CHEMISTRY

BOOKS - BRILLIANT PUBLICATION

STATES OF MATTER

(LEVEL-I (HOMEWORK)

1. A vessel of 2L capacity contain hydrogen at 380 mm pressure at $27^{\circ} C$. 16 gm of O_2 is added to the container-then find the total pressure where R = 0.0821 L atm $mol^{-1} K^{-1}$.

A. $6.65atm$

B. $5.55atm$

C. $3.25atm$

D. $4.87atm$

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2. One litre flask contain air, water vapour and a small amount of liquid water at a pressure of 200 mm Hg. If this is connected to another 1L evacuated flask, what will be the final pressure of the gas mixture at equilibrium? Assume the temperature to be $50^{\circ} C$. Aqueous tension at $50^{\circ} C = 93$ mm of Hg

A. $120.56 mm$

B. $230 mm$

C. $146.5 mm$

D. $109.4 mm$

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3. A mixture of CO and CO_2 is found to have density of 1.50 g /litre at $30^\circ C$ and 730 mm. Composition of mixture is

A. $43.2\ \%\ CO$ and $56.8\ \%\ CO_2$

B. $18.32\ \%\ CO$ and $81.68\ \%\ CO_2$

C. $32.19\ \%\ CO$ and $67.8\ \%\ CO_2$

D. $67.8\ \%\ CO$ and $32.19\ \%\ CO_2$

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4. An open vessel at $27^\circ C$ is heated until $3/5^{th}$ of the air in it has been expelled. Assuming that volume of vessel remains constant. Find the temperature at which vessel was heated

A. 630 K

B. 750K

C. 570K

D. 970 K

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5. Calculate payload of a balloon having volume 100 L. It is filled with He gas at 0.2486 atm pressure and 300 K. Density of air is 1.3 g/litre and mass of material of balloon is 20 g : 810, 930, 1230, 1060

A. 810

B. 930

C. 1230

D. 1060

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6. Which of the following statements are correct

A. He diffuses at a rate 8.65 time as much as CO does

B. He escapes at a rate 2.65 times as fast as CO does

C. He escapes at a rate 4 times as fast as CO_2 does

D. He escapes at a rate 4 times as fast as SO_3 does

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7. A certain volume of Ar gas require 45 sec to effuse through a hole at a certain pressure and temperature. The same volume of another gas of unknown molecular weight require 60 sec to pass through the same hole under the same condition of temperature and pressure. The molecular weight of gas is

A. 53u

B. 35 u

C. 71u

D. 121 u

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8. On the surface of the earth at 1 atm pressure, a balloon filled with H_2 gas occupies 500 ml. This volume 5/6 of its maximum capacity. The balloon is left in air, it starts rising. The height above which the balloon will burst if temperature of the atmosphere remain constant and pressure decreases 1 mm for every 100 cm rise of height is

A. 120 m

B. $136.67m$

C. $126.67m$

D. 100 m

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9. A real gas most closely approaches the behaviour of an ideal gas at which among the following conditions?

A. 15 atm and 200 K

B. 1 atm and 273K

C. 0.5 atm and 500K

D. 15 atm and 500 K

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10. The temperature at which rms speed of O_2 is equal to that of neon at 300 K is

A. 280K

B. 480K

C. 680K

D. 180 K

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11. 20 L of SO_2 diffuses through a porous partition in 60 sec. Volume of O_2 diffuse under similar condition in 30 second will be

A. $12.14L$

B. $14.14L$

C. $28.14L$

D. $18.14L$

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12. A chemist has synthesized a greenish yellow gaseous compound of chlorine and oxygen and find that its density is 7.71 g/L at $36^{\circ} C$ and 2.88 atm. Then the molecular formula of the compound will be

A. ClO_3

B. ClO_2

C. ClO

D. CI_2O_2

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13. 2.9g of a gas $95^\circ C$ occupied the same volume as 0.184g of H_2 at $17^\circ C$ at the same pressure. What is the molar mass of the gas?

A. $40 g mol^{-1}$

B. $20 g mol^{-1}$

C. $30 g mol^{-1}$

D. $32 g mol^{-1}$

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14. The rms velocity of CO_2 at temperature T is $'x' cms^{-1}$. At what temperature the rms velocity of nitrous oxide would be 4x cms^{-1}?

A. 16 T

B. 2 T

C. 4 T

D. 32 T

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15. A4 dm flask containing N_2 at 4 bar was connected to 6 dmflask containing He at 6 bar, and the gases were allowed to mix isothermally, then the total pressure of the resulting mixture will be

A. 10 bar

B. 5.2 bar

C. 1.6 bar

D. 5 bar

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16. A sample of gas at $0^{\circ}C$ and 1 atm pressure occupies 3L. What change in temperature is necessary to adjust the pressure of the gas to 1.5 atm after it has been transferred to 2L container?

A. $273^{\circ}C$

B. $0^{\circ}C$

C. $5^{\circ}C$

D. $10^{\circ}C$

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17. A balloon filled with ethyne is pricked with a sharp point and quickly dropped in a tank of H_2 gas under identical condition. After a while the balloon will have

A. Shrunk

B. Enlarged

C. Completely collapsed

D. Remained unchanged in size

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18. A balloon has maximum capacity of 20 L. At one atmospheric pressure 10 L of air is filled in the ballon. It will burst when the external pressure is reduced to (assume isothermal conditions)

A. $0.5atm$

B. $0.4atm$

C. $0.7atm$

D. $0.8atm$

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19. The term that corrects for the attractive forces present in a real gas in the Vander Waal's equation is

A. nb

B. $\frac{n^2a}{v^2}$

C. $\frac{-n^2a}{v^2}$

D. $-nb$

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20. Equal masses of CH_4 and O_2 are mixed in an empty container at $25^\circ C$. The fraction of the total pressure exerted by oxygen is

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

B. $\frac{1}{3} \times \frac{273}{298}$

C. $\frac{1}{3}$

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

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21. If temperature changes from $27^{\circ} C$ to $127^{\circ} C$, the relative percentage change in rms velocity is

A. 1.56

B. 2.56

C. 15.6

D. 82.4

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22. The vander Waal's constant for four gases P, Q, R and S are 4.17, 3.59, 6.17 and 3.8 atm$L^2 mo^{l-2}$ Therefore, the ascending order of their liquifaction is

A. $R < P < S < Q$

B. $Q < S < R < P$

C. $Q < S < P < R$

D. $R < P < Q < S$

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23. If the density of a certain gas at $30^{\circ} C$ and 768 torr is 1.35 Kg/m^{3}, then density at STP is

A. $1.48 kg/m^{3}$

B. $1.27 kg/m^{3}$

C. $1.35 kg/m^{3}$

D. $1.00 kg/m^{3}$

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24. The critical temperature and pressure of CO_2 gas are 304.2 K and 72.9 atm respectively. What is the radius of CO_2 molecule assuming it to behave as vander Waal's gas

A. $1.62A^\circ$

B. $3.1A^\circ$

C. $2.3A^\circ$

D. $0.81A^\circ$

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25. Through the ends of a glass tube of length 200 cm, HCl gas and NH_3 are allowed to enter. At what distance $NHCI_4$ will first appear?

A. $190.2cm$

B. $118.9cm$

C. 182 cm

D. $151.4cm$

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26. At what temperature will the total KE of 0.3 mol of He be the same as total KE of 0.4 mol of Ar at 400 K

A. 533 K

B. 400 K

C. 346 K

D. 300K

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27. A gas at a pressure of 5atm is heated from 0° to $546^{\circ}C$ and is simultaneously compressed to one third of its original volume, the final pressure is

A. $15.0atm$

B. $30.0atm$

C. $45.0atm$

D. $5/9atm$

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28. A 34.0 L cylinder contains $212 g O_2$ gas at $27^\circ C$.

What mass of O_2(g) must be released to reduce the pressure to 2.463 atm?

A. $103.2 g$

B. $108.89 g$

C. $100.0 g$

D. $32.0 g$

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29. A1.00 L vessel containing 1.00 g H_2 gas at$27^\circ C$ is connected to a 2.00 L vessel containing 88.0 g CO_2 gas at also $27^\circ C$. When the gases are completely mixed, total pressure is

A. $20.50atm$

B. $4.105atm$

C. $16.420atm$

D. $730.69atm$

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30. At what temperature will the total KE of 0.3 mol of He be the same as total KE of 0.4 mol of Ar at 400 K

A. 533 K

B. 400 K

C. 346 K

D. 300 K

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31. One litre of O_2 gas is passed through a ozoniser, the final volume of mixture becomes 820 ml. If this mixture is passed through turpentine oil the final volume of gas remaining is

A. 180 ml

B. 540 ml

C. 460 ml

D. 730 ml

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32. What is the % (by volume) of ozone in an ozonised sample if the rate of diffusion of the sample is 0.9 times than that of oxygen

A. 47

B. 39.5

C. 60.5

D. 53

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33. The lifting power of a 100 L balloon filled with He at 730 mm Hg at $25^{\circ}C$ if density of air 1.25 g/L (mass of material of balloon neglected)

A. 125 g

B. $109.3g$

C. $140.7g$

D. $15.7g$

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(LEVEL-II (HOMEWORK)

1. A vessel of volume 5 litre contain 1.4 g of nitrogen at a temperature 1800 K. The pressure of the gas if 30% of its molecules are dissociated into atoms at this temperature is

A. $4.05atm$

B. $2.025atm$

C. $3.84atm$

D. 1.92 atm

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2. There is a drum of volume VL in which air is filled at 1 atm pressure. Now a sealed glass tube of 25L containing an inert gas at 20 atm is placed inside it and it is sealed. During the transportation the glass tube is cracked final pressure inside the drum rises to 1.4 atm. What is the volume of the drum?

A. 1300L

B. 1250 L

C. 1376. 4

D. 1187. 5L

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3. A compound exist in gaseous state both as monomer and dimer. The molecular mass of monomer is 48. In an experiment 96 g of the compound was taken in a vessel of volume 33.6 L at 273 K. What is the pressure developed if the compound exist as a dimer to an extend of 50% by mass?

A. $1.5 atm$

B. 1 atm

C. 2 atm

D. $2.2 atm$

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4. 10 cm column of air is trapped by a column of Hg 4.00 cm long in a capillary tube of uniform bore when the tube is held horizontally at 1 atm. What will be the length of air column when the tube is held vertically with the open end up? (a) 9.50 cm (b) 3.53 cm (c) 4.6 cm (d) 13.8 cm

A. $9.50cm$

B. $3.53cm$

C. $4.6cm$

D. $13.8cm$

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5. One litre of O_2 gas is passed through a ozoniser, the final volume of mixture becomes 820 ml. If this mixture is passed through turpentine oil the final volume of gas remaining is

A. 180 ml

B. 540 ml

C. 460 ml

D. 730 ml

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6. A bubble of gas released at the bottom of a lake increases to eight times its original volume when it reaches the surface. Assuming that atmospheric pressure is equivalent to the pressure exerted by a column of water 10 m height, the depth of the lake is

A. 80 m

B. 90 m

C. 70 m

D. 40 m

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7. In a hospital, an oxygen cylinder holds 10L of oxygen at 200 atm pressure. If a patient breathes in 0.50 mL of oxygen at 1.0 atm with each breath, for how many breaths the cylinder will be sufficient. Assume all the data is at $37^\circ C$

A. 6×10^4

B. 3×10^6

C. 8×10^5

D. 4×10^6

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8. An evacuated glass vessel weighs 50 g when empty, 144.0 g when filled with a liquid of density 0.47 gmLand 50.5 g when filled with an ideal gas at 760 mm Hg at 300 K. The molar mass of the ideal gas is (Given R = 0.0821 L atm $k^{-1}mol^{-1}$

A. 47.870

B. 130.98

C. 123.75

D. 61.575

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9. What will happen to the volume of a bubble of air found under water in a lake where the temperature is 15ºC and the pressure is 1.5 atm, if the bubble then rises to the surface where the temperature is $25^{\circ} C$ and pressure is 1 atm

A. Its volume will become greater by a factor of 2.5

B. Its volume will becomes greater by a factor of 1.6

C. Its volume will become greater by factor of 1.1

D. Its volume will become greater by factor of 0.7

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10. A student forgot to add reaction mixture to round bottomed flask at $27^{\circ}C$, but he placed the flask on the flame. After a lapse of time, he realised his mistake, using a pyrometer, he found the

temperature of the flask was $477^{\circ}C$. What fraction of the air would have been expelled out?

A. 0.6

B. 0.45

C. 0.8

D. 0.5

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11. The drain cleaner, Drainex, contains aluminium which reacts with caustic soda to produce H_2.

What volume of H_2 at $20^\circ C$ and 1 bar will be increased when 0.15 g of Al reacts?

A. 253 ml

B. 90 ml

C. 108 ml

D. 203 mol

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12. Equal weights of two gases of molecular mass 4 and 40 are mixed. The pressure of mixture is 1.1

atm. The partial pressure of the light gas in this mixture is

A. 2 atm

B. $1.5 atm$

C. 1 atm

D. $2.9 atm$

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13. A mixture of C_3H_8 and CH_4 exert a pressure of 320 mm of Hg at temperature TK in a V litre flask. On complete combustion, gaseous mixture contains CO_2 only and exert a pressure of 448 mm of Hg under identical conditions. Hence mole fraction of C_3H_8 in the mixture is

A. 0.2

B. 0.8

C. 0.25

D. 0.75

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14. A 2L container at 300 K holds a gaseous mixture of 0.2 g of He, 1.6 g of CH_4 and $2.2 g of$ CO_(2). The pressure of mixture is

A. $2.4 atm$

B. $1.8 atm$

C. $4.8 atm$

D. $3.6 atm$

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15. In a tube of length 5m having two identical holes at the opposite ends. H_2 and O_2 are made to effuse into tube from opposite ends under identical conditions. Find the point where gases will meet for the first time

A. 3.5 m from H_2 side

B. 4 m from H_2 side

C. 2m from O_2 side

D. 1.5 m from O_2 side

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16. Three foot balls are respectively filled with nitrogen, hydrogen and helium. If the leaking of the gas occurs with time from the filling hole, then the ratio of the rate of leaking of gases $(r_{N_2} : r_{H_2} : r_{He})$ from three foot balls is

A. $1 : \sqrt{14} : \sqrt{7}$

B. $\sqrt{14} : \sqrt{7} : 1$

C. $\sqrt{7} : 1 : \sqrt{14}$

D. $1 : \sqrt{7} : \sqrt{14}$

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17. 1.22 g of a gas measured over water at 15ºC and a pressure of 775 mm of Hg Occupied 900 ml. Calculate the volume of dry gas at vapour pressure of water at $15^{\circ} C$ is 14 mm of Hg

A. 894 m

B. 854 ml

C. 927 ml

D. 727 ml

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18. One mole of N_2 gas at 0.8 atm takes 38 sec to diffuse through a pin hole whereas 1 mole of an unknown compound of xenon with fluorine at 1.6 atm takes 57 sec to diffuse through the same hole. Calculate the molecular formula of the compound

A. XeF_4

B. XeF_2

C. XeF_6

D. XeF_8

19. Xml of H_2 effuses out through a hole in a container in 5 seconds. The time taken for the effusion of the same volume of the gas specified below under indentical condition is

A. $10 \sec, H_2$

B. $20 \sec O_2$

C. $25 \sec, NO_2$

D. $55 \sec, CO_2$

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20. The average molecular speed is greatest in which of the following gas sample?

A. 1 mole N_2 at 560 K

B. 0.5 mole of Ne at 500 K

C. 0.2 mole of CO_2 at 440 K

D. 2 mole of He at 140 K

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21. The pressure of a vessel that contained pure oxygen dropped from 2000 torr to 1500 torr in 40 min as the oxygen leaked through a small hole into a vacuum. When the same vessel was filled with another gas, the pressure dropped from 2000 torr to 1500 torr in 80 min. The molecular mass of second gas is

A. 136 g/mol

B. 128 g/mol

C. 102 g/mol

D. 48 g/mol

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22. The pressure exerted by 10^{23} gas molecules, each mass 10^{-22} g in a container of volume one litre, the RMS velocity of molecule is $10^5 cm \sec^{-1}$

A. $3.3 \times 10^6 pa$

B. $2.54 \times 10^5 Pa$

C. $1.32 \times 10^6 Pa$

D. $3.33 \times 10^7 Pa$

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23. Which one of the following statement is not true about the effect of an increase in temperature on the distribution of molecular speed?

A. The area under the curve remains same as under the lower temperature

B. The distribution becomes broader

C. The fraction of molecules with the most probable speed increases

D. The most probable speed increases

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24. The kinetic energy for 14g of N_2 gas at $127^\circ C$ is nearly

A. $8.3 kJ$

B. $4.15 kJ$

C. $2.5 kJ$

D. $3.3 kJ$

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25. What is the pay load when a balloon of volume 4186 m^(3), mass 100 kg is filled with He at 1.66 bar at $27^{\circ}C$. (Density of air $= 1.2 kgm^{-3}$)

A. 5.083×10^{3}

B. 1.115×10^{3}

C. 3.808×10^{3}

D. 1.384×10^{3}

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26. Rate of diffusion of LPG (a mixture of n-butane and propane) is 1.25 times that of SO_3 Hence, mole fraction of n-butane in LPG is

A. 0.75

B. 0.25

C. 0.50

D. 0.67

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27. Two gas bulb A and B are connected by a tube having a stopcock. Bulb A has a volume of 100 ml and contain hydrogen. After opening the gas from A to the evacuated bulb B, the pressure falls down by 40%. The volume of (ml) of B must be

A. 75 ml

B. 150 ml

C. 125 ml

D. 200 ml

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28. Arrange the following gases in order of their cirtical temperature NH_3, H_2O, CO_2, O_2

A. $NH_3 > H_2O > CO_2 > O_2$

B. $O_2 > CO_2 > H_2O > NH_3$

C. $H_2O > NH_3 > CO_2 > O_2$

D. $CO_2 > O_2 > NH_3 > H_2O$

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29. At low pressure, the vander Waal's equation is written as $\left(P+\frac{a}{V^2}\right)V=RT$. The compressibility factor is then equal to

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

B. $\left(1-\frac{RTV}{a}\right)$

C. $\left(1-\frac{a}{RTV}\right)$

D. $\left(1+\frac{RTV}{a}\right)$

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30. Gasses X,Y,Z , P and Q have the vander Waals constant a and b as shown below

X(a=6, b=0.025), Y(a=6, b=0.150), Z(a=6, b=0.25),Q(a=.5, b=0.3) The gas with highest cirtical temperature is

A. X

B. Z

C. Y

D. Q

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31. Assertion: The pressure of real gas is less than the pressure of the ideal gas.

