\gamma - 1)R}$

D. $\frac{(\gamma - 1)M v^2}{2R}$

Answer: D

Watch Video Solution

30. On increasing number density for a gas in a vessel, mean free path of a gas

A. Decreases

B. Increases

C. Remains same

D. Becomes double

Answer: A

Watch Video Solution

Exercise Assignment Section B Objective Type Questions

1. At room temperature the rms speed of the molecules of a certain diatomic gas is found to be 1920 m/s. The gas is

A. H_2

B. F_2

C. CI_2

D. O_2

Answer: A

Watch Video Solution

2. A gas is enclosed in a vessel of volume V at a pressure P. It is being pumped out of the vessel by mean of a piston-pump with a stroke volume. v. What is the final pressure in the vessel after $'n'$ strokes of the pump ? Assume temperature reamains constant.

A. $P\left(\frac{V}{V+v}\right)^n$

B. $\frac{PV}{(V-v)^n}$

C. $P\frac{V^n}{V^n}$

D. $P\left(\frac{V}{V-v}\right)^n$

Answer: A

Watch Video Solution

3. Three perfect gases at absolute temperature $T_1, T_2,$ and T_3 are mixed. The masses of molecules are n_1, n_2 and n_3 respectively. Assuming to loss of energy, the final temperature of the mixture is:

A. $\dfrac{T_1 + T_2 + T_3}{3}$

B. $\dfrac{n_1^2 T_1 + n_2^2 T_2 + n_3^2 T_3}{n_1 + n_2 + n_3}$

C. $\dfrac{n_1T_1 + n_2T_2 + n_3T_3}{n_1 + n_2 + n_3}$

D. $\dfrac{T_1 + T_2 + T_3}{n_1 + n_2 + n_3}$

Answer: C

Watch Video Solution

4. Variation of atmospheric pressure, with height from earth is

A. Linear

B. Parabolic

C. Exponential

D. Hyperbolic

Answer: C

Watch Video Solution

5. A glass tube $80cm$ long and open ends is half immersed in mercury. Then the top of the tube is closed and it is taken out of the mercury. A column of murcury $20cm$ long then remains in the tube. The atmospheric (in cm of Hg) is

(assume temperature to be constant)

A. 20 cm of air column

B. 60 cm of Hg column

C. 60 cm of air column

D. 20 cm of Hg column

Answer: B

Watch Video Solution

6. One mole of monoatomic gas and three moles of diatomic gas are put together in a container. The molar specific heat (in $JK^{-1}\ \mathrm{mol}^{-1}$) at constant volume is (R = 8.3 $JK^{-1}\ \mathrm{mol}^{-1}$)

A. 18

B. 19

C. 20

D. 21

Answer: A

Watch Video Solution

7. Two colsed vessel A and B of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow open tube . If the temperature of one is now maintained at T_1 and other at T_2 (where $T_1 > T_2$) then that what will be the final pressure ?

A. $\dfrac{2P_0T}{T+T_0}$

B. $\dfrac{P_0T}{T+(T_0)}$

C. $\dfrac{P_0T}{2(T+T_0)}$

D. $\dfrac{T+T_0}{P_0}$

Answer: A

Watch Video Solution

8. The temperature of a gas is $-68^\circ C$. To what temperature should it be heated so that the average kinetic energy of the molecules be doubled

A. $137^\circ C$

B. $127^\circ C$

C. $100^{\circ}C$

D. $105^{\circ}C$

Answer: A

Watch Video Solution

9. A closed compartment containing gas is moving with some acceleration in horziontal direction. Neglect effect of gravity. Then the pressure in the compartment is

A. Uniform everywhere

B. Less in front

C. Less at back

D. Less at top

Answer: B

Watch Video Solution

10. One kg of a diatomic gas is at a pressure of $8 \times 10^4 N/m^2$. The density of the gas is $4kg/m^3$. What is the energy of the gas due to its thermal motion ?