Reason :The intermolecular forces of attraction in real gases are greater than these of ideal gas.

A. If both Assertion and Reason are true and Reason is correct explanation of Assertion

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true and Reason is wrong

D. If both Assertion and Reason are wrong

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32. Assertion: A gas can be easily liquified at any temperature below its critical temperature.

Reason : Liquifaction of gas takes place when the average kinetic energy of the molecule is low.

A. If both Assertion and Reason are true and Reason is correct explanation of Assertion

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true and Reason is wrong

D. If both Assertion and Reason are wrong

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33. Assertion: The value of vander waal's constant a is higher for NH_3 than for N_2

Reason : Intermolecular H-bonding is present in NH_3

A. If both Assertion and Reason are true and Reason is correct explanation of Assertion

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true and Reason is wrong

D. If both Assertion and Reason are wrong

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34. Assertion: Hot air balloon rises up by displacing denser air of atmosphere

Reason : The given mass of a gas occupies larger volume at high temperature. : If both Assertion and Reason are true and Reason is correct explanation of Assertion, If both Assertion and Reason are true but Reason is not correct explanation of Assertion, If Assertion is true and Reason is wrong, If both Assertion and Reason are wrong

A. If both Assertion and Reason are true and Reason is correct explanation of Assertion

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true and Reason is wrong

D. If both Assertion and Reason are wrong

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35. Assertion : Under similar condition of temperature and pressure, O_2 diffuses 1.4 times faster than SO_2

Reason : Density of SO_2 is 1.4 times greater than that of O_2

A. If both Assertion and Reason are true and Reason is correct explanation of Assertion

B. If both Assertion and Reason are true but Reason is not correct explanation of Assertion

C. If Assertion is true and Reason is wrong

D. If both Assertion and Reason are wrong

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QUESTIONS

1. The density of a gas at 675 mm pressure is $45 g L^{-1}$. What is the density of the gas at 750mm pressure at the same temperature?

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2. A gas occupies a volume $1.5L$ at $9.5 \times 10^5 Nm^{-2}$. Calculate the additional pressure required to decrease the volume to $1.0L$ keeping temperature constant.

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3. At what temperature will the volume of a gas at $27^\circ C$ doubles itself at constant pressure?

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4. A sample of gas occupies volume of $750cm^3$ at $27^\circ C$. Calculate the temperature at which it will occupy a volume of $350cm^3$?

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5. A gas cylinder can withstand a pressure of $14.5atm$. A pressure gauge connected to it reads $11.5atm$ at $30^\circ C$. What is the maximum temperature that the cylinder can withstand without exploding?

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6. At what temperature will the pressure of a gas at $0^{\circ}C$ doubles itself when volume remains constant?

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7. Calculate the number of moles of hydrogen present in $10dm^3$ of the gas at $25^{\circ}C$ and $1.5atm$ pressure.

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8. $5.0g$ of oxygen is introduced into an evacuated vessel of $10dm^3$ capacity maintained at $25^\circ C$. Calculate the pressure of the gas in the container assuming that the gas behaves ideally.

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9. An open vessel contains air at $29^\circ C$. To what temperature it must be heated to expel one-third of the air?

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10. An air bubble of volume $0.21 cm^3$ at the bottom of a water tank, at $5^{\circ} C$ and 3 atm pressure, rises to the surface where the temperature is $25^{\circ} C$ and pressure is 1 atm. What will be the volume of the bubble when it reaches the surface?

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11. In a 1 L flask, 250 mL nitrogen at 720mm pressure and 380 mL of oxygen at 650 mm pressure are taken together. If temperature is kept constant, what will be the pressure of the mixture?

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12. The volume of a given mass of a gas is 919 mL in dry state at STP. The same mass when collected over water at $15^{\circ} C$ and 750 mm pressure occupies a volume of 1 L. Find out the vapor pressure of water at $15^{\circ} C$.

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13. Calculate the average translation kinetic energy of an ideal gas per molecule (ε) and per mole (E) at $25^{\circ} C$. (Boltzmann constant, $k = 1.38 \times 10^{-23} JK^{-1}$).

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14. Calculate the pressure exerted by 10 moles of neon gas in a 5 L container at $27^{\circ} C$, using the ideal gas equation.

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15. Calculate the pressure exerted by 10 moles of neon gas in a 5 L container at $27^{\circ} C$, using

The van der Waals equation. The van der Waals constants

$a = 0.2107 atm L^2 mol^2, b = 0.0171 L mol^{-1}.$

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16. Find out the value of the van der Waals constant 'a' when two moles of a gas confined in a 4 L flask exerts a pressure of $11.0 atm$ at $300 K$. $(b = 0.05 L mol^{-1})$.

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17. The van der Walls constants for CO_2 are $a = 3.59 dm^6 atm mol^{-2}$ and $b = 0.0427 dm^3 mol^{-1}$. Calculate the Boyle temperature T_B for CO_2 gas.

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18. Compute the relative rates of effusion of H_2 and O_2 at $27^{\circ} C$ and 1 atm pressure.

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19. A certain gaseous organic compound effuses about half as fast as neon. What is the molar mass of the compound?

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20. For hydrogen gas, calculate

Root mean square velocity at STP.

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21. For hydrogen gas, calculate

Average velocity at STP.

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22. For hydrogen gas, calculate most probable velocity at $0^\circ C$

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23. Calculate the temperature at which the average velocity of oxygen equals that of hydrogen at 25 K.

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24. For oxygen gas at $27^{\circ}C$ and 1 atm pressure, calculate

The number of collisions per cubic metre per second. The collision diameter of oxygen molecule is 361 picometre.

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25. For oxygen gas at $27^{\circ} C$ and 1 atm pressure, calculate

The number of collisions per cubic metre per second. The collision diameter of oxygen molecule is 361 picometre.

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26. For oxygen gas at $27^{\circ} C$, calculate the mean free path at 1 atm pressure. The collision diameter of oxygen molecule is 361 picometre.

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27. For oxygen gas at $27^{\circ} C$, calculate the mean free path at $10^{-5} mmHg$ pressure. The collision diameter of oxygen molecule is 361 picometre.

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28. Calculate the critical temperature of a van der Waals gas for which P_c is 73 atm and b is $34 cm^3 mol^{-1}$.

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29. Calculate the pressure exerted by one mole of CO_2 gas at $50^{\circ}C$, confined to a volume of $0.125dm^3$, using the law of corresponding states, given that the critical constants of the gas are $V_{m,c}=0.0957dm^3, T_c=304K$ and $P_c=73.0atm$

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30. The boiling point of benzene is $80^{\circ}C$. Estimate its molar heat of vaporisation assuming that it obeys Trouton's rule.

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31. Consider the flow of water through a horizontal pipe with $R = 3.0cm$ and $varv = 3cms^{-1}$. If $\eta = 1.008, cP$ at $20^{\circ}C$ and $p = 0.9994gcm^{-3}$, calculate the Reynolds number.

Watch Video Solution

32. The vapour pressure of water at $100^{\circ}C$ is $760mm$. What is the vapour pressure at $90^{\circ}C$ if $\triangle_{vap}H$ of water is $41.25kJmol^{-1}$?

Watch Video Solution

33. The density of a gas at 675 mm pressure is $45 gL^{-1}$. What is the density of the gas at 750mm pressure at the same temperature?

Watch Video Solution

34. A gas occupies a volume $1.5 L$ at $9.5 \times 10^5 Nm^{-2}$. Calculate the additional pressure required to decrease the volume to $1.0 L$ keeping temperature constant.

Watch Video Solution

35. At what temperature will the volume of a gas at $27^{\circ} C$ doubles itself at constant pressure?

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36. A sample of gas occupies volume of $750 cm^3$ at $27^{\circ} C$. Calculate the temperature at which it will occupy a volume of $350 cm^3$?

Watch Video Solution

37. A gas cylinder can withstand a pressure of $14.5atm$. A pressure gauge connected to it reads $11.5atm$ at $30^{\circ}C$. What is the maximum temperature that the cylinder can withstand without exploding?

Watch Video Solution

38. At what temperature will the pressure of a gas at $0^{\circ}C$ doubles itself when volume remains constant?

Watch Video Solution

39. Calculate the number of moles of hydrogen present in $10dm^3$ of the gas at $25^\circ C$ and $1.5atm$ pressure.

Watch Video Solution

40. $5.0g$ of oxygen is introduced into an evacuated vessel of $10dm^3$ capacity maintained at $25^\circ C$. Calculate the pressure of the gas in the container assuming that the gas behaves ideally.

Watch Video Solution

41. An open vessel contains air at $29^\circ C$. To what temperature it must be heated to expel one-third of the air?

Watch Video Solution

42. An air bubble of volume $0.21 cm^3$ at the bottom of a water tank, at $5^\circ C$ and 3 atm pressure, rises to the surface where the temperature is $25^\circ C$ and pressure is 1 atm. What will be the volume of the bubble when it reaches the surface?

Watch Video Solution

43. In a 1 L flask, 250 mL nitrogen at 720mm pressure and 380 mL of oxygen at 650 mm pressure are taken together. If temperature is kept constant, what will be the pressure of the mixture?

Watch Video Solution

44. The volume of a given mass of a gas is 919 mL in dry state at STP. The same mass when collected over water at $15^{\circ}C$ and 750 mm pressure occupies a volume of 1 L. Find out the vapor pressure of water at $15^{\circ} C$.

Watch Video Solution

45. Calculate the average translation kinetic energy of an ideal gas per molecule (ε) and per mole (E) at $25^{\circ} C$. (Boltzmann constant, $k = 1.38 \times 10^{-23} JK^{-1}$).

Watch Video Solution

46. Calculate the pressure exerted by 10 moles of neon gas in a 5 L container at $27^{\circ} C$, using the ideal gas equation.

Watch Video Solution

47. Find out the value of the van der Waals constant 'a' when two moles of a gas confined in a 4 L flask exerts a pressure of $11.0 atm$ at $300 K$. $\left(b = 0.05 L mol^{-1}\right)$.

Watch Video Solution

48. Compute the relative rates of effusion of H_2 and O_2 at $27^{\circ} C$ and 1 atm pressure.

Watch Video Solution

49. A certain gaseous organic compound effuses about half as fast as neon. What is the molar mass of the compound?

Watch Video Solution

50. For hydrogen gas ,calculate (a) root mean square velocity (b) average velocity and (c) most probable velocity at $0^\circ C$

Watch Video Solution

51. The van der Walls constants for CO_2 are $a = 3.59 dm^6 atm mol^{-2}$ and $b = 0.0427 dm^3 mol^{-1}$. Calculate the Boyle temperature T_B for CO_2 gas.

Watch Video Solution

52. Calculate the critical temperature of a van der Waals gas for which P_c is 73 atm and b is $34 cm^3 mol^{-1}$.

Watch Video Solution

53. Calculate the pressure exerted by one mole of CO_2 gas at $50^\circ C$, confined to a volume of $0.125 dm^3$, using the law of corresponding states, given that the critical constants of the gas are $V_{m,c} = 0.0957 dm^3, T_c = 304K$ and $P_c = 73.0 atm$

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Watch Video Solution

54. The boiling point of benzene is $80^{\circ} C$. Estimate its molar heat of vaporisation assuming that it obeys Trouton's rule.

Watch Video Solution

55. Consider the flow of water through a horizontal pipe with $R = 3.0 cm$ and $var v = 3 cms^{-1}$. If $\eta = 1.008, cP$ at $20^{\circ} C$ and $p = 0.9994 gcm^{-3}$, calculate the Reynolds number.

Watch Video Solution

56. The vapour pressure of water at $100^{\circ}C$ is $760mm$. What is the vapour pressure at $90^{\circ}C$ if $\triangle_{vap}H$ of water is $41.25kJmol^{-1}$?

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LEVEL - I

1. According to kinetic theory of gases for a diatomic molecule (a)The pressure exerted by the gas is proportional to the mean square speed of the molecules

(b) The pressure exerted by the gas is proportional to the root mean square speed of the molecules

(c) The root mean square speed is inversely proportional to the temperature

(d) The mean translational KE of the molecules is directly proportional to the absolute temperature

A. the pressure exerted by the gas is proportional to the mean square speed of the molecules

B. the pressure exerted by the gas is proportional to the root mean square speed of the molecules

C. the root mean square speed is inversely proportional to the temperature

D. the mean translational KE of the molecules is directly proportional to the absolute temperature

Answer: D

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2. A helium atom is two times heavier than a hydrogen molecule. At 298 K, the average kinetic energy of a helium atom is

A. two times that of a hydrogen molecule

B. four times that of a hydrogen molecule

C. half that of a hydrogen molecule

D. same as that of a hydrogen molecule

Answer: D

Watch Video Solution

3. The Joule-Thomson coefficient is zero at

A. absolute temperature

B. critical temperature

C. inversion temperature

D. below $0^{\circ} C$

Answer: C

Watch Video Solution

4. Which of the given sets of temperature and pressure will cause a gas to exhibit the greatest deviation from ideal gas behaviour?

A. $100^{\circ} C \quad \text{and} \quad 4 atm$

B. $100^{\circ} C \quad \text{and} \quad 2 atm$

C. $-100^{\circ} C \quad \text{and} \quad 4 atm$

D. $0^{\circ} C \quad \text{and} \quad 2 atm$

Answer: C

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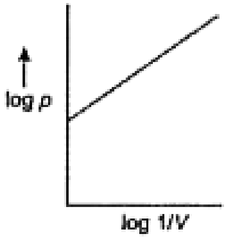
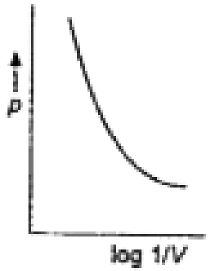
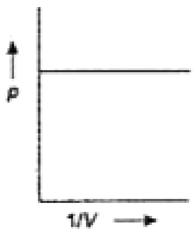
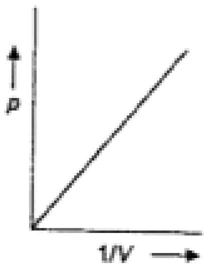
5. Which of the following graphs is not according to Boyle's law?

A. 

B. 

C. 

D. 

Answer: C

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6. The molecular velocity of any gas is

A. inversely proportional to the square root of temperature

B. inversely proportional to absolute temperature

C. directly proportional to square of temperature

D. directly proportional to square root of temperature

Answer: D

Watch Video Solution

7. $1.0L$ of N_2 and $\frac{7}{8}L$ of O_2 at the same temperature and pressure were mixed together. What is the relation between the masses of the two gases in the mixture?

A. $M_{N_2} = 3M_{O_2}$

B. $M_{N_2} = 8M_{O_2}$

C. $M_{N_2} = M_{O_2}$

D. $M_{N_2} = 16M_{O_2}$

Answer: C

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8. If the absolute temperature of a gas is doubled and the pressure is reduced to one half, the volume of the gas will.

A. Remain unchanged

B. Double

C. Increase four-fold

D. Be reduced to $1/4th$

Answer: C

Watch Video Solution

9. A gas was compressed to half of its volume at $30^\circ C$. To what temperature it should be heated so that its volume increases to double of its original volume? (At constant pressure)

A. $60^{\circ}C$

B. $303K$

C. $1212K$

D. $606K$

Answer: C

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10. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. If one litre of O_2 at $15^{\circ}C$ and 750 mm pressure contains N molecules, the number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be

A. $N/2$

B. N

C. $2N$

D. $4N$

Answer: C

Watch Video Solution

11. Equal weights of ethane and hydrogen are mixed in an empty container at $25^\circ C$. The fraction of the total pressure exerted by hydrogen is

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

B. $\frac{2}{15}$

C. $\frac{1}{16}$

D. $\frac{15}{16}$

Answer: D

Watch Video Solution

12. A gas of volume 100 is kept in a vessel at pressure $10^4 Pa$ maintained at temperature $24^\circ C$. If now the pressure is increased to $10^5 Pa$ keeping the temperature constant, the volume of gas becomes.

A. 10

B. 100

C. 1

D. 1000

Answer: A

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13. What is the compressibility factor of water vapour at $10^{\circ}C$ and 1 atm pressure. Its molar volume is $33.18 dm^3 mol^{-1}$.

A. 0.896

B. 1.42

C. 1.986

D. 1.896

Answer: B

Watch Video Solution

14. A balloon filled with ethyne is pricked with a sharp point and quickly dropped in a tank of H_2 gas under identical condition. After a while the balloon will have

A. shrunk

B. enlarged

C. completely collapsed

D. unchanged in size

Answer: B

Watch Video Solution

15. $0.2g$ of a gas X occupies a volume of $440mL$. If $0.1g$ of carbon dioxide gas occupies a volume of 320 mL at the same temperature and pressure, gas X could be

A. O_2

B. SO_2

C. NO

D. C_4H_{10}

Answer: B

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16. The rate of effusion of two gases a and b under identical conditions of temperature and pressure is in the ratio of 2 : 1. What is the ratio of rms velocity of their molecules if T_a and T_b are in the ratio of 2 : 1?

A. $2:1$

B. $\sqrt{2}:1$

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

D. $1:\sqrt{2}$

Answer: C

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Watch Video Solution

17. A one litre vessel at a pressure P_1 and a two litre vessel at pressure P_2 contain one mole each of oxygen gas. If the temperature is so adjusted such that the velocities of O_2 molecules in 1 lit. vessel are 4 times that of 2 lit. vessel, then at what ratio P_1 and P_2 will be

A. $4:1$

B. $8:1$

C. $16:1$

D. $32:1$

Answer: D

Watch Video Solution

18. A drop of liquid acquires spherical shape because

A. of its viscous nature

B. of capillary action

C. surface tension tends to minimise the surface area

D. all of these

Answer: C

Watch Video Solution

19. The Van der Waals parameters for gases, W, X, Y and Z are :

(Gas)	$a\left(\text{litre}^2 - \text{atm}/\text{mole}^2\right)$	$b(\text{litre}/\text{mole})$
W	4.0	0.027
X	8.0	0.030
Y	12.0	0.027
Z	6.0	0.024

Which one of the gases has the highest Boyle temperature?

A. W

B. X

C. Y

D. Z

Answer: C

Watch Video Solution

20. At the top of the mountain, the thermometer reads $0^{\circ} C$ and the barometer reads 710 mm Hg. At the bottom of the mountain the temperature is $30^{\circ} C$ and the prëssure is 760 mm Hg. The ratio of the density of air at the top with that at the bottom is (assume average molar mass of air remains constant)

A. $1:1$

B. $1.04:1$

C. $1:1.04$

D. $1:1.5$

Answer: B

Watch Video Solution

21. Which of the following contains greatest number of N atoms?

A. $22.4L$ nitrogen gas at STP

B. $500mL$ of $2.00MNH_3$

C. 1.00 mol of NH_4Cl

D. 6.02×10^{23} molecules of NO_2

Answer: A

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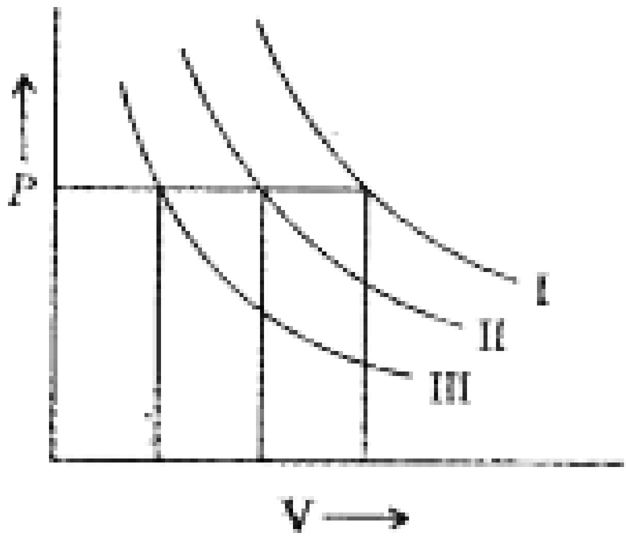
22. I, II and III are three isotherms, respectively, at T_1, T_2 and T_3. Temperature will be in order



$T_1 = T_2 = T_3$, $T_1 < T_2 < T_3$, $T_1 > T_2 > T_3$, $T_1 > T_2 = T_3$

A. $T_1 = T_2 = T_3$

B. $T_1 < T_2 < T_3$

C. $T_1 > T_2 > T_3$

D. $T_1 > T_2 = T_3$

Answer: C

Watch Video Solution

23. At what temperature will hydrogen molecules have the same KE as Nitrogen molecules at 280 K

A. $280K$

B. $40K$

C. $400K$

D. $50K$

Answer: A

Watch Video Solution

24. The pressure exerted by 1 mol of CO_2 at $273K$ is $34.98atm$. Assuming that volume occupied by CO_2 molecules is negligible, the value of van der Waal's constant for attraction of CO_2 gas is

A. $3.59dm^6 atmmol^{-2}$

B. $2.59dm^6 atmmol^{-2}$

C. $1.25 dm^6 atm mol^{-2}$

D. $1.59 dm^6 atm mol^{-2}$

Answer: A

Watch Video Solution

25. A 3:2 molar mixture of N_2 and CO is present in a vessel at 500 bar pressure. Due to hole in the vessel, the gas mixture leaks out. The composition of mixture effusing out initially is

A. $n_{N_2} : n_{CO} : : 1 : 2$

B. $n_{N_2} : n_{CO} : : 6 : 1$

C. $n_{CO} : n_{N_2} : : 1 : 2$

D. $n_{CO} : n_{N_2} : : 2 : 3$

Answer: D

Watch Video Solution

26. If a gas is expanded at constant temperature

A. The pressure decreases

B. The kinetic energy of the molecules remains the same

C. The kinetic energy of the molecules decreases

D. The number of molecules of the gas increases

Answer: A

Watch Video Solution

27. At $25^{\circ}C$ and $730 mm$ pressure, 730 mL of dry oxygen was collected. If the temperature is kept constant what volume will oxygen gas occupy at 760 mm pressure?

A. $701 mL$

B. $449 mL$

C. $569 mL$

D. $621 mL$

Answer: A

Watch Video Solution

28. At STP, the order of mean square velocity of molecules of H_2, N_2, O_2 and HBr is

A. $H_2 > N_2 > O_2 > HBr$

B. $HBr > O_2 > N_2 > H_2$

C. $HBr > H_2 > O_2 > N_2$

D. $N_2 > O_2 > H_2 > HBr$

Answer: A

Watch Video Solution

29. An ideal gas obeying kinetic theory of gases can be liquified, if

(a)Its temperature is more than critical temperature T c

(b)Its pressure is more than critical pressure P c (c)Its pressure is more than P c at a temperature less than T c

(d)It cannot be liquified at any value of P and T

A. Its temperature is more than critical temperature T_c

B. Its pressure is more than critical pressure P_c

C. Its pressure is more than P_c at a temperature less than T_c

D. It cannot be liquified at any value of P and T

Answer: D

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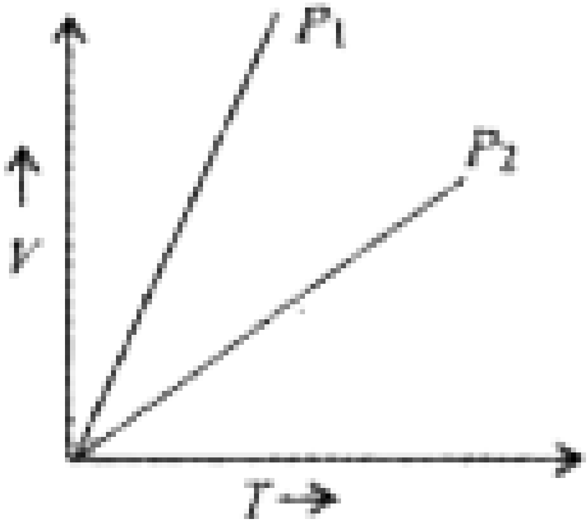
30. V vs T curves at different pressures P_1 and P_2 for an ideal gas are shown below:



Which one of the following is correct? : $P_1 > P_2$, $P_1 < P_2, P_1 = P_2, P_2/P_1 = 1/2$

A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. $P_2/P_1 = 1/2$

Answer: B

Watch Video Solution

31. The vapour pressure of water at $80^\circ C$ is $355 mmHg$. A one-litre vessel contains O_2 at $80^\circ C$, saturated with water vapour the total pressure being 760 mm Hg. The contents of the vessel were pumped into $0.3L$ vessel at the same temperature. What is the partial pressure of O_2?

A. $1350 mmHg$

B. $2263.3 mmHg$

C. $123.5 mmHg$

D. $455 mmHg$

Answer: A

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32. Boron forms a variety of unusual compounds with hydrogen. Achemist isolated $6.3mg$ of one of the boron hybrides in a glass bulb with a volume of $385mL$ at $25^{\circ}C$ and a bulb pressure of 11 torr. the molecular mass of the boron hybride in g mol^{-1} is

A. 3.68

B. 27.6

C. 36.35

D. 56.52

Answer: B

Watch Video Solution

33. A small quantity of gaseous NH_3 and HBr are introduced simultaneously into the opposite ends of an open tube that is 1 m long. Calculate the distance of the white solid NH_4Br formed from the end that was used to introduce NH_3.

A. $68.55cm$

B. $63.5cm$

C. $60.09cm$

D. $65.24cm$

Answer: A

Watch Video Solution

34. Which one of the following statement is not true about the effect of an increase in temperature on the distribution of molecular speed?

A. The most probable speed increases

B. The fraction of the molecules with the most probable speed increases

C. The distribution becomes broader

D. The area under the distribution curve remains the same as under the lower temperature

Answer: B

Watch Video Solution

35. Two moles of a gas confined in a 4L flask exert a pressure of $11.0atm$ of $300K$ temperature. The value of b is $0.05Lmol$, the value of a is

A. $6.00Latmmol^{-2}$

B. $6.52 Latmmol^{-2}$

C. $6.46 Latmmol^{-2}$

D. $6.46 Latmmol^{-1}$

Answer: B

Watch Video Solution

36. $1 mol$ of N_2 gas at $0.8 atm$ takes 38s to diffuse through a pinhole, whereas 1 mol of an unknown gas at $1.6 atm$ takes 57s to diffuse through the same pinhole. The molecular weight of unknown gas is

A. 126

B. 64

C. 80

D. 252

Answer: D

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37. What will be the molecular diameter of helium if van der Waals constant, $b = 24 mL mol^{-1}$?

A. $2.67 A^0$

B. $2.67nm$

C. $5.42A^0$

D. $542A^0$

Answer: A

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38. Rate of diffusion of LPG (a mixture of n-butane and propane) is 1.25 times that of SO_3 Hence, mole fraction of n-butane in LPG is

A. 0.752

B. 0.256

C. 0.514

D. 0.667

Answer: C

Watch Video Solution

39. Many laboratory gases are sold in steel cylinders with a volume of $43.8L$. What mass (in grams) of argon is inside a cylinder whose pressure is $17, 180kPa$ at $20^{\circ}C$?

A. $13.3kg$

B. $12.35kg$

C. $11.3kg$

D. $10.3kg$

Answer: B

Watch Video Solution

40. At STP, a container has 1 mole of He, 2 mole Ne, 3 mole O_2 and 4 mole N_2. Without changing total pressure if 2 mole of O_2 is removed, the partial pressure of O_2 will be decreased by:

A. $26\ \%$

B. $40\ \%$

C. $58.33\ \%$

D. $66.66\ \%$

Answer: C

Watch Video Solution

41. A rigid container containing 5 mole H_2 gas at same pressure and temperature. The gas has been allowed to escape by simple process from the container due to which pressure of the gas becomes half of its initial pressure and temperature become $(2/3)rd$ of its initial. The mass of gas remaining is

A. $7.5g$

B. $1.5g$

C. $2.5g$

D. $3.5g$

Answer: A

Watch Video Solution

42. The most probable speed of $8g$ of H_2 is $200ms^{-1}$. Average kinetic energy (neglect rotational and vibrational energy) of H_2 gas is :

A. $480J$

B. $240J$

C. $120J$

D. $360J$

Answer: B

Watch Video Solution

43. The ratio among most probable velocity, mean velocity and root mean square velocity is given by

A. $1:2:3$

B. $1:\sqrt{2}:\sqrt{3}$

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

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

Answer: D

Watch Video Solution

44. Calculate relative rate of effusion of SO_2 to CH_4, if the mixture obtained by effusing out a mixture with molar ratio $\frac{n_{SO_2}}{n_{CH_4}} = \frac{8}{1}$ for three effusing steps.

A. $2:1$

B. $1:4$

C. $1:2$

D. $3:1$

Answer: C

Watch Video Solution

45. A balloon weighing 50 kg is filled with 685 kg of helium at 1 atm pressure and $25^\circ C$. What will be its pay load if it displaced 5108 kg of air? : $4373kg$, $4423kg$, $5793kg$, $5192kg$

A. $4373kg$

B. $4423kg$

C. $5793kg$

D. $5192kg$

Answer: A

Watch Video Solution

46. Calculate the volume occupied by 16 gram O_2, at 300 K and $8.31 Mpa$ if $\frac{P_cV_c}{RT_c} = \frac{3}{8}$ and $\frac{P_rV_r}{T_r} = 2.21$ (Given : $R = 8.314 J/K - mol$)

A. $125.31 mL$

B. $124.31 mL$

C. $248.62 mL$

D. $223.62 mL$

Answer: B

Watch Video Solution

47. If Pd v/s. P(where P denotes pressure in atm and d denotes density in gm/L) is plotted for He gas, (assume ideal) at a particular temperature. If $\left[\frac{d}{dP}(Pd)\right]_{P=8.21 atm} = 5$, then the temperature will be

A. $160K$

B. $320K$

C. $80K$

D. $240K$

Answer: A

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Watch Video Solution

48. Gas molecules each of mass $10^{-26} kg$ are taken in a container of volume $1 dm^3$. The root mean square speed of gas molecules is $1 km \sec^{-1}$. What is the temperature of gas molecules?(Given: $N_A = 6 \times 10^{23}, R = 8 J/mol. K$).

A. $298 K$

B. $25 K$

C. $250 K$

D. $2500 K$

Answer: C

Watch Video Solution

49. For a real gas (mol. Mass = 60) if density at critical point is $0.80 g/cm^3$ and its $T_c = \frac{4 \times 10^5}{821} K$, then van der Waal's constant a (in $atm L^2 mol^{-2}$) is

A. 0.3375

B. 3.375

C. 1.68

D. 0.025

Answer: B

Watch Video Solution

50. Two flasks A and B of 500 mL each are respectively filled with O_2 and SO_2 at 300 K and 1 atm. pressure. The flasks will contain : The same number of atoms, The same number of molecules, More number of moles of molecules in flask A as compared to flask B, The same amount of gases

A. The same number of atoms

B. The same number of molecules

C. More number of moles of molecules in flask A as compared to flask B

D. The same amount of gases

Answer: B

Watch Video Solution

LEVEL - II

1. 1.22 g of a gas measured over water at 15ºC and a pressure of 775 mm of Hg Occupied 900 ml. Calculate the volume of dry gas at vapour pressure of water at $15^{\circ} C$ is 14 mm of Hg

A. $372.21 mL$

B. $854.24 mL$

C. $869.96 mL$

D. $917.76 mL$

Answer: B

Watch Video Solution

2. $3.7g$ of a gas at $25^{\circ}C$ occupied the same volume as $0.184g$ of hydrogen at $17^{\circ}C$ and at the same pressure. The molecular mass of the gas is

A. 0.024

B. 39.14

C. 41.33

D. 59.14

Answer: C

Watch Video Solution

3. A gas bulb of 1 mL capacity contains 2.0×10^{21} molecules of nitrogen exerting a pressure of $7.57 \times 10^{3} Nm^{-2}$. The root mean square speed of the gas molecules is

A. $274 ms^{-1}$

B. $494 ms^{-1}$

C. $690 ms^{-1}$

D. $988 ms^{-1}$

Answer: B

Watch Video Solution

4. Two closed vessels of equal volume containing air at pressure p_1 and temperature T_1 are connected to each other through a narrow tube. If the temperature in one of the vessels is now maintained at T_1 and that in the other at T_2, what will be the pressure in the vessels?

A. $\dfrac{2p_1T_1}{T_1+T_2}$

B. $\dfrac{T_1}{2p_1T_2}$

C. $\dfrac{2p_1T_2}{T_1+T_2}$

D. $\dfrac{2p_1}{T_1+T_2}$

Answer: C

Watch Video Solution

5. The volume of oxygen collected by the decomposition of potassium chlorate at $24^\circ C$ and atmospheric pressure of 760 mm Hg is 128 mL. Calculate the mass of oxygen gas obtained. The pressure of the water vapour at $24^\circ C$ is $22.4 mmHg$.

A. $0.123g$

B. $0.163g$

C. $0.352g$

D. $1.526g$

Answer: B

Watch Video Solution

6. Which one of the following statement is not true about the effect of an increase in temperature on the distribution of molecular speed?

A. The area under the distribution curve remains the same as under the lower termperature

B. The distribution becomes broader

C. The fraction of the molecules with the most probable speed increases

D. The most probable speed increases

Answer: C

Watch Video Solution

7. The ratio of average speed of an oxygen molecule to the rms speed of a nitrogen molecule at the same temperature is : $\left(\frac{3\pi}{7}\right)^{\frac{1}{2}}$, $\left(\frac{7}{3\pi}\right)^{\frac{1}{2}}$, $\left(\frac{7}{3\pi}\right)^{\frac{1}{2}}$, $\left(\frac{7\pi}{3}\right)^{\frac{1}{2}}$

A. $\left(\frac{3\pi}{7}\right)^{\frac{1}{2}}$

B. $\left(\frac{7}{3\pi}\right)^{\frac{1}{2}}$

C. $\left(\frac{3}{7\pi}\right)^{\frac{1}{2}}$

D. $\left(\frac{7\pi}{3}\right)^{\frac{1}{2}}$

Answer: B

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8. A $15.0L$ cylinder of Ar gas is connected to an evacuated $235.0L$ tank. If the final pressure is 750 mm Hg, what have been the original gas pressure in the cylinder? : $76atm$, $12.56atm$, $16.45atm$, $23atm$

A. $76atm$

B. $12.56atm$

C. $16.45atm$

D. $23atm$

Answer: C

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9. A balloon indoors where the temperature is $27^{\circ}C$ has a volume of $2.00L$. What will be the volume of outdoors where the temperature is $-23^{\circ}C$? Assuming pressure remains constant

A. $1.67L$

B. $2.23L$

C. $0.53L$

D. $1.26L$

Answer: A

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10. A vessel has nitrogen gas and water vapour at a total pressure of 1 atm. The partial pressure of water vapour is $0.3 atm$. The contents of this vessel are transferred to another vessel having one-third the capacity of the original vessel, completely at the same temperature. The total pressure of the system in the new vessel is

A. $2.4 atm$

B. $1 atm$

C. $3.33 atm$

D. $0.3 atm$

Answer: A

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11. A gas cylinder containing cooking gas can withstand a pressure of $14.9 atm$. The pressure of the cylinder indicates 12 atm, at $27^{\circ} C$. Due to sudden fire in the building, its temperature starts rising. At what temperature will the cylinder explode?