A. $3 \times 10^4 J$

B. $5 \times 10^4 J$

C. $6 \times 10^4 J$

D. $7 \times 10^4 J$

Answer: B

Watch Video Solution

11. A container contains 32 g of O_2 at a temperature T. The pressure of the gas is P. An identical container containing 4 g of H_2 at a temperature 2T has a pressure of

A. 8P

B. 4P

C. P

D. $18P$

Answer: B

Watch Video Solution

12. An ideal gas is expanding such that $PT^2 =$ constant. The coefficient of volume expansion of the gas is

A. $\frac{1}{T}$

B. $\frac{2}{T}$

C. $\frac{3}{T}$

D. $\frac{4}{T}$

Answer: B

Watch Video Solution

13. 50 cal of heat is required to raise the temperature of 1 mole of an ideal gas from $20^\circ C$ to $25^\circ C$, while the pressure of the gas is kept constant. The amount of heat required to raise the temperature of the same has through same temperature range at constant volume is (R = 2 cal/mol/K)

A. 70 cal

B. 60 cal

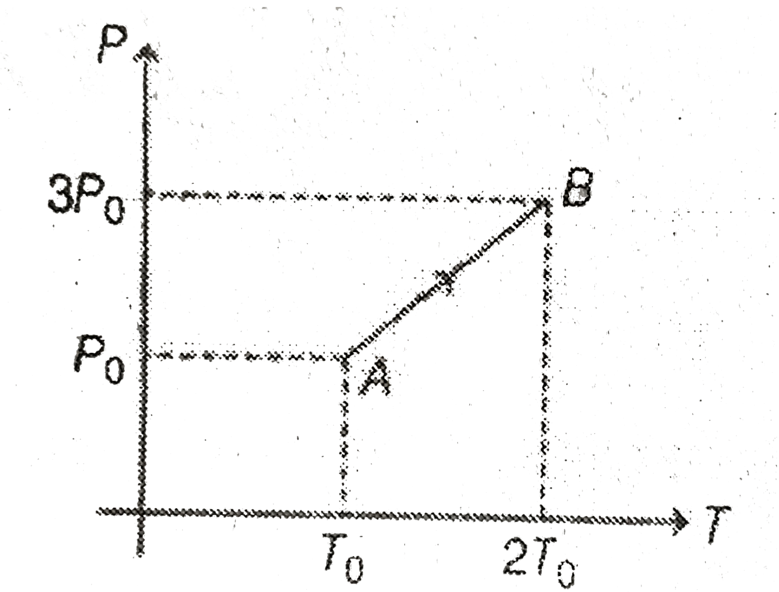
C. 40 cal

D. 50 cal

Answer: C

Watch Video Solution

14. Pressure versus temperature graph of an ideal gas is as shown in figure. Density of the gas at point A is ρ_0. Density at B will be



A. $\frac{3}{4}\rho_0$

B. $\frac{3}{2}\rho_0$

C. $\frac{4}{3}\rho_0$

D. $2\rho_0$

Answer: B

Watch Video Solution

15. The energy (in eV) possessed by a neon atom at $27^\circ C$ is

A. 1.72×10^{-3}

B. 4.75×10^{-4}

C. 3.88×10^{-2}

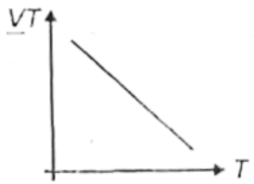
D. 3.27×10^{-5}

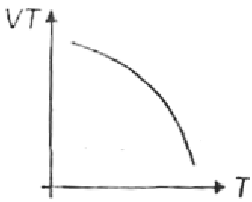
Answer: C

Watch Video Solution

16. If heat energy is given to an ideal gas at constant pressure, then select the graph which best represents the variation of VT with temperature (T).

A. 

B. 

C. 

D. 