A. $90.5^{\circ} C$

B. $99.5^\circ C$

C. $87.3^\circ C$

D. $34^\circ C$

Answer: B

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12. A compound exists in the gaseous state both as monomer (A_1) and dimer (A_2). The molecular weight of the monomer is 48. In an experiment, 96 g of the compound was confined in vessel of volume $33.6L$ and heated to $273^\circ C$. Calculate the pressure developed, if the compound exists as a dimer to the extent of 50% by weight under these conditions.

A. $7.5 atm$

B. $2.0 atm$

C. $0.9 atm$

D. $5.4 atm$

Answer: B

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13. For two gases A and B with molecular weights M_A and M_B, it is observed that at certain temperature T, the mean velocity of A is equal to the root mean square velocity of B. Thus the mean velocity of A can be made equal to the mean velocity of B if : A is lowered to a temperature $T_2 = \frac{3\pi}{8}T$, A is lowered to a temperature $T_2 = (8/3\pi)T$, B is lowered to a temperature $T_2 = \frac{3\pi T}{8}$, B is lowered to a temperature $T_2 = \frac{8T}{3\pi}$

A. A is lowered to a temperature $T_2 = \frac{3\pi}{8}T$

B. A is lowered to a temperature

$T_2 = (8/3\pi)T$

C. B is lowered to a temperature $T_2 = \frac{3\pi T}{8}$

D. B is lowered to a temperature $T_2 = \frac{8T}{3\pi}$

Answer: B

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14. For the reaction $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$. What is the $\%$ of NH_3 converted if the mixture diffuses twice as fast as that of S_2 under similar conditions?

A. 3.125

B. 6.25

C. 12.5

D. 9.25

Answer: B

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15. Assuming that dry air contains $79\% N_2$ and $21\% O_2$ by volume, calculate the density of moist air at $25^\circ C$ at one atmosphere when the relative humidity is 60%. The vapour pressure of water at $25^{\circ} C$ is $23.76 mm$ of Hg.

A. $1.17 g L^{-1}$

B. $2.16 g L^{-1}$

C. $3.12 g L^{-1}$

D. $4.16 g L^{-1}$

Answer: A

Watch Video Solution

16. A volume V of a gas at a temperature T_1 and a pressure P' is enclosed in a sphere. It is connected to another sphere of volume $\frac{V}{2}$ by a tube and stop cock. The second sphere is initially evacuated and the stop cock is closed. If the stop cock is opened the temperature of the gas in the second sphere becomes T_2. The first sphere is maintained at $'T_1'$, what is the final pressure within the apparatus.

A. $\frac{2PT_2}{2T_2+T_1}$

B. $\frac{2PT_2}{T_2+2T_1}$

C. $\frac{2PT_2}{2T_2+T_1}$

D. $\frac{2PT_2}{2T_1 + T_2}$

Answer: A

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17. A gas obeys $P(V - b) = RT$. Which of the following are correct about this gas?

I. Isochoric curves have slope $= \frac{R}{V - b}$

II. Isobaric curves have slope $\frac{R}{P}$ and intercept b.

III. For the gas compressibility factor $= 1 + \frac{Pb}{RT}$

IV. The attractive forces are overcome by repulsive forces.

A. I

B. II, III

C. III

D. I, II, III, IV

Answer: D

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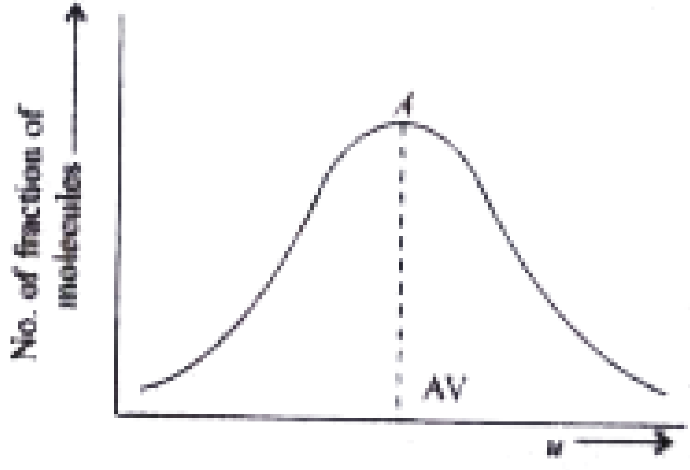
18. Distribution of molecules with velocity is represented by the curve



Velocity corresponding to point A is : $\sqrt{\frac{3RT}{M}}$, $\sqrt{\frac{2RT}{M}}$, $\sqrt{\frac{8RT}{\pi M}}$, $\sqrt{\frac{RT}{M}}$

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

B. $\sqrt{\frac{2RT}{M}}$

C. $\sqrt{\frac{8RT}{\pi M}}$

D. $\sqrt{\frac{RT}{M}}$

Answer: B

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19. If χ_M, χ_P and χ_V are mole fraction, pressure fraction and volume fraction respectively of a gaseous mixture, then

A. $\chi_M = \frac{1}{\chi_P} \times \frac{1}{\chi_V}$

B. $\frac{1}{\chi_M} = \chi_P \times \frac{1}{\chi_V}$

C. $\chi_M = \chi_P = \chi_V$

D. $(\chi_P) = \frac{1}{\chi_M} \times \frac{1}{\chi_V}$

Answer: C

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20. A flask containing 12 g of a gas of relative molecular mass 120 at a pressure of 100 atm was evacuated by means of a pump until the pressure was $0.01 atm$. Which of the following is the best estimate of the number of molecules left in the flask ($N_0 = 6 \times 10^{23} mol^{-1}$)?

A. 6×10^{19}

B. 6×10^{18}

C. 6×10^{17}

D. 6×10^{13}

Answer: B

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21. The compressibility factor for definite amount of van der Waal's gas at $0^{\circ} C$ and 100 atm is found to be 0.5. Assuming the volume of gas molecules negligible, the van der Waal's constant a for a gas is

A. $1.256 atm L^2 mol^{-2}$

B. $0.256 atm L^2 mol^{-2}$

C. $2.256 atm L^2 mol^{-2}$

D. $0.0256 atm L^2 mol^{-2}$

Answer: A

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22. A spherical air bubble is rising from the depth of a lake when pressure is Patm and temperature is TK. The percentage increase in the radius when it comes to the surface of a lake will be (Assume temperature and pressure at the surface to be, respectively, 2TK and $P/4$).

A. 100%

B. 50%

C. 40%

D. 200%

Answer: A

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23. The density of gas at 27°C and 1 atm is d. Pressure remaining constant at which of the following temp will its density become 0.75d?

A. $20^{\circ}C$

B. $30^\circ C$

C. $400K$

D. $300K$

Answer: C

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24. A vessel is filled with a mixture of oxygen and nitrogen. At what ratio of partial pressures will the mass of gases be identical.

A. $P_{O_2} = 0.785 P_{N_2}$

B. $P_{O_2} = 8.75 P_{N_2}$

C. $P_{O_2} = 11.4 P_{N_2}$

D. $P_{O_2} = 0.875 P_{N_2}$

Answer: D

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25. 15 L of gas at STP is subjected to four different conditions of temperature and pressure as shown below. In which case the volume will remain unaffected?

A. $273K$, 2 bar pressure

B. $273^\circ C$, 0.5 atm pressure

C. $546^\circ C$, 1.5 atm pressure

D. $273^\circ C$, 2 atm pressure

Answer: D

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26. For 1 mole of ideal gas kept at $6.5 atm$ in a container of capacity $2.463L$, the Avogadro proportionality constant is:

A. 22.4

B. 2.46

C. 0.406

D. 3.25

Answer: C

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27. The average oxygen content of arterial blood is approximately $0.25g$ of O_2 per litre. Assuming a body temperature of $37^\circ C$, how many moles of oxygen are transported by each litre of arterial blood and how many millilitres?

A. 7.8×10^{-3} and $200 mL$

B. 6.8×10^{-3} and $200 mL$

C. 7.8×10^{-3} and $100 mL$

D. 6.8×10^{-3} and $100 mL$

Answer: A

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28. How many mililitres of H_2O vapour measured at $327^{\circ}C$ and 760 torr are formed when 50 mL of ammonia at 950 torr and $127^{\circ}C$ reacts with oxygen according to the following reaction?

$$NH_3(g) + O_2(g) \rightarrow N_2(g) + H_2O(g)$$

A. $75mL$

B. $125mL$

C. $140.22mL$

D. $241.4mL$

Answer: C

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29. Equal masses of methane and oxygen are mixed in an empty container at $25^\circ C$. The fraction of the total pressure exerted by oxygen is

A. $1/2$

B. $2/3$

C. $\frac{1}{3} \times \frac{273}{298}$

D. $1/3$

Answer: D

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30. Which of the following statements is incorrect about H_2 and CO_2 gas considering them as ideal gases?

A. The average kinetic energies of H_2 and CO_2 molecules are the same at a given temperature.

B. The root mean square velocities of H_2 and CO_2 molecules are the same at a given temperature

C. The fraction of H_2 and CO_2 molecules with the most probable velocity decreases with increase in temperature.

D. The density of H_2 is less than CO_2 at a given temperature and pressure

Answer: B

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31. A real gas obeys the equation of state $p(V - nb) = nRT$ where b is van der Waals constant and R is the gas constant. If the pressure and temperature are such that the molar volume of the gas is 10b, what is the value of compressibility factor?

A. $10/9$

B. $8/9$

C. $12/11$

D. $10/11$

Answer: A

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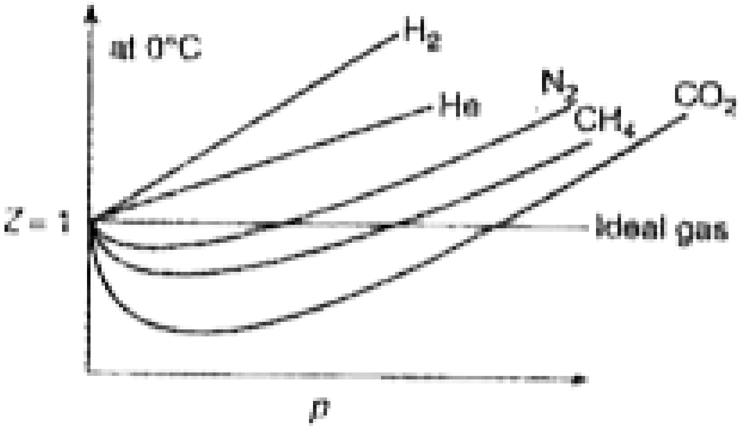
32. Which of the following statements is correct as shown in the graph?



A. The slope of Z vs. p at constant temperåture for all real gases, is b/RT.

B. The slope of Z vs. p at constant temperature for both He and H_2 is b/RT.

C. The slope of Z vs. p at low pressure for all real gases, at constant temperature is b/RT.

D. The slope of Z vs. p at high pressure and at constant temperature for real gases is $-b/RT$.

Answer: B

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33. Two flasks X and Y of volumes 250 mL and 300 mL respectively at the same temperature are connected by a stop cock of negligible volume. The flask X contains nitrogen gas at a pressure of 660 torr and the flask Y contains neon gas at a pressure of 825 torr. If the stop cock is opened to allow the two gases to mix, the partial pressure of neon gas and total pressure of the system will be

A. 300 torr, 700 torr

B. 400 torr, 700 torr

C. 450 torr, 750 torr

D. 300 torr, 750 torr

Answer: C

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34. A chemist isolated a gas in a glass bulb with a volume of 255 mL at a temperature of $25^{\circ} C$ and a pressure (in the bulb) of 10.0 torr. The gas weighed $12.1 mg$. What is the molecular mass of the gas?

A. $78.9 g mol^{-1}$

B. $35.2 g mol^{-1}$

C. $88.2 g mol^{-1}$

D. $96.3 g mol^{-1}$

Answer: C

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35. The pressure exerted by 12 g of an ideal gas at temperature $T(^\circ C)$ in a vessel of volume V is 1 atm. When the temperature is increased by $10^\circ C$ at the same volume, the pressure increases by 10%. If molecular weight of the gas is 120, the temperature $(T^\circ C)$ and volume (V) are

A. $T = -273^\circ C, V = 0.082L$

B. $T = -173^\circ C, V = 0.82L$

C. $T = 0^\circ C, V = 22.4L$

D. $T = 27^\circ C, V = 22.4L$

Answer: B

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36. Dry ice (solid CO_2) has occasionally been used as an explosive in mining. A hole is drilled, dry ice and a small amount of gun powder are placed in the hole, a fuse is added, and the hole is plugged. When lit, it explodes up with an immense pressure. Assume that $500.0g$ of dry ice is placed in a cavity with a volume of $0.800L$ and the ignited gun powder heats the CO_2 to 700 K. What is the final pressure inside the hole?

A. $416atm$

B. $816atm$

C. $616atm$

D. $1216atm$

Answer: B

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37. Starting out on a trip into the mountains, you inflate the tires on your automobile to a recommended pressure of $3.21 \times 10^5 Pa$ on a day when the temperature is $-5.0^\circ C$. You drive to the beach, where the temperature is $28.0^\circ C$. Assume that the volume of the tire has increased by 3%. What is the final pressure in the tyres?

A. $350 Pa$

B. $3500 Pa$

C. $3.5 \times 10^5 Pa$

D. $3.5 Pa$

Answer: C

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38. An open flask containing air is heated from 300 K to 500 K. What percentage of air will be escaped to the atmosphere, if pressure is keeping constant?

A. 80

B. 40

C. 60

D. 20

Answer: B

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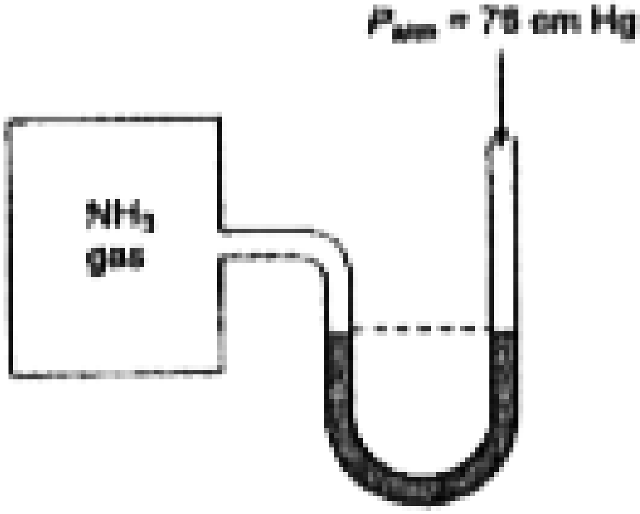
39. A manometer attached to a flask contains ammonia gas have no difference in mercury level initially as shown in diagram. After sparking into the flask, ammonia is partially dissociatedas $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ now it have difference of 6 cm in mercury level in two columns, what is partial pressure of $H_2(g)$ at equilibrium?



A. $9 cmHg$

B. $18 cmHg$

C. $27 cmHg$

D. $15 cmHg$

Answer: A

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40. A jar contains a gas and a few drops of water. The pressure in the jar is 830 mm of Hg. The temperature of the jar is reduced by 1%. The vapour pressure of water at two temperatures are 30 and 25 mm of Hg. Calculate the new pressure in jar.

A. $792mm \text{ of } Hg$

B. $817mm \text{ of } Hg$

C. $800mm \text{ of } Hg$

D. $840mm \text{ of } Hg$

Answer: B

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41. A gaseous mixture contains three gases A, B and C with a total number of moles of 10 and total pressure of 10 atm. The partial pressure of A and B are 3 atm and 1 atm respectively and if C has molecular weight of $2g/mol$. Then, the weight of C present in the mixture will be:

A. $8g$

B. $12g$

C. $3g$

D. $6g$

Answer: B

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42. The density of a gas filled electric lamp is $0.75kg/m^3$. After the lamp has been switched on, the pressure in it increases from $4 \times 10^4 Pa$ to $9 \times 10^4 Pa$. What is increase in U_{RMS}?

A. 100

B. 200

C. 300

D. 400

Answer: B

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43. The average speed at temperature $T^\circ C$ of $CH_4(g)$ is $\sqrt{\frac{28}{88}} \times 10^3 ms^{-1}$. What is the value of T?

A. $240.55^\circ C$

B. $-32.45^{\circ} C$

C. $3000^{\circ} C$

D. $-24.055^{\circ} C$

Answer: B

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44. A gaseous mixture containing He, CH_4 and SO_2 was allowed to effuse through a fine hole then find what molar ratio of gases coming out initially? If mixture contain He, CH_4 and SO_2 in 1 : 2 : 3 mole ratio

A. $2:2:3$

B. $6:6:1$

C. $\sqrt{2}:\sqrt{2}:3$

D. $4:4:3$

Answer: D

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45. The compressibility factor for nitrogen at 330 K and 800 atm is 1.90 and at 570 K and 200 atm is 1.10. A certain mass of N_2 occupies a volume of $1dm^3$ at 330 K and 800 atm. Calculate volume occupied by same quantity of N_2 gas at 570 K and 200 atm.

A. $1L$

B. $2L$

C. $3L$

D. $4L$

Answer: D

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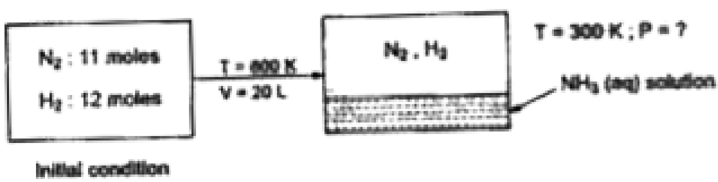
46. 11 moles N_2 and 12 moles of H_2 mixture reacted in 20 litre vessel at 800 K. After equilibrium was reached, 6 mole of H_2 was present. 3.58 litre of liquid water is injected in equilibrium mixture and resultant gaseous mixture suddenly cooled to 300K. What is the final pressure of gaseous mixture? Neglect vapour pressure of liquid solution. Assume (i) all NH_3 dissolved in water (ii) no change in volume of liquid (iii) no reaction of N_2 and H_2 at 300 K.



A. $18.47 atm$

B. $60 atm$

C. $22.5 atm$

D. $45 atm$

Answer: C

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47. What is the density of wet air with 75% relative humidity at 1 atm and 300 K? Given: vapour pressure of H_2O is 30 torr and average molar mass of air is $29 g mol^{-1}$.

A. $1.614 g/L$

B. $0.96 g/L$

C. $1.06 g/L$

D. $1.164 g/L$

Answer: D

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48. A given volume of ozonized oxygen (containing 60% oxygen by volume) required 220 sec to effuse which an equal volume of oxygen took 200 sec only under the conditions. If density of O_2 is $1.6 g/L$ then find density of O_3.

A. $1.936 g/L$

B. $2.16 g/L$

C. $3.28 g/L$

D. $2.44 g/L$

Answer: D

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49. A mixture of nitrogen and water vapours is admitted to a flask at 760 torr which contains a sufficient solid drying agent after long time the pressure reached a steady value of 722 torr. If the experiment is done at $27^\circ C$ and drying agent increases in weight by $0.9g$, what is the volume of the flask? Neglect any possible vapour pressure of drying agent and volume occupied by drying agent.

A. $443.34L$

B. $246.3L$

C. $12.315L$

D. $24.63L$

Answer: D

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50. Which one is not correct for gaseous state obeying van der Waals equation?

A. Compressibility factor at critical temperature $= 0.375$

B. For a gas if van der Waals' constant $a = 0, T_c = 0$

C. Ideal gases do not have critical temperature

D. Gaseous molecules showing H-bonding show minimum deviations from $Z = 0.375$.

Answer: D

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LEVEL - II (ASSERTION-REASON TYPE)

1. Assertion : At constant temperature, if pressure of a gas is doubled density is also doubled.

Reason : At constant'temperature, pressure of a gas is directly proportional to density and inversely proportional to molecular mass.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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2. Assertion: The pressure of real gases is less than that of ideal gases.

Reason : The inter molecular force of attraction is present in real gases.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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3. Assertion : Ideal gas equation is nearly valid for real gases at low pressure and high temperature.

Reason : Molecular interactions are negligible under this condition.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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4. Assertion : Compressibility factor (Z) for non-ideal gases can be greater than 1.

Reason : Non-ideal gases always exert higher pressure than ideal gases under identical conditions expected.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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5. Assertion : Gases become denser at high pressure.

Reason : At high pressures, real gases deviate from Boyle's law.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

Watch Video Solution

6. Assertion : Real gases show ideal behaviour when the volume occupied is large so that the volume of the molecules can be neglected in comparison to it.

Reason : The behaviour of the gas becomes more ideal when pressure is very low.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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7. Assertion : At constant temperature PV vs P plot for real gases is not a straight line.

Reason : In the curves of dihydrogen and helium, as the pressure increases the value of PV also increases.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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8. Assertion : Compressibility factor (Z) is the ratio of actual molar volume of the gas to the molar volume it, if it were an ideal gas at that temperature and pressure.

Reason : At high pressure all the gases have $Z < 1$ and can be easily compressed.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

Watch Video Solution

9. Assertion : All the gases should be cooled below their critical temperature for liquification.

Reason : Cooling slows down the movement of molecules therefore, intermolecular forces may hold the slowly moving molecules together and the gas liquifies.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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10. Assertion : A lighter gas diffuse more rapidly than a heavier gas.

Reason : At a given temperature, the rate of diffusion of a gas is inversely proportional to the square root of its density.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

Watch Video Solution

11. Assertion : On compressing a gas to half the volume, the number of molecules is halved.

Reason : The number of moles present decreases with decrease in volume.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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12. Assertion : SO_2 gas is easily liquefied while H_2 is not.

Reason : SO_2 has low critical temperature while H_2 has high critical temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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13. Assertion : The pressure of a fixed amount of an ideal gas is proportional to its temperature.

Reason : The frequency of collisions and their impact both increase in proportion to the square root of temperature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

Watch Video Solution

14. Assertion : At high pressure, the compressibility factor Z is $\left(1+\frac{Pb}{RT}\right)$.

Reason : At high pressure, van der Waals equation is modified as $P(V-b)=RT$.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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15. Assertion: The value of van der Waals constant 'a' for ammonia is larger than that of nitrogen gas.

Reason : Molecular weight of ammonia is smaller than that of nitrogen gas.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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16. Assertion : For a certain fixed amount of gas, the product PV is always constant.

Reason : Real gases have higher pressure and lower volume than ideal gases and hence product PV is constant.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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17. Assertion: A gas can be easily liquified at any temperature below its critical temperature.

Reason : Liquifaction of gas takes place when the average kinetic energy of the molecule is low.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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18. Assertion : Under similar condition of temperature and pressure, O_2 diffuses 1.4 times faster than SO_2

Reason : Density of SO_2 is 1.4 times greater than that of O_2

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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19. Assertion : At constant temperature, if pressure of a gas is doubled density is also doubled.

Reason : At constant'temperature, pressure of a gas is directly proportional to density and inversely proportional to molecular mass.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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20. Assertion : van der Waals equation is applicable only to non-ideal gases.

Reason : Ideal gases obey the equation $PV = nRT$.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: B

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LEVEL I

1. According to kinetic theory of gases for a diatomic molecule

A. the pressure exerted by the gas is proportional to the mean square speed of the molecules

B. the pressure exerted by the gas is proportional to the root mean square speed of the molecules

C. the root mean square speed is inversely proportional to the temperature

D. the mean translational KE of the molecules is directly proportional to the absolute temperature

Answer: D

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2. A helium atom is two times heavier than a hydrogen molecule. At 298 K, the average kinetic energy of a helium atom is

A. two times that of a hydrogen molecule

B. four times that of a hydrogen molecule

C. half that of a hydrogen molecule

D. same as that of a hydrogen molecule

Answer: D

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3. The Joule-Thomson coefficient is zero at

A. absolute temperature

B. critical temperature

C. inversion temperature

D. below 0° C

Answer: C

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4. Which of the given sets of temperature and pressure will cause a gas to exhibit the greatest deviation from ideal gas behaviour?

A. $100^{\circ}C$ and 4 atm

B. $100^{\circ}C$ and 2 atm

C. $-100^{\circ}C$ and 4 atm

D. $0^{\circ}C$ and 2 atm

Answer: C

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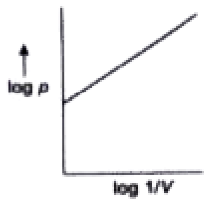
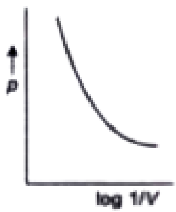
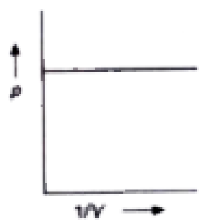
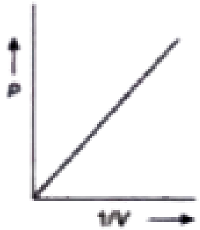
5. Which of the following graphs is not according to Boyle's law?

A. 

B. 

C. 

D. 

Answer: C

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6. The molecular velocity of any gas is

A. inversely proportional to the square root of temperature

B. inversely proportional to absolute temperature

C. directly proportional to square of temperature

D. directly proportional to square root of temperature

Answer: D

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7. $1.0L$ of N_2 and $\frac{7}{8}L$ of O_2 at the same temperature and pressure were mixed together. What is the relation between the masses of the two gases in the mixture?

A. $M_{N_2} = 3M_{O_2}$

B. $M_{N_2} = 8M_{O_2}$

C. $M_{N_2} = M_{O_2}$

D. $M_{N_2} = 16M_{O_2}$

Answer: C

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8. If the absolute temperature of a gas is doubled and the pressure is reduced to one half, the volume of the gas will.

A. Remain unchanged

B. Double

C. Increase four-fold

D. Be reduced to 1/4th

Answer: C

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9. A gas was compressed to half of its volume at $30^\circ C$. To what temperature it should be heated so that its volume increases to double of its original volume? (At constant pressure)

A. $60^\circ C$

B. $303K$

C. 1212 K

D. 606 K

Answer: C

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10. The molecular weight of O_2 and SO_2 are 32 and 64 respectively. If one litre of O_2 at $15^\circ C$ and 750 mm pressure contains N molecules, the number of molecules in two litres of SO_2 under the same conditions of temperature and pressure will be

A. N/2

B. N

C. 2N

D. 4N

Answer: C

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11. Equal weights of ethane and hydrogen are mixed in an empty container at $25^{\circ}C$. The fraction of the total pressure exerted by hydrogen is

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

B. $\frac{2}{15}$

C. $\frac{1}{16}$

D. $\frac{15}{16}$

Answer: D

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12. A gas of volume 100 is kept in a vessel at pressure $10^4 Pa$ maintained at temperature $24^\circ C$. If now the pressure is increased to $10^5 Pa$ keeping the temperature constant, the volume of gas becomes.

A. 10 cc

B. 100 cc

C. 1 cc

D. 1000 cc

Answer: A

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13. What is the compressibility factor of water vapour at $10^{\circ} C$ and 1 atm pressure. Its molar volume is $33.18 dm^{3} mol^{-1}$.

A. 0.896

B. 1.42

C. 1.986

D. 1.896

Answer: B

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14. A balloon filled with ethyne is pricked with a sharp point and quickly dropped in a tank of H_2 gas under identical condition. After a while the balloon will have

A. shrunk

B. enlarged

C. completely collapsed

D. unchanged in size

Answer: B

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15. $0.2g$ of a gas X occupies a volume of $440mL$. If $0.1g$ of carbon dioxide gas occupies a volume of 320 mL at the same temperature and pressure, gas X could be

A. O_2

B. SO_2

C. NO

D. C_4H_{10}

Answer: B

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16. The rate of effusion of two gases a and b under identical conditions of temperature and pressure is in the ratio of 2 : 1. What is the ratio of rms velocity of their molecules if T_a and T_b are in the ratio of 2 : 1?

A. $2 : 1$

B. $\sqrt{2} : 1$

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

D. $1 : \sqrt{2}$

Answer: C

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17. A one litre vessel at a pressure P_1 and a two litre vessel at pressure P_2 contain one mole each of oxygen gas. If the temperature is so adjusted such that the velocities of O_2 molecules in 1 lit. vessel are 4 times that of 2 lit. vessel, then at what ratio P_1 and P_2 will be

A. $4 : 1$

B. $8:1$

C. $16:1$

D. $32:1$

Answer: D

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18. A drop of liquid acquires spherical shape because

A. f its viscous nature

B. of capillary action

C. surface tension tends to minimise the surface area

D. all of these

Answer: C

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19. The Van der Waals parameters for gases, W, X, Y and Z are :

(Gas)	$a\left(\text{litre}^2 - \text{atm}/\text{mole}^2\right)$	$b(\text{litre}/\text{mole})$
W	4.0	0.027
X	8.0	0.030
Y	12.0	0.027
Z	6.0	0.024

Which one of the gases has the highest Boyle temperature?

A. W

B. X

C. Y

D. Z

Answer: C

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20. At the top of the mountain, the thermometer reads $0^{\circ} C$ and the barometer reads 710 mm Hg. At the bottom of the mountain the temperature is $30^{\circ} C$ and the prëssure is 760 mm Hg. The ratio of the density of air at the top with that at the bottom is (assume average molar mass of air remains constant)

A. $1: 1$

B. $1.04: 1$

C. $1: 1.94$

D. $1: 1.5$

Answer: B

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21. Which of the following contains greatest number of N atoms?

A. 22.4 L nitrogen gas at STP

B. 500 mL of 2.00 M NH_3

C. 1.00 mol of NH_4Cl

D. 6.02×10^{23} molecules of NO_2

Answer: A

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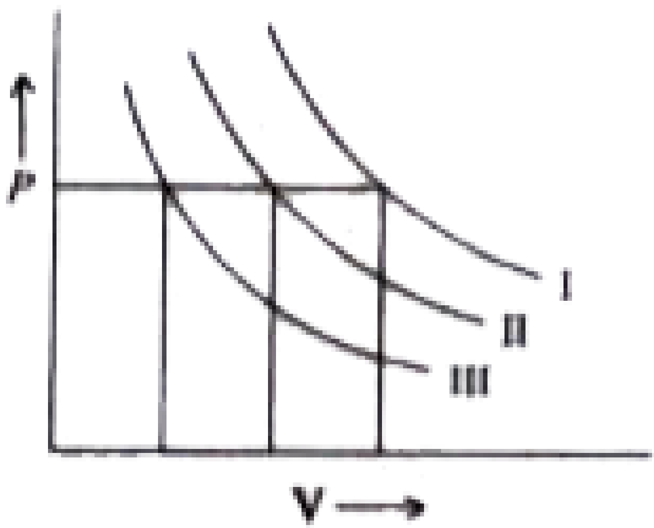
22. I, II and III are three isotherms, respectively, at T_1, T_2 , and T_3. Temperature will be in order.



A. $T_1 = T_2 = T_3$

B. $T_1 < T_2 < T_3$

C. $T_1 > T_2 > T_3$

D. $T_1 > T_2 = T_3$

Answer: C

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23. At what temperature will hydrogen molecules have the same KE as Nitrogen molecules at 280 K

A. 280 K

B. 40 K

C. 400 K

D. 50K

Answer: A

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24. The pressure exerted by 1 mol of CO_2 at $273K$ is $34.98 atm$. Assuming that volume occupied by CO_2 molecules is negligible, the value of van der Waal's constant for attraction of CO_2 gas is

A. $3.59 dm^6 \text{atm mol}^{-2}$

B. $2.59 dm^6 \text{atm mol}^{-2}$

C. $1.25 \mathrm{dm}^6 \mathrm{atm} \mathrm{~mol}^{-2}$

D. $1.59 dm^6 \mathrm{atm} \mathrm{~mol}^{-2}$

Answer: A

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25. A 3:2 molar mixture of N_2 and CO is present in a vessel at 500 bar pressure. Due to hole in the vessel, the gas mixture leaks out. The composition of mixture effusing out initially is

A. $n_{N_2} : n_{CO} : : 1 : 2$

B. $n_{N_2} : n_{CO} : : 6 : 1$

C. $n_{CO} : n_{N_2} : : 1 : 2$

D. $n_{CO} : n_{N_2} : : 2 : 3$

Answer: D

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26. What happened if a gas is expanded at constant temperature

A. The pressure decreases

B. The kinetic energy of the molecules remains the same

C. The kinetic energy of the molecules decreases

D. The number of molecules of the gas increases

Answer: A

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27. At $25^{\circ}C$ and $730mm$ pressure, 730 mL of dry oxygen was collected. If the temperature is kept constant what volume will oxygen gas occupy at 760 mm pressure?

A. 701 mL

B. 449 mL

C. 569 mL

D. 621 mL

Answer: A

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28. At STP, the order of average velocity of molecules of H_2, N_2, O_2 and HBr is

A. $H_2 > N_2 > O_2 > HBr$

B. $HBr > O_2 > N_2 > H_2$

C. $HBr > H_2 > O_2 > N_2$

D. $N_2 > O_2 > H_2 > HBr$

Answer: A

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29. An ideal gas obeying kinetic theory of gases can be liquified, if

A. Its temperature is more than critical temperature T_c

B. Its pressure is more than critical pressure P_c

C. Its pressure is more than P_c at a temperature less than T_c

D. It cannot be liquified at any value of P and T .

Answer: D

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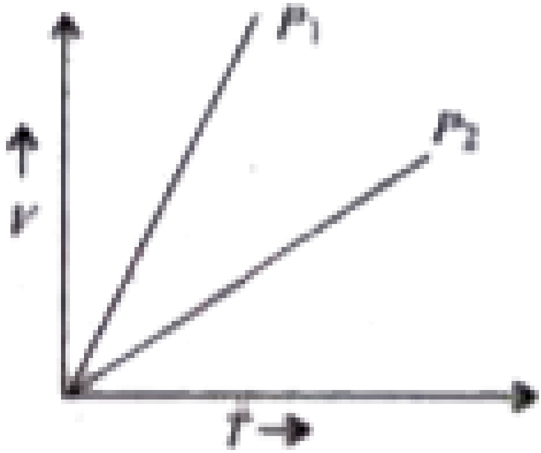
30. V vs T curves at different pressures P_1 and P_2 for an ideal gas are shown below:



Which one of the following is correct?

A. $P_1 > P_2$

B. $P_1 < P_2$

C. $P_1 = P_2$

D. $P_2 / P_1 = 1/2$

Answer: B

Watch Video Solution

31. The vapour pressure of water at $80^\circ C$ is $355 mmHg$. A one-litre vessel contains O_2 at $80^\circ C$, saturated with water vapour the total pressure being 760 mm Hg. The contents of the vessel were pumped into $0.3L$ vessel at the same temperature. What is the partial pressure of O_2?

A. 1350 mm Hg

B. 2263.3 mm Hg

C. 123.5 mm Hg

D. 455 mm Hg

Answer: A

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32. Boron forms a variety of unusual compounds with hydrogen. Achemist isolated $6.3mg$ of one of the boron hybrides in a glass bulb with a volume of $385mL$ at $25^\circ C$ and a bulb pressure of 11 torr. the molecular mass of the boron hybride in g mol^{-1} is

A. 3.68

B. 27.6

C. 36.35

D. 56.52

Answer: B

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33. A small quantity of gaseous NH_3 and HBr are introduced simultaneously into the opposite ends of an open tube that is 1 m long. Calculate the distance of the white solid NH_4Br formed from the end that was used to introduce NH_3.

A. 68.55 cm

B. 63.5 cm

C. 60.09 cm

D. 65.24 cm

Answer: A

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34. Which one of the following statement is not true about the effect of an increase in temperature on the distribution of molecular speed?

A. The most probable speed increases

B. The fraction of the molecules with the most probable speed increases

C. The distribution becomes broader

D. The area under the distribution curve remains the same as under the lower temperature

Answer: B

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35. 2 moles of a gas confined in a 4 L flask exert a pressure of 9.0 atm of 300 K temperature. The value of bis 0.05 L mol, the value of a is

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36. $1 mol$ of N_2 gas at $0.8 atm$ takes 38s to diffuse through a pinhole, whereas 1 mol of an unknown gas at $1.6 atm$ takes 57s to diffuse through the same pinhole. The molecular weight of unknown gas is

A. 126

B. 64

C. 80

D. 252

Answer: D

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37. What will be the molecular diameter of helium if van der Waals constant, $b = 24 mL mol^{-1}$?