Answer: A

Watch Video Solution

17. If hydrogen gas is heated to a very high temperature, then the fraction of energy possessed by gas molecules correspond to rotational motion :-

A. $\frac{3}{5}$

B. $\frac{2}{7}$

C. $\frac{3}{7}$

D. $\frac{2}{5}$

Answer: B

Watch Video Solution

18. The temperature (T) of one mole of an ideal gas varies with its volume (V) as $T = -\alpha V^3 + \beta V^2$, where α and β are positive constants. The maximum pressure of gas during this process is

A. $\frac{\alpha\beta}{2R}$

B. $\frac{\beta^2 R}{4\alpha}$

C. $\dfrac{(\alpha+\beta)R}{2\beta^2}$

D. $\dfrac{\alpha^2 R}{2\beta}$

Answer: B

Watch Video Solution

19. Nitrogen gas is filled in an isolated container. If α fraction of moles dissociates without exchange of any energy, then the fractional change in its temperature is

A. a.$\dfrac{-\alpha}{5+\alpha}$

B. b. $\frac{\alpha}{3+\alpha}$

C. c. $\frac{-3\alpha}{2+\alpha}$

D. d. $5\frac{\alpha}{2+3\alpha}$

Answer: A

Watch Video Solution

20. An ideal has undergoes a polytropic given by equation PV^n = constant. If molar heat capacity of gas during this process is arithmetic mean of its molar heat capacity at constant pressure and constant volume then value of n is

A. Zero

B. -1

C. $+1$

D. γ

Answer: B

Watch Video Solution

21. If α moles of a monoatomic gas are mixed with β moles of a polyatomic gas and mixture behaves like diatomic gas, then [neglect the vibration mode of freedom]

A. $2\alpha = \beta$

B. $\alpha = 2\beta$

C. $\alpha = -3\beta$

D. $3\alpha = -\beta$

Answer: A

Watch Video Solution

22. If different ideal gases are at the same temperature, pressure and have same volume, then all gases have same

A. Density

B. Number of molecules

C. Most probable speed

D. Internal energy per mole

Answer: B

Watch Video Solution

23. The internal energy of 10 g of nitrogen at N. T. P. is about

A. 2575 J

B. 2175 J

C. 3721 J

D. 4051 J

Answer: B

Watch Video Solution

24. The mean free path of a molecule of He gas is α. Its mean free path along any arbitrary coordinates axis will be

A. α

B. $\frac{\alpha}{3}$

C. $\frac{\alpha}{\sqrt{3}}$

D. 3α

Answer: C

Watch Video Solution

25. According to C.E van der Waal, the interatomic potential varies with the average interatomic distance (R) as

A. R^{-1}

B. R^{-2}

C. R^{-4}

D. R^{-6}

Answer: D

Watch Video Solution

26. The value of critical temperature in terms of van der Waals' constants a and b is given by

A. $T_C = \frac{8a}{27Rb}$

B. $T_C = \frac{27a}{8Rb}$

C. $T_C = \frac{a}{2Rb}$

D. $T_C = \frac{a}{27Rb}$

Answer: A

Watch Video Solution

27. To find out degree of freedom, the correct expression is:

A. $f = \frac{2}{\gamma - 1}$

B. $f = \frac{\gamma + 1}{2}$

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

D. $f = \frac{1}{\gamma + 1}$

Answer: A

Watch Video Solution

28. Nitrogen gas N_2 of mass 28 g is kept in a vessel at pressure of 10 atm and temperature $57^\circ C$. Due to leakage of N_2 gas its pressure falls to 5 atm and temperature to $26^\circ C$. The amount of N_2 gas leaked out is

A. $\frac{5}{63} g$

B. $\frac{63}{5} g$

C. $\frac{28}{63} g$

D. $\frac{63}{28} g$

Answer: B

Watch Video Solution

29. A diatomic gas of molecular mass 40 g/mol is filled in rigid container at temperature $30^\circ C$. It is moving with velocity 200 m/s. If its is suddenly stopped, the rise in the temperature of the gas is

A. $\frac{32}{R}{}^\circ C$

B. $\frac{320}{R}{}^\circ C$

C. $\frac{3200}{R}{}^\circ C$

D. $\frac{3.2}{R}{}^\circ C$

Answer: B

Watch Video Solution

30. The ratio of average translatory kinetic energy of He gas molecules to O_2 gas molecules is

A. $\frac{25}{21}$

B. $\frac{21}{25}$

C. $\frac{3}{2}$

D. 1

Answer: D

Watch Video Solution

Exercise Assignment Section C Previous Years Questions

1. A gas mixture consists of 2 moles of O_2 and 4 moles of Ar at temperature T. Neglecting all vibrational modes, the total internal energy of the system is

A. 4 RT

B. 15 RT

C. 9.5 RT

D. 11 RT

Answer: D

Watch Video Solution

2. A given sample of an ideal gas occupise a volume V at a pressure p and absolute temperature T.The mass of each molecule of the gas is m. Which of the following is the density of the gas ?