A. 2.67 Å

B. 2.67 nm

C. 5.42 Å

D. 542 Å

Answer: A

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38. Rate of diffusion of LPG (a mixture of n-butane and propane) is 1.25 times that of SO_3 Hence, mole fraction of n-butane in LPG is

A. 0.752

B. 0.256

C. 0.514

D. 0.667

Answer: C

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39. Many laboratory gases are sold in steel cylinders with a volume of $43.8L$. What mass (in grams) of argon is inside a cylinder whose pressure is $17, 180kPa$ at $20^\circ C$?

A. 13.3 kg

B. 12.35 kg

C. 11.3 kg

D. 10.3 kg

Answer: B

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40. At STP, a container has 1 mole of He, 2 mole Ne, 3 mole O_2 and 4 mole N_2. Without changing total pressure if 2 mole of O_2 is removed, the partial pressure of O_2 will be decreased by:

A. 0.26

B. 0.4

C. 0.5833

D. 0.6666

Answer: C

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41. A rigid container containing 5 mole H_2 gas at same pressure and temperature. The gas has been allowed to escape by simple process from the container due to which pressure of the gas becomes half of its initial pressure and temperature become $(2/3)rd$ of its initial. The mass of gas remaining is

A. 7.5 g

B. 1.5 g

C. 2.5 g

D. 3.5 g

Answer: A

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42. The most probable speed of $8g$ of H_2 is $200ms^{-1}$. Average kinetic energy (neglect rotational and vibrational energy) of H_2 gas is :

A. 480 kJ

B. 240 kJ

C. 120 kJ

D. 360 kJ

Answer: B

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43. The ratio among most probable velocity, mean velocity and root mean square velocity is given by

A. $1:2:3$

B. $1:\sqrt{2}:\sqrt{3}$

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

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

Answer: D

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44. Calculate relative rate of effusion of SO_2 to CH_4, if the mixture obtained by effusing out a mixture with molar ratio $\frac{n_{SO_2}}{n_{CH_4}} = \frac{8}{1}$ for three effusing steps.

A. $2:1$

B. $1:4$

C. $1:2$

D. $3:1$

Answer: C

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45. A balloon weighing 50 kg is filled with 685 kg of helium at 1 atm pressure and $25^{\circ} C$. What will be its pay load if it displaced 5108 kg of air? : $4373 kg$, $4423 kg$, $5793 kg$, $5192 kg$

A. 4373 kg

B. 4423 kg

C. 5793 kg

D. 5192 kg

Answer: A

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46. Calculate the volume occupied by 16 gram O_2, at 300 K and $8.31 Mpa$ if $\frac{P_c V_c}{RT_c} = \frac{3}{8}$ and $\frac{P_r V_r}{T_r} = 2.21$ (Given : $R = 8.314 J/K - mol$)

A. 125.31 mL

B. 124.31 mL

C. 248.62 mL

D. 223.62 mL

Answer: B

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47. If Pd v/s. P(where P denotes pressure in atm and d denotes density in gm/L) is plotted for He gas, (assume ideal) at a particular temperature. If $\left[\frac{d}{dP}(Pd)\right]_{P=8.21atm}=5$, then the temperature will be

A. 160 K

B. 320 K

C. 80 K

D. 240 K

Answer: A

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48. Gas molecules each of mass $10^{-26} kg$ are taken in a container of volume $1 dm^3$. The root mean square speed of gas molecules is $1 km \sec^{-1}$. What is the temperature of gas molecules?(Given: $N_A = 6 \times 10^{23}, R = 8 J/mol. K$).

A. 298 K

B. 25 K

C. 240 K

D. 2500 K

Answer: C

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49. For a real gas (mol. Mass = 60) if density at critical point is $0.80 g/cm^3$ and its $T_c = \frac{4 \times 10^5}{821} K$, then van der Waal's constant a (in $atm L^2 mol^{-2}$) is

A. 0.3375

B. 3.375

C. 1.68

D. 0.025

Answer: B

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50. Two flasks A and B of 500 mL each are respectively filled with O_2 and SO_2 at 300 K and 1 atm. pressure. The flasks will contain : The same number of atoms, The same number of molecules, More number of moles of molecules in flask A as compared to flask B, The same amount of gases

A. The same number of atoms

B. The same number of molecules

C. More number of moles of molecules in flask A as compared to flask B

D. The same amount of gases

Answer: B

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LEVEL II

1. 1.22 g of a gas measured over water at 15°C and a pressure of 775 mm of Hg Occupied 900 ml. Calculate the volume of dry gas at vapour pressure of water at $15^\circ C$ is 14 mm of Hg

A. 372.21 mL

B. 854.24 mL

C. 869.96 mL

D. 917.76 mL

Answer: B

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2. $3.7g$ of a gas at $25^{\circ}C$ occupied the same volume as $0.184g$ of hydrogen at $17^{\circ}C$ and at the same pressure. The molecular mass of the gas is

A. 0.024

B. 39.14

C. 41.33

D. 59.14

Answer: C

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3. A gas bulb of 1 mL capacity contains 2.0×10^{21} molecules of nitrogen exerting a pressure of $7.57 \times 10^{3} Nm^{-2}$. The root mean square speed of the gas molecules is

A. $274 ms^{-1}$

B. $494 ms^{-1}$

C. $690 ms^{-1}$

D. $988 ms^{-1}$

Answer: B

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4. Two closed vessels of equal volume containing air at pressure p_1 and temperature T_1 are connected to each other through a narrow tube. If the temperature in one of the vessels is now maintained at T_1 and that in the other at T_2, what will be the pressure in the vessels?

A. $\dfrac{2p_1T_1}{T_1+T_2}$

B. $\dfrac{T_1}{2p_1T_2}$

C. $\dfrac{2p_1T_2}{T_1+T_2}$

D. $\dfrac{2p_1}{T_1+T_2}$

Answer: C

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5. The volume of oxygen collected by the decomposition of potassium chlorate at $24^{\circ} C$ and atmospheric pressure of 760 mm Hg is 128 mL. Calculate the mass of oxygen gas obtained. The pressure of the water vapour at $24^{\circ} C$ is $22.4 mmHg$.

A. 0.123 g

B. 0.163 g

C. 0.352 g

D. 1.526 g

Answer: B

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6. Which one of the following statement is not true about the effect of an increase in temperature on the distribution of molecular speed?

A. The area under the distribution curve remains the same as under the lower termperature

B. The distribution becomes broader

C. The fraction of the molecules with the most probable speed increases

D. The most probable speed increases

Answer: C

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7. The ratio of average speed of an oxygen molecule to the rms speed of a nitrogen molecule at the same temperature is : $\left(\frac{3\pi}{7}\right)^{\frac{1}{2}}$, $\left(\frac{7}{3\pi}\right)^{\frac{1}{2}}$, $\left(\frac{7}{3\pi}\right)^{\frac{1}{2}}$, $\left(\frac{7\pi}{3}\right)^{\frac{1}{2}}$

A. $\left(\frac{3\pi}{7}\right)^{1/2}$

B. $\left(\frac{7}{3\pi}\right)^{1/2}$

C. $\left(\frac{3}{7\pi}\right)^{1/2}$

D. $\left(\frac{7\pi}{3}\right)^{1/2}$

Answer: B

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8. A $15.0L$ cylinder of Ar gas is connected to an evacuated $235.0L$ tank. If the final pressure is 750 mm Hg, what have been the original gas pressure in the cylinder? : $76atm$, $12.56atm$, $16.45atm$, $23atm$

A. 76 atm

B. 12.56 atm

C. 16.45 atm

D. 23 atm

Answer: C

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9. A balloon indoors where the temperature is $27^{\circ}C$ has a volume of $2.00L$. What will be the volume of outdoors where the temperature is $-23^{\circ}C$? Assuming pressure remains constant

A. 1.67 L

B. 2.23 L

C. 0.53 L

D. 1.26 L

Answer: A

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10. A vessel has nitrogen gas and water vapour at a total pressure of 1 atm. The partial pressure of water vapour is $0.3 atm$. The contents of this vessel are transferred to another vessel having one-third the capacity of the original vessel, completely at the same temperature. The total pressure of the system in the new vessel is

A. 2.4 atm

B. 1 atm

C. 3.33 atm

D. 0.3 atm

Answer: A

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11. A gas cylinder containing cooking gas can withstand a pressure of $14.9 atm$. The pressure of the cylinder indicates 12 atm, at $27^\circ C$. Due to sudden fire in the building, its temperature starts rising. At what temperature will the cylinder explode?

A. $90.5^\circ C$

B. $99.5^{\circ} C$

C. $87.3^{\circ} C$

D. $34^{\circ} C$

Answer: B

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12. A compound exists in the gaseous state both as monomer (A_1) and dimer (A_2). The molecular weight of the monomer is 48. In an experiment, 96 g of the compound was confined in vessel of volume $33.6 L$ and heated to $273^{\circ} C$. Calculate the pressure developed, if the compound exists as a dimer to the extent of 50% by weight under these conditions.

A. 7.5 atm

B. 2.0 atm

C. 0.9 atm

D. 5.4 atm

Answer: B

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13. For two gases A and B with molecular weights M_A and M_B, it is observed that at certain temperature T, the mean velocity of A is equal to the root mean square velocity of B. Thus the mean velocity of A can be made equal to the mean velocity of B if : A is lowered to a temperature $T_2 = \frac{3\pi}{8}T$, A is lowered to a temperature $T_2 = (8/3\pi)T$, B is lowered to a temperature $T_2 = \frac{3\pi T}{8}$, B is lowered to a temperature $T_2 = \frac{8T}{3\pi}$

A. A is lowered to a temperature $T_2 = \frac{3\pi}{8}T$

B. A is lowered to a temperature

$T_2 = (8/3\pi)T$

C. B is lowered to a temperature $T_2 = \frac{3\pi T}{8}$

D. B is lowered to a temperature $T_2 = \frac{8T}{3\pi}$

Answer: B

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14. For the reaction $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$. What is the $\%$ of NH_3 converted if the mixture diffuses twice as fast as that of S_2 under similar conditions?

A. 3.125

B. 6.25

C. 12.5

D. 9.25

Answer: B

Watch Video Solution

15. Assuming that dry air.contains 79% N_2 and 21% O_2 by volume, calculate the density of moist air at $25^\circ C$ at one atmosphere when the relative humidity is 60%. The vapor pressure of water at 25°C is 23.76 mm of Hg.

A. $1.17 gL^{-1}$

B. $2.16 gL^{-1}$

C. $3.12 gL^{-1}$

D. $4.16 gL^{-1}$

Answer: A

Watch Video Solution

16. A volume V of a gas at a temperature T_1 and a pressure P' is enclosed in a sphere. It is connected to another sphere of volume $\frac{V}{2}$ by a tube and stop cock. The second sphere is initially evacuated and the stop cock is closed. If the stop cock is opened the temperature of the gas in the second sphere becomes T_2. The first sphere is maintained at $'T_1'$, what is the final pressure within the apparatus.

A. $\frac{2PT_2}{2T_2+T_1}$

B. $\frac{2PT_2}{T_2+2T_1}$

C. $\frac{2PT_2}{2T_2+T_1}$

D. $\dfrac{2PT_2}{T_1+T_2}$

Answer: A

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17. A gas obeys $P(V-b)=RT$. Which of the following are correct about this gas?

I. Isochoric curves have slope $=\dfrac{R}{V-b}$

II. Isobaric curves have slope $\dfrac{R}{P}$ and intercept b.

III. For the gas compressibility factor $=1+\dfrac{Pb}{RT}$

IV. The attractive forces are overcome by repulsive forces.

A. I

B. II , III

C. III

D. II ,III , IV

Answer: D

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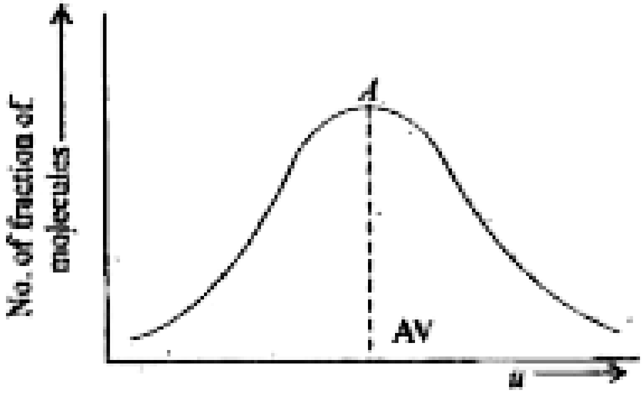
18. Distribution of molecules with velocity is represented by the curve



Velocity corresponding to point A is

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

B. $\sqrt{\frac{2RT}{M}}$

C. $\sqrt{\frac{8RT}{\pi M}}$

D. $\sqrt{\frac{RT}{M}}$

Answer: B

Watch Video Solution

19. If χ_M, χ_P and χ_V are mole fraction, pressure fraction and volume fraction respectively of a gaseous mixture, then

A. $\chi_M = \frac{1}{\chi_P} \times \frac{1}{\chi_V}$

B. $\frac{1}{\chi_M} = \chi_P \times \frac{1}{\chi_V}$

C. $\chi_M = \chi_P \times \chi_V$

D. $\frac{1}{\chi_P} = \frac{1}{\chi_M} \times \frac{1}{\chi_V}$

Answer: C

Watch Video Solution

20. A flask containing 12 g of a gas of relative molecular mass 120 at a pressure of 100 atm was evacuated by means of a pump until the pressure was $0.01 atm$. Which of the following is the best estimate of the number of molecules left in the flask ($N_0 = 6 \times 10^{23} mol^{-1}$)?

A. 6×10^{19}

B. 6×10^{18}

C. 6×10^{17}

D. 6×10^{15}

Answer: B

Watch Video Solution

21. The compressibility factor for definite amount of van der Waal's gas at $0^{\circ} C$ and 100 atm is found to be 0.5. Assuming the volume of gas molecules negligible, the van der Waal's constant a for a gas is

A. 1.256 atm $L^2 mol^{-2}$

B. 0.256 atm $L^2 mol^{-2}$

C. 2.256 atm $L^2 mol^{-2}$

D. 0.0256 atm $L^2 mol^{-2}$

Answer: A

Watch Video Solution

22. A spherical air bubble is rising from the depth of a lake when pressure is Patm and temperature is TK. The percentage increase in the radius when it comes to the surface of a lake will be (Assume temperature and pressure at the surface to be, respectively, 2TK and $P/4$).

A. $100\ \%$

B. $50\ \%$

C. $40\ \%$

D. $200\ \%$

Answer: A

Watch Video Solution

23. The density of gas at 27°C and 1 atm is d. Pressure remaining constant at which of the following temp will its density become 0.75d?

A. 20° C

B. $30^{\circ}C$

C. $400K$

D. $300K$

Answer: C

Watch Video Solution

24. A vessel is filled with a mixture of oxygen and nitrogen. At what ratio of partial pressures will the mass of gases be identical.

A. $P_{O_2} = 0.785 P_{N_2}$

B. $P_{O_2} = 8.75 P_{N_2}$

C. $P_{O_2} = 11, 4P_{N_2}$

D. $P_{O_2} = 0.875P_{N_2}$

Answer: D

Watch Video Solution

25. 15 L of gas at STP is subjected to four different conditions of temperature and pressure as shown below. In which case the volume will remain unaffected?

A. 273 K, 2 bar pressure

B. $273^\circ C$,0.5 atm pressure

C. 546° C, 1.5 atm pressure

D. 273° C and 2 atm pressure

Answer: D

Watch Video Solution

26. For 1 mole of ideal gas kept at $6.5 atm$ in a container of capacity $2.463 L$, the Avogadro proportionality constant is:

A. 22.4

B. 2.46

C. 0.406

D. 3.25

Answer: C

Watch Video Solution

27. The average oxygen content of arterial blood is approximately $0.25g$ of O_2 per litre. Assuming a body temperature of $37^\circ C$, how many moles of oxygen are transported by each litre of arterial blood and how many millilitres?

A. 7.8×10^{-3} and 200 mL

B. 6.8×10^{-3} and 200 mL

C. 7.8×10^{-3} and 100 mL

D. 6.8×10^{-5} and 100 mL

Answer: A

Watch Video Solution

28. How many millilitres of H_2O vapour measured at 327°C and 760 torr are formed when 50 mL of ammonia at 950 torr and 127°C reacts with oxygen accordirig to the following reaction?

$$NH_3(g) + O_2(g) \rightarrow N_2(g) + H_2O(g)$$

A. 76 mL

B. 125 mL

C. 140.625 mL

D. 241.4 mL

Answer: C

Watch Video Solution

29. Equal masses of methane and oxygen are mixed in an empty container at $25^\circ C$. The fraction of the total pressure exerted by oxygen is

A. $1/2$

B. $2/3$

C. $\frac{1}{3} \times \frac{273}{298}$

D. $1/3$

Answer: D

Watch Video Solution

30. Which of the following statements is incorrect about H_2 and CO_2 gas considering them as ideal gases?

A. The average kinetic energies of H_2 and CO_2 molecules are the same at a given temperature.

B. The root mean square velocities of H_2 and CO_2 molecules are the same at a given temperature

C. The fraction of H_2 and CO_2 molecules with the most probable:velocity decreases with increase in temperature.

D. The density of H_2 is less that CO_2 at a given temperature and pressure

Answer: B

Watch Video Solution

31. A real gas obeys the equation of state $p(V - nb) = nRT$ where b is van der Waals constant and R is the gas constant. If the pressure and temperature are such that the molar volume of the gas is 10b, what is the value of compressibility factor?

A. $10/9$

B. $8/9$

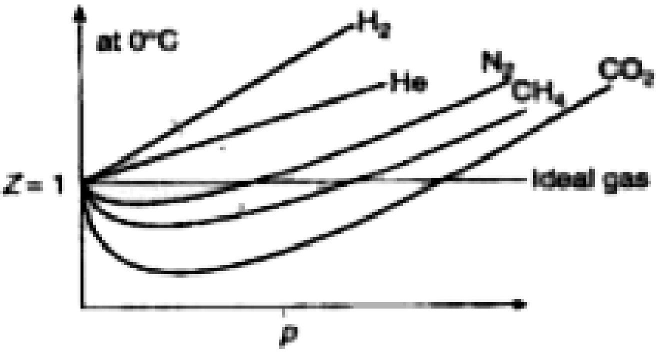
C. $12/11$

D. $10/11$

Answer: A

Watch Video Solution

32. Which of the following statements is correct as shown in the graph?



A. The slope of Zvs. p at constant temperature for all real gases, is b/RT.

B. The slope of Zvs. p at constant temperature for both He and H_2 is b/RT.

C. The slope of Z vs. p at low pressure for all real gases, at constant temperature is b/RT.

D. The slope of Z vs. p at high pressure and at constant temperature for real gases is -b/RT.

Answer: B

View Text Solution

33. Two flasks X and Y of volumes 250 mL and 300 mL respectively at the same temperature are connected by a stop cock of negligible volume. The flask X contains nitrogen gas at a pressure of 660 torr and the flask Y contains neon gas at a pressure of 825 torr. If the stop cock is opened to allow the two gases to mix, the partial pressure of neon gas and total pressure of the system will be

A. 300 torr, 700 torr

B. 400 torr, 700 torr

C. 450 torr, 750 torr.

D. 300 torr, 750 torr

Answer: C

Watch Video Solution

34. A chemist isolated a gas in a glass bulb with a volume of 255 mL at a temperature of $25^{\circ}C$ and a pressure (in the bulb) of 10.0 torr. The gas weighed $12.1mg$. What is the molecular mass of the gas?

A. $78.9gmol^{-1}$

B. $35.2gmol^{-1}$

C. $88.2gmol^{-1}$

D. $96.3gmol^{-1}$

Answer: C

Watch Video Solution

35. The pressure exerted by 12 g of an ideal gas at temperature $T(^\circ C)$ in a vessel of volume V is 1 atm. When the temperature is increased by $10^\circ C$ at the same volume, the pressure increases by 10%. If molecular weight of the gas is 120, the temperature $(T^\circ C)$ and volume (V) are

A. $T = -273^\circ C, V = 0.082L$

B. $T = -173^\circ C, V = 0.82L$

C. $T = 0^\circ C, V = 22.4L$

D. $T = 27^\circ C, V = 22.4L$

Answer: B

Watch Video Solution

36. Dry ice (solid CO_2) has occasionally been used as an explosive in mining. A hole is drilled, dry ice and a small amount of gun powder are placed in the hole, a fuse is added, and the hole is plugged. When lit, it explodes up with an immense pressure. Assume that $500.0g$ of dry ice is placed in a cavity with a volume of $0.800L$ and the ignited gun powder heats the CO_2 to 700 K. What is the final pressure inside the hole?

A. 416 atm

B. 816 atm

C. 616 atm

D. 1216 atm

Answer: B

Watch Video Solution

37. Starting out on a trip into the mountains, you inflate the tires on your automobile to a recommended pressure of $3.21 \times 10^5 Pa$ on a day when the temperature is $-5.0^\circ C$. You drive to the beach, where the temperature is $28.0^\circ C$. Assume that the volume of the tire has increased by 3%. What is the final pressure in the tyres?

A. 350 Pa

B. 3500 Pa

C. $3.5x \times 10^5$ Pa

D. 3.5 Pa

Answer: C

Watch Video Solution

38. An open flask containing air is heated from 300 K to 500 K. What percentage of air will be escaped to the atmosphere, if pressure is keeping constant?

A. 80

B. 40

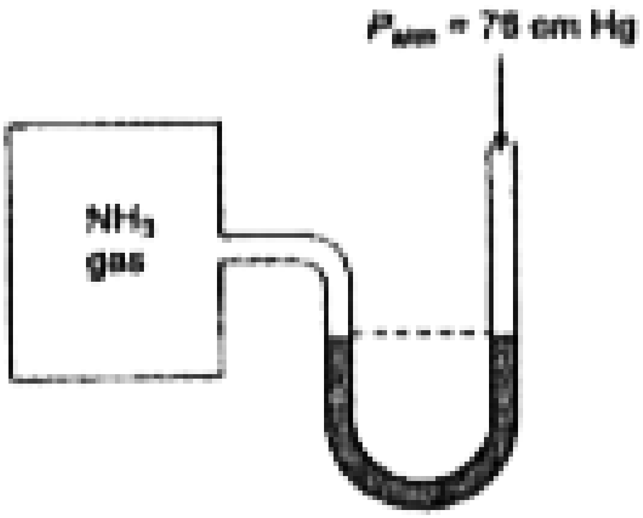
C. 60

D. 20

Answer: B

Watch Video Solution

39. A manometer attached to a flask contains ammonia gas have no difference in mercury level initially as shown in diagram. After sparking into the flask, ammonia is partially dissociatedas $2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ now it have difference of 6 cm in mercury level in two columns, what is partial pressure of $H_2(g)$ at equilibrium?



A. 9 cm Hg

B. 18 cm Hg

C. 27 cm Hg

D. 15 cm Hg

Answer: A

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40. A jar contains a gas and a few drops of water. The pressure in the jar is 830 mm of Hg. The temperature of the jar is reduced by 1%. The vapour pressure of water at two temperatures are

30 and 25 mm of Hg. Calculate the new pressure in jar.

A. 792 mm of Hg

B. 817mm of Hg

C. 800 mm Hg

D. 840 mm Hg

Answer: B

Watch Video Solution

41. A gaseous mixture contains three gases A, B and C with a total number of moles of 10 and total pressure of 10 atm. The partial pressure of A and B are 3 atm and 1 atm respectively and if C has molecular weight of $2g/mol$. Then, the weight of C present in the mixture will be:

A. 8 g

B. 12 g

C. 3 g

D. 6 g

Answer: B

Watch Video Solution

42. The density of a gas filled electric lamp is $0.75 kg/m^3$. After the lamp has been switched on, the pressure in it increases from $4 \times 10^4 Pa$ to $9 \times 10^4 Pa$. What is increase in U_{RMS}?

A. 1.00

B. 200

C. 300

D. 400

Answer: B

Watch Video Solution

43. The average speed at temperature $T^{\circ}C$ of $CH_4(g)$ is $\sqrt{\frac{28}{88}} \times 10^3 ms^{-1}$. What is the value of T?

A. $240.55^{\circ}C$

B. $-32.45^{\circ}C$

C. $3000^{\circ}C$

D. $-24.055^{\circ}C$

Answer: B

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44. A gaseous mixture containing He, CH_4 and SO_2 was allowed to effuse through a fine hole then find what molar ratio of gases coming out initially? If mixture contain He, CH_4 and SO_2 in 1 : 2 : 3 mole ratio

A. $2:2:3$

B. $6:6:1$

C. $\sqrt{2}:\sqrt{2}:3$

D. $4:4:3$

Answer: D

Watch Video Solution

45. The compressibility factor for nitrogen at 330 K and 800 atm is 1.90 and at 570 K and 200 atm is 1.10. A certain mass of N_2 occupies a volume of $1dm^3$ at 330 K and 800 atm. Calculate volume occupied by same quantity of N_2 gas at 570 K and 200 atm.

A. 1 L

B. 2 L

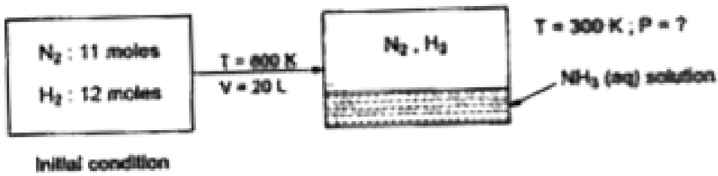
C. 3 L

D. 4 L

Answer: D

Watch Video Solution

46. 11 moles N_2 and 12 moles of H_2 mixture reacted in 20 litre vessel at 800 K. After equilibrium was reached, 6 mole of H_2 was present. 3.58 litre of liquid water is injected in equilibrium mixture and resultant gaseous mixture suddenly cooled to 300K. What is the final pressure of gaseous mixture? Neglect vapour pressure of liquid solution. Assume (i) all NH_3 dissolved in water (ii) no change in volume of liquid (iii) no reaction of N_2 and H_2 at 300 K.



A. 18.47 atm

B. 60 atm

C. 22.5 atm

D. 45 atm

Answer: C

Watch Video Solution

47. What is the density of wet air with 75% relative humidity at 1 atm and 300 K? Given: vapour pressure of H_2O is 30 torr and average molar mass of air is $29 g mol^{-1}$.

A. 1.614 g/L

B. 0.96 g/L

C. 1.06 g/L

D. 1.164 g/L

Answer: D

Watch Video Solution

48. A given volume of ozonized oxygen (containing 60% oxygen by volume) required 220 sec to effuse which an equal volume of oxygen took 200 sec only under the conditions. If density of O_2 is $1.6g/L$ then find density of O_3.

A. 1.936 g/L

B. 2.16 g/L

C. 3.28 g/L

D. 2.44 g/L

Answer: D

Watch Video Solution

49. A mixture of nitrogen and water vapours is admitted to a flask at 760 torr which contains a sufficient solid drying agent after long time the pressure reached a steady value of 722 torr. If the experiment is done at $27^{\circ} C$ and drying agent increases in weight by $0.9g$, what is the volume of the flask? Neglect any possible vapour pressure of drying agent and volume occupied by drying agent.

A. 443.34 L

B. 246.3 L

C. 12.315 L

D. 24.63 L

Answer: D

Watch Video Solution

50. If the slope of “Z' (compressibility factor) v/s “p'curve is constant (slope = $\frac{\pi}{492.6}\text{atm}^{-1}$) at a particular temperature (300K) and very high pressure, then calculate diameter of the molecules

(Given: $N_A = 6.0x10^{23}$, R=0.0821 atm. lit $mol^{-1}K^{-1}$)

A. 7.5 Å

B. 5 Å

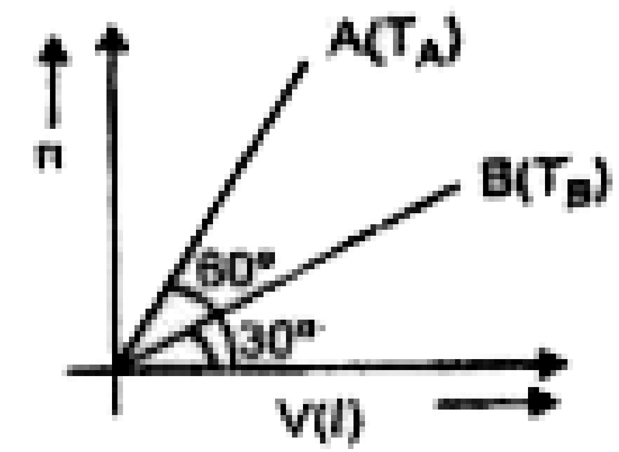
C. 2.5 Å

D. 1.25 Å

Answer: B

Watch Video Solution

51. For two samples A and B of ideal gas following curve is plotted between n vs V (volume of container 16.42 atm pressure as follows, then temperature of A and B respectively are:



A. $\frac{200}{\sqrt{3}}, 200\sqrt{3}K$

B. $\frac{200}{\sqrt{3}}{}^{\circ}C, \left(200\sqrt{3}\right){}^{\circ}C$

C. $200\sqrt{3}K, \frac{200}{\sqrt{3}}K$

D. $200K, \frac{\sqrt{3}}{200}K$

Answer: A

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52. Which one is not correct for gaseous state obeying van der Waals equation?

A. Compressibility factorat critical temperature = 0.375.

B. For a gas if van der Waals'constant a=0, $T_c = 0$

C. Ideal gases do not have critical temperature

D. Gaseous molecules showing H-bonding show minimum deviations from Z = 0.375

Answer: D

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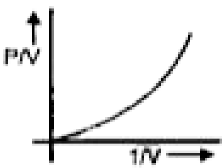
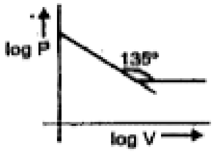
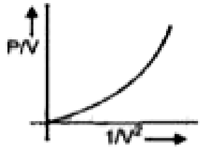
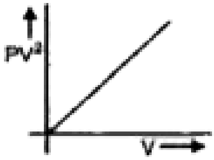
53. Which is incorrect curve for Boyle's law?

A. 

B. 

C. 

D. 

Answer: C

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54. At $100^{\circ}C$ and 1 atm, if the density of liquid water is 1.0 g cm^{-3} and that, of water vapour

0.0006 g cm^{-3} then the volume occupied by water' molecules in 1 litre of steam at that temperature is

A. $6cm^{-3}$

B. $60cm^{3}$

C. $0.6cm^{3}$

D. $0.06cm^{3}$

Answer: C

Watch Video Solution

55. A mixture of NH_3 (g) and N_2H_4 (g) is placed in a sealed container at 300 K. The pressure within the container is 0.6 atm. The container is heated to 1000 K where the gases undergo complete decomposition as:

$2NH_3(g) \rightarrow N_2(g) + 3H_2(g)$ and

$N_2H_4(g) \rightarrow N_2(g) + 2H_2(g)$

The pressure of the container at this stage becomes 4.8 atm. The mole per cent of $NH_3(g)$ in the original mixture was

A. 40

B. 50

C. 60

D. 70

Answer: C

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LEVEL III (Single Correct Answer Type)

1. What percentage of a sample of nitrogen must be allowed to escape if its temperature, pressure and volume are changed from $220^\circ C$, 3.0 atm and

1.65 L to 110°C, 0.7 atm and 1.0 L respectively? :

0.1813, 0.34, 0.62, 0.8187

A. 0.1813

B. 0.34

C. 0.62

D. 0.8187

Answer: D

Watch Video Solution

2. A spherical balloon of 21cm diameter is to be filled with hydrogen at STP from a cylinder containing the gas at 20 atm and 27°C. If the cylinder can hold 2.82 L of water, the number of balloons that can be filled up is

A. 5

B. 2

C. 10

D. 12

Answer: C

Watch Video Solution

Watch Video Solution

3. Helium gas collected over water measures 350 mL at 20° C. If atmospheric pressure is 752.5 mm of Hg and vapour pressure of water at $20^{\circ}C$ be 17.5 mm of Hg, what is the percentage weight of water vapour in moist helium gas?

A. $98.76\ \%$

B. $9.67\ \%$

C. $5.32\ \%$

D. $13.83\ \%$

Answer: B

Watch Video Solution

4. A collapsed balloon is filled with He to a volume of 12 L at a pressure of 1.0 atm. Oxygen gas is then added, so that the final volume of balloon is 26 L with a total pressure of 1.0 atm. The temperature, constant throughout, is equal to $20^{\circ} C$. Determine mass of oxygen gas added

A. 32.34 g

B. 16.21 g

C. 28.34 g

D. 18.67 g

Answer: D

Watch Video Solution

5. Determine the volume of air containing 20% oxygen by volume, that would have to be inhaled at 20°C and 1.0 atm to consume 1.00 kg of fat $C_{57}H_{110}O_6$ assuming that only 70% (by volume) of the oxygen present in the air is used up in combustion.

A. 15715 L

B. 23123 L

C. 18832 L

D. 16312 L

Answer: A

Watch Video Solution

6. Excess F_2(g) reacts at $150^\circ C$ and 1.0 atm pressure with Br_2(g) to give a compound BrF_n .If 423 mL of Br_2(g) at the same temperature and pressure produced 4.2 g of BrF_n what is n?

(Br=80, F= 19)

A. 3

B. 1

C. 5

D. 7

Answer: C

Watch Video Solution

7. Assuming that the behaviour of ammonia is correctly described by the van der Waal's equation near the critical point, and knowing the critical molar volume of $0.72500 mol L^{-1}$ and critical temperature of 405.3 K, determine the critical pressure of ammonia.

A. 109.8 atm

B. 141.3 atm

C. 152.6 atm

D. 17.20 atm

Answer: D

Watch Video Solution

8. At room temperature the following reactions proceed nearly to completion : $2NO + O_2 \to 2NO_2 \to N_2O_4$. The dimer N_2O_4 solidified at 262 K. A 250 mL flask and a 100 mL flask are separated by a stopcock. At 300 K, the nitric oxide in the larger flask exerts a pressure of 1.053 atm and the smaller one contains oxygen at 0.789 atm. The gases are mixed by opening the stopcock and after the end of the reaction the flasks are cooled to 220 K. Neglecting the vapour pressure of the dimer, find out the pressure of the

gas remaining at 220 K. (Assume the gases to behave ideally)

A. 0.682 atm

B. 0.383 atm

C. 0.221 atm

D. 0.536 atm

Answer: C

Watch Video Solution

9. The composition of the equilibrium mixture (Cl $\Leftrightarrow 2CI$), which is attained at. 1200°C, is determined by measuring the rate of effusion through a pinhole. It is observed that at 1.80 mm Hg pressure, the mixture effuses 1.16 times as fast as krypton effuses under the same conditions. Calculate the fraction of chlorin molecules dissociated into atoms: (Relative atomic mass of Kr=84)

A. 0.1374

B. 0.9325

C. 0.2573

D. 0.6256

Answer: A

Watch Video Solution

10. Using van der Waals equation, calculate the constant a when two moles of a gas confined in a 4L flask exert a pressure of 11.0 atm at a temperature of 300 K. The value of b is 0.05 L mol^{-1}

A. 7.52 L^2 atm mol^{-2}

B. 6.46 L^2 atm mol^{-2}

C. 12.241.atm mol^{-2}

D. 18.63 $L^2 atm$mol^(-2)`

Answer: B

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LEVEL III (Multiple Correct Answer type)

1. Which of the following changes decrease the vapour pressure of water kept in a sealed vessel? Decreasing the quantity of water Adding salt to water Decreasing the volume of the vessel to one-half Decreasing the temperature of water

A. Decreasing the quantity of water

B. Adding salt to water

C. Decreasing the volume of the vessel to one-half

D. Decreasing the temperature of water

Answer: B::D

Watch Video Solution

2. If the rms velocities of nitrogen and oxygen molecules are same at two different temperatures and same pressure then

A. most probable velocity of molecules is also equal

B. average speed of molecules is also same

C. number of moles of each gas is also equal

D. density of nitrogén and oxygen is also equal

Answer: A::B::D

Watch Video Solution

3. Which of the following is/are true?

A. Higher the value of a, weaker is intermolecular force of attraction

B. At low pressure, $Z = 1 = \dfrac{a}{V_m RT}$, for ideal gas

C. $\dfrac{V_1}{V_2} = \dfrac{T_2}{(T_1)^{3/2}}$ for reversible adiabatic expansion

D. A gas can be liquified below critical temperature at high pressure

Answer: B::C::D

Watch Video Solution

4. According to kinetic theory of gases

A. Collisions are always elastic

B. heavier molecules transfer more momentum to the wall of the container

C. only a small number of molecules have very high velocity

D. between collisions, the molecules move in straight lines with constant velocities

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

Watch Video Solution

5. Which of the following facts regarding mean free path of gaseous molecules is/are correct?

A. A. Mean free path is directly proportional to Kelvin temperature provided pressure of the gas is held constant

B. B. Mean free path is directly proportional to pressure provided temperature of the gas is held constant.

C. C. Mean free path is inversely proportional to the molecular diameter (σ^2)

D. D. Mean free path is inversely proportional to the number of molecules per unit volume of the gas.

Answer: A::C::D

Watch Video Solution

6. Two flasks A and B have equal volumes. Flask A contains hydrogen at 300K while B contains equal mass o methane of 600K. Which of the following facts is/are correct if the gases follow ideal behaviour?