A. $\frac{P}{(kT)}$

B. $\frac{Pm}{(kT)}$

C. $\frac{P}{(kTV)}$

D. mkT

Answer: B

Watch Video Solution

3. The molecules of a given mass of have rms speed $200 ms^{-1}$ at $27^{\circ} C$ and $10^5 Nm^{-2}$ pressure. When the absolute temperature is double and the pressure is halved, the rms speed of the molecules of the same gas is

A. $\frac{100}{3}$

B. $100\sqrt{2}$

C. $\frac{400}{\sqrt{3}}$

D. $\frac{100\sqrt{2}}{3}$

Answer: C

Watch Video Solution

4. Two vessels separately contain two ideal gases A and B at the same temperature, the pressure of A being twice that of B. Under such conditions, the density of A is found to be 1.5 times the density of B. the rato of molecular weight of A and B is

A. $\frac{1}{2}$

B. $\frac{2}{3}$

C. $\frac{3}{4}$

D. 2

Answer: C

Watch Video Solution

5. The ratio of the specific heats $\frac{C_p}{C_v} = \gamma$ in terms of degrees of freedom (n) is given by

A. $\left(1 + \frac{n}{2}\right)$

B. $\left(1 + \frac{1}{n}\right)$

C. $\left(1 + \frac{n}{3}\right)$

D. $\left(1 + \frac{2}{n}\right)$

Answer: D

Watch Video Solution

6. The mean free path of molecules of a gas (radium) is inversely proportional to

A. r^3

B. r^2

C. r

D. $\sqrt{r}$

Answer: B

Watch Video Solution

7. The amount of heat energy required to raise the temperature of 1 g of helium at NTP, from T_1K to T_2K is

A. $\frac{3}{2}N_ak_B(T_2 - T_1)$

B. $\frac{3}{4}N_ak_B(T_2 - T_1)$

C. $\frac{3}{4}N_ak_B\left(\frac{T_2}{T_1}\right)$

D. $\frac{3}{8} N_a k_B (T_2 - T_1)$

Answer: D

Watch Video Solution

8. Two containers A and B are partly filled with water and closed. The volume of A is twice that of B and it contains half the amount of water in B. If both are at the same temperature, the water vapour in the containers will have pressure in the ratio of

A. $1:2$

B. $1:1$

C. $2:1$

D. $4:1$

Answer: B

Watch Video Solution

9. At constant volume temperature is increased, then

A. Collision on walls will be less

B. Number of collisions per unit time will increase

C. Collisions will be in straight lines

D. Collisions will not change

Answer: B

Watch Video Solution

10. A polyatomic gas with n degrees of freedom has a mean energy per molecule given by

A. $\frac{nKT}{N}$

B. $\frac{nKT}{2N}$

C. $\frac{nKT}{2}$

D. $\frac{nKT}{4}$

Answer: C

Watch Video Solution

11. For a certain gas the ratio of specific heats is given to be $\gamma = 1.5$, for this gas

A. $C_v = \frac{3R}{J}$

B. $C_p = \frac{3R}{J}$

C. $C_p = \frac{5R}{J}$

D. $C_v = \frac{5R}{J}$

Answer: B

Watch Video Solution

12. According to kinetic theory of gases, at absolute zero temperature

A. Water freezes

B. Liquid helium freezes

C. Molecular motion stops

D. Liquid hydrogen freezes

Answer: C

Watch Video Solution

13. One mole of an ideal gas requires 207 J heat to rise the temperature by 10 K when heated at constant pressure. If the same gas is heated at constant volume to raise the temperaure by the same $10K$, the heat required is (Given the gas constant $R = 8.3J / Mol - K$)

A. 198.7 J

B. 19 J

C. 215.3 J

D. 124 J

Answer: D

Watch Video Solution

14. Relation between pressure (P) and average kinetic energy per unit volume of gas (E) is

A. $P = \frac{2}{3}E$

B. $P = \frac{1}{3}E$

C. $P = \frac{1}{2}E$

D. $P = 3E$

Answer: A

Watch Video Solution

15. If c_s is the velocity of sound in air and c is rms velocity , then

A. $C_s < C$

B. $C_s = C$

C. $C_s = C\left(\frac{\gamma}{3}\right)^{1/2}$

D. None of these

Answer: C

Watch Video Solution

16. The temperature of an ideal gas is increased from $27^\circ C$ to $927^\circ C$. The rms speed of its molecules becomes.

A. $\sqrt{\frac{927}{27}}$ times the earlier value

B. Remain the same

C. Gets halved

D. Get doubled

Answer: D

Watch Video Solution

17. The equation of state, corresponding to 8 g of O_2 is

A. $PV = 8RT$

B. $PV = \frac{RT}{4}$

C. $PV = RT$

D. $PV = \frac{RT}{2}$

Answer: B

Watch Video Solution

18. At $0K$, which of the following properties of a gas will be zero ?

A. Kinetic energy

B. Potential energy

C. Density

D. Mass

Answer: A

Watch Video Solution

19. At $10^{\circ}C$ the value of the density of a fixed mass of an ideal gas divided by its pressure is x. At $110^{\circ}C$ this ratio is

A. $\frac{283}{383}x$

B. x

C. $\frac{383}{283}x$

D. $\frac{10}{110}x$

Answer: A

Watch Video Solution

20. The degrees of freedom of a molecule of a triatomic gas are

A. 6

B. 4

C. 2

D. 8

Answer: A

Watch Video Solution

21. The equation of state for 5 g of oxygen at a pressure P and temperature T, when occupying a volume V, will be

A. $PV = \frac{5}{32}RT$

B. $PV = 5RT$

C. $PV = \frac{5}{2}RT$

D. $PV = \frac{5}{16}RT$

Answer: A

Watch Video Solution

Exercise Assignment Section D Assertion Reason Type Questions

1. Assertion : The internal energy of a real gas is function of both, temperature and volume.

Reason : Internal kinetic energy depends on temperature and internal potential energy depends on volume

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

Watch Video Solution

2. A : The gravitational force between the gas molecules is ineffective due to extremely small size and very high speed.

R : No force of interaction acts between molecules of an ideal gas.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

Watch Video Solution

3. A : Average velocity of gas molecules is zero,

R : Due to random motion of gas molecules, velocities of different molecules cancer each other.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)
B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)
C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

Watch Video Solution

4. A : At constant volume on increasing temperature the collision frequency increases.

R : Collision frequency $\propto$ temperature of gas.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: C

Watch Video Solution

5. A : Two gases with the same average translational kinetic: energy have same temperature even if one has greater rotational energy as compared to other.

R : Only average translational kinetic energy of a gas contributes to its temperature.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

Watch Video Solution

6. Assertion : All molecular motion ceases at $-273^{\circ}C$.

Reason : Temperature $-273^{\circ}C$ cannot be attained.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

Watch Video Solution

7. A : Magnitude of mean velocity of the gas molecules is same as their mean speed.

R : The only difference between mean velocity and mean speed is that mean velocity is a vector and mean speed is a scalar.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)
B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)
C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: D

Watch Video Solution

8. Assertion : Mean free path of a gas molecule varies inversely as density of the gas.

Reason : Mean free path varies inversely as pressure of the gas.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: B

Watch Video Solution

9. A : Number of air molecules in a room in winter is more than the number of molecules in the same room in summer.

R : At a given pressure and volume, the number of molecules of a given mass of a gas is directly proportional to the absolute temperature.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: C

Watch Video Solution

10. A : Evaporation occurs at any temperature whereas the boiling point depends on the external pressure.

R : Evaporation of a liquid occurs from the surface of a liquid at all temperature whereas boiling takes place at a temperature determined by the external pressure.

A. If both Assertion & Reason are true and the reason is the correct explanation of the assertion, then Mark (1)

B. If both Assertion & Reason are true but the reason is not the correct explanation of the assertion, then mark (2)

C. If Assertion is true statement but Reason is false, then mark (3)

D. If both Assertion and Reason are false statements, then mark (4).

Answer: A

Watch Video Solution