A. Flask A contains greater number of molecules.

B. The average speed of molecules in flask B is twice that of molecules in flask A.

C. Both the gases have the same compression factor

D. Total kinetic energy of molecules in flask Ais greater than that of molecules in flask B

Answer: A::C::D

Watch Video Solution

7. Which of the following facts stated along with the given characteristics of two identical gases is/are correct?

A. Equal p, V, T, $m_1 > m_2 \Rightarrow \overline{KE}_1 = \overline{KE}_2$

B. Equal p , V , T , $m_1 > m_2 \Rightarrow n_1 > n_2$

C. Equal p, V, $n_1 > n_2 \Rightarrow T_1 < T_2$

D. Equal V, N, T, $m_1 > m_2 \Rightarrow p_1 > p_2$

Answer: A::C

Watch Video Solution

8. Which of the following statements are not correct?

A. At low pressure the molecules of an ideal gas move with slower speed as compared to the gas at high pressure.

B. The value of gas constant R is

$8.314 JK^{-1} mol^{-1}$

C. The value of Boltzmann constant K is

$1.38 \times 10^{-23} JK^{-1} \text{molecule}^{-1}$

D.

Answer: A::B::C

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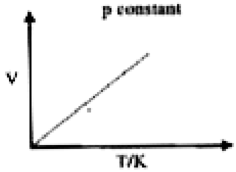
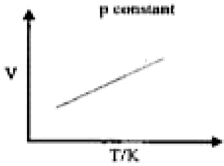
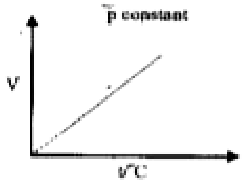
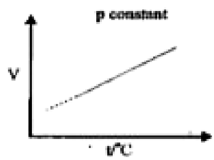
9. Which of the following graphs represent the behaviour of an ideal gas ?

A. 

B. 

C. 

D. 

Answer: A::D

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10. Let u_{av}, u_{rms} and u_{mp} respectively denote the average speed, root mean square average speed and most. probable speed in an ideal monoatomic gas at kelvin temperature T. Arrange them in their increasing order

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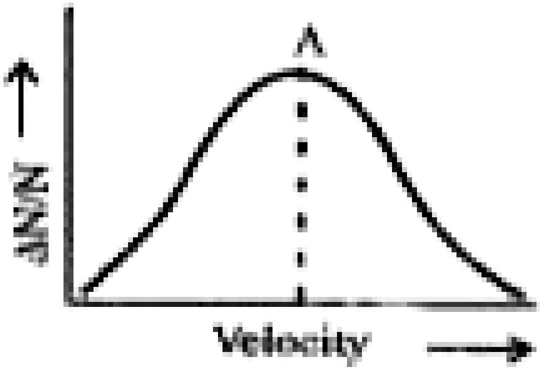
11. Point A in the given curve shifts to higher value of velocity if



A. T is increased

B. P is decreased

C. V is decreased

D. Molecular weight M is decreased

Answer: A::D

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12. Precisely I'mole of helium and 1 mol of neon are placed in a container. Indicate the correct statements about the system

A. Molecules of the two gases strike the wall of the container with same frequency.

B. Molecules of helium strike the wall more frequently

C. Molecules of helium have greater average molecular speed.

D. Helium exerts larger pressure.

Answer: B::C

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13. Which of the following pair of gases will have same rate of diffusion under similar conditions?H 2 and H e C O 2 and N 2 O C O and C 2 H 4 NO and CO

A. H_2 and He

B. CO_2 and N_2O

C. CO and C_2H_4

D. NO and CO

Answer: B::C

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14. Which of the following statements is/are correct about real gases?

A. The molecules do cause attractive forces on each another

B. They obey gas laws at low temperature and high pressure

C. They show deviations from ideal behaviour

D. The molecules have negligible mass

Answer: A::C

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LEVEL III (Numerical Type)

1. At 400 K, the root mean square (Ims) speed ofa gas X(molecular weight=40) is equal to the most probable speed of gas Y at 60 K. The molecular weight of Y is

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2. The diffusion coefficient of an ideal gas is proportional to its mean free path and mean speed. The absolute temperature of an ideal gas is increased 4 times and its pressure is increased 2 times. As a result, the diffusio coefficient of this gas increases x times. The value of x is

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3. A certain gas is at a temperature of 350 K. If the temperature is raised to 700 K, the average translation a kinetic energy of the gas will increase by

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4. A 10 L box contains 41.4 g of a mixture of gases C_xH_8 and C_xH_{12}. The total pressure at $44^{\circ}C$ in flask 1.56 atm. Analysis revealed that the gas mixture has 87% total C and 13% total H. Find out the value of x

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5. The stop cock connecting two bulbs of volume 5 litre and 10 litre containing an ideal gas at 9 atm and 6 atm respectively, is opened. What is the final pressure in the two bulbs if the temperature remains the same?

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6. A gas has a vapour density 11.2.The volume occupied by 1 gram of the gas at STP will be

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7. To an evacuated vessel with movable piston under external pressure of 1 atm, 0.1 mole of He and 1.0 mol of unknown compound (vapour pressure 0.68 atm at 0°C) are introduced. Considering ideal gas behaviour the total volume (in litre) of the gases at 0°C is close to:

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LEVEL III (Matching Column Type .)

1. Match the term with the expression.

Column I	Column II
A) Root mean square speed	p) $\propto \sqrt{T}$
B) Average speed	q) $\propto \sqrt{\frac{1}{M}}$
C) Most probable speed	r) $\propto \sqrt{\frac{1}{d}}$
D) Kinetic energy per mole	s) $\propto T$

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2. Match the statements in column I with those of column II

Column I	Column II
A) Hydrogen gas ($P = 200$ atm, $T = 273$ K)	p) Compressibility factor $\neq 1$
B) Hydrogen gas ($p \approx 0$, $T = 273$ K)	q) Attractive forces are dominant
C) CO_2 ($P = 1$ atm, $T = 273$ K)	r) $PV = nRT$
D) Real gas with very large molar volume	s) $P(V - nb) = nRT$

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3. Match the expression with the change it undergoes.

Column I	Column II
A) If temperature of given gas is increased	p) Average speed of gas will increase
B) If the pressure of a given gas is increased at constant temperature	q) Root mean square speed of gas molecules will increase
C) If the density of a given gas is lowered at constant temperature	r) Most probable speed of gas molecules will increase
D) If the volume of a given gas is increased at constant temperature	s) Speed of gas molecules will not change

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4. Match the term with the expression .

Column I	Column II
A) Boyle's temperature	p) a/Rb
B) $\frac{1}{2}$ (Inversion temperature)	q) $8a/27Rb$
C) Critical temperature	r) The gas cannot be liquified above this temperature, on applying pressure
D) Critical pressure	s) $a/27b^2$

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5. Match the statement with different conditions .

Column I	Column II
A) PV = constant, when T is constant	p) Pressure
B) Rate of diffusion of a gas	q) Closed container
C) Velocity of a gas	r) Temperature
D) Vapour pressure of a liquid	s) Molecular mass

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6. Match the terms and statements in column I with those of column II

Column I	Column II
A) Vapour pressure of pure liquid	p) van der Waals' constant b
B) Co-volume	q) PV/n RT
C) Z	r) Universal gas constant
D) $JK^{-1} mol^{-1}$	s) Depends on temperature and nature of Liquid

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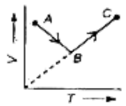
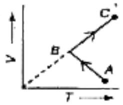
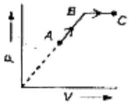
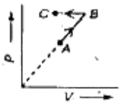
7. Match the following

Column I	Column II
A) 	p) Temperature increases
B) 	q) Pressure first increases and then remains constant
C) 	r) Temperature first decreases and then increases
D) 	s) Pressure first decreases and then remains constant

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LEVEL III (Statement Type)

1. Assertion : Ideal gas equation is nearly valid for real gases at low pressure and high temperature.

Reason : Molecular interactions are negligible under this condition.

A. Statement 1 is True, statement 2 is True, Statement 2 is 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 iş False.

D. Statement 1 is False, Statement 2 is True.

Answer: A

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2. Statement 1 : Critical temperature is the temperature at which a real gas.exhibits ideal behaviour considerable range of pressure.

Statement 2 : At critical point the densities of a substance in gaseous and liquid states are same. : Statement 1 is True, statement 2 is True, Statement 2 is Correct explanation for Statement 1.; Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.; Statement 1 is True, Statement 2 iş False.; Statement 1 is False, Statement 2 is True.

A. Statement 1 is True, statement 2 is True, Statement 2 is 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 iş False.

D. Statement 1 is False, Statement 2 is True.

Answer: D

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3. Assertion : Compressibility factor (Z) for non-ideal gases can be greater than 1.

Reason : Non-ideal gases always exert higher pressure than ideal gases under identical conditions expected.

A. Statement 1 is True, statement 2 is True, Statement 2 is 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 iş False.

D. Statement 1 is False, Statement 2 is True.

Answer: C

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4. Statement 1 : Real gases show ideal behaviour when the volume occupied is large so that the volume oft molecules can be neglected in comparison to it.

Statement 2 : The behaviour of the gas becomes more ideal when pressure is very low.

A. Statement 1 is True, statement 2 is True, Statement 2 is 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 iş False.

D. Statement 1 is False, Statement 2 is True.

Answer: B

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5. Statement 1. : The pressure of a fixed amount of an ideal gas is proportional to its temperature.

Statement 2 : The frequency of collisions and their impact both increase in proportion to the square root temperature.

A. Statement 1 is True, statement 2 is True, Statement 2 is 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 iş False.

D. Statement 1 is False, Statement 2 is True.

Answer: B

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LEVEL III (Linked Comprehension Type)

1. which of the following statements is correct?

A. When $Z > 1$, real gases are easier to compress than the ideal gas

B. When Z=1, real gases get compressed easily ·

C. When $Z > 1$, real gases are difficult to compress

D. When Z=1, real gases are difficult to compress

Answer: C

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2. At Boyle's temperature, compressibilitý factor Z for a real gas is:

A. $Z = 1$

B. Z = 0

C. $Z > 1$

D. $Z < 1$

Answer: A

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3. A very convenient method of study in PV deviation of real gases from ideal behaviour is through a compressibility factor (Z), Z= $\frac{PV}{nRT}$

i) Z=1, for ideal gases , ii) Z+1, for real gases

The behaviour of a real gas is usually depicted by plotting compressibility factor Z versus pressure P at a constant temperature. At high temperature and pressure, Z is usually more than one. This fact can be explained by van der Waal's equation when: the constant$a$ is negligible but not$b$, the constant b is negligible but not a, both the constants a and b are negligible, both the constants a and b are not negligible

A. the constant'a' is negligible but not'b'

B. the constant 'b' is negligible but not 'a'

C. both the constants 'a' and 'b' are negligible

D. both the constants 'a' and 'b' are not negligible

Answer: A

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4. The behaviour of a real gas. is usually depicted by plotting.compression factor Z(= pV_m / RT) versus p at a constant temperature. These plots are explained on the basis of van der Waals equation $\left(p + a / V_m^2\right)(V_m - b) = RT$

The value of Z lt 1`.is observed provided

A. p is low and $T > T_B$ (Boyle temperature)

B. p is low and T $< T_B$

C. p is low and T = T_B

D. p is high and $T < T_B$

Answer: B

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5. The behaviour of a real gas. is usually depicted by plotting.compression factor Z(= pV_m / RT) versus p at a constant temperature. These plots are explained on the basis of van der Waals equation $\left(p+a/V_m^2\right)(V_m-b)=RT$

The value of $Z>1$ is observed provided

A. p is low and $T<T_c$ (critical temperature)

B. p is low and $T<T_B$

C. p is low and $T=T_B$

D. p is high and $T>T_B$

Answer: D

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6. The behaviour of a real gas. is usually depicted by plotting.compression factor Z(= pV_m / RT) versus p at a constant temperature. These plots are explained on the basis of van der Waals equation $\left(p + a / V_m^2\right)\left(V_m - b\right) = RT$

The value of Z lt 1`.is observed provided

A. p is low and $T > T_B$

B. p is low and $T < T_B$

C. p is low and $T = T_B$

D. p is high and $T < T_B$

Answer: C

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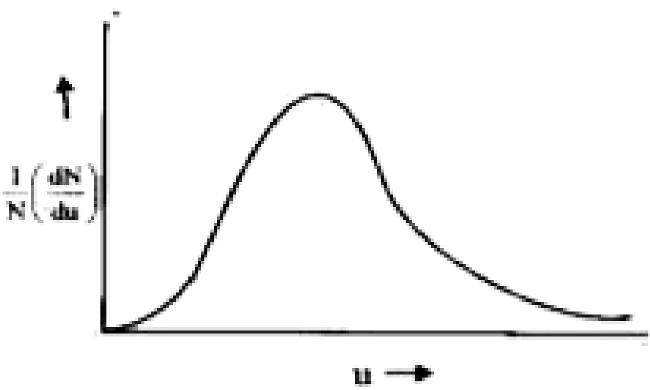
7. The fraction of gaseous molecules having speed in between u and u+ du as governed by Maxwell distribution of speeds is given by $\frac{dN_u}{N} = 4\pi\left(\frac{M}{2\pi RT}\right)^{1/2}$ exp $\left(-\mathrm{Mu}^2/2RT\right)u^2$ du

Graphically this distribution is shown in fig.



Based on this distribution, answer the following three question

With increase in temperature, the quantity (dN/N)/du in the low speed range.

A. increases

B. decreases

C. shows no change

D. increases or decreases depending upon the gas

Answer: B

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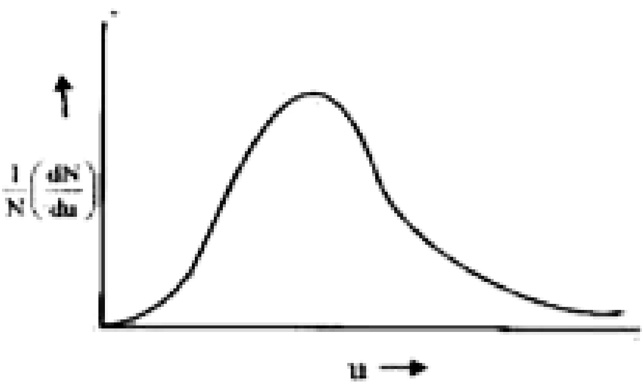
8. The fraction of gaseous molecules having speed in between u and u+ du as governed by Maxwell distribution of speeds is given by

$$\frac{dN_u}{N} = 4\pi\left(\frac{M}{2\pi RT}\right)^{1/2} \exp\left(-\mathrm{Mu}^2/2RT\right)u^2$$

du

Graphically this distribution is shown in fig.



Based on this distribution, answer the following three question

With increase in temperature, the quantity (dN/N)/du in the high speed range

A. increases

B. decreases

C. shows no change

D. increases or decreases depending upon the gas

Answer: A

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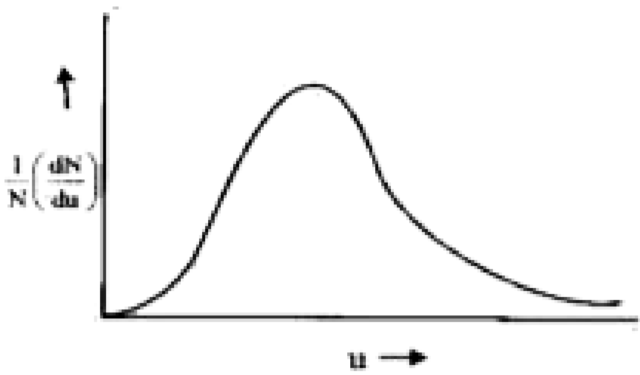
9. The fraction of gaseous molecules having speed in between u and u+ du as governed by Maxwell distribution of speeds is given by

$$\frac{dN_u}{N} = 4\pi\left(\frac{M}{2\pi RT}\right)^{1/2} \exp\left(-\mathrm{Mu}^2/2RT\right)u^2$$

du

Graphically this distribution is shown in fig.



Based on this distribution, answer the following three question

The maximum value of (dN/N)/du corresponds to most probable speed. With increase in temperature, this maximum fraction

A. increases

B. decreases

C. shows no change

D. increases or decreases depending upon the gas

Answer: B

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