CHEMISTRY

BOOKS - G.R. BATHLA & SONS CHEMISTRY (HINGLISH)

STATES OF MATTER (GASES AND LIQUIDS)

Example

1. A sample of gas occupies 10 litre under a pressure of 1 atmosphere. What will be its volume if the pressure is increased to 2 atmosphere? Assume that the temperature of the gas sample does not change

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2. A sample of a gas occupies 600 mL at $27^{\circ} C$ and 1 atm. What will be the volume at $127^{\circ} C$ if the pressure is kept constant ?

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

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4. A 1000 mL sample of a gas at $-73^{\circ}C$ and 2 atmosphere is heated to $123^{\circ}C$ and the pressure is reduced to 0.5 atmosphere. What will be the find volume ?

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5. A sample of a gas occupies a volume of 512 mL at $20^{\circ}C$ and $74cm$ of Hg as pressure. What volume would this gas occupy at STP ?

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6. $3.7gm$ of gas at $25^{\circ}C$ occupied the same volume as $0.184gm$ of hydrogen at $17^{\circ}C$ and at the same pressure. What is the molecular mass of the gas ?

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7. What is the pressure of HCl gas at $-40^{\circ}C$ if its density is $8.0kgm^{-3}$? $(R = 8.314JK^{-1}mol^{-1})$

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8. A certain quantity of a gas occupies 100 mL when collected over water at $15^{\circ}C$ and 750 mm pressure. It occupies $91.9mL$ in dry state at NTP. Find the aqueous vapour pressure at $15^\circ C$.

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9. A ballon of diameter 20 metre weighs $100kg$ Calculate its pay-load if its is filled with He at 1.0 atm and $27^\circ C$ Density of air is $1.2kg,^{-3}$

$\left[R = 0.082dm^3 \text{ atm } K^{-1}mo1^{-1}\right]$.

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10. The density of a gas is $0.259gL^{-1}$ at 400 K and 190 torr. Find its molar mass:

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11. The density of phosphorus vapour at $310^{\circ} C$ and 775 torr is $2.64 g dm^{-3}$. What is the molecular formula of phosphorus ?

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12. What percent of a sample of nitrogen must be allowed to escape if its temperature, pressure, and volume are to be changed from $220^{\circ} C, 3 atm$, and $1.65 L$ to $110^{\circ} C, 0.7 atm$, and $1 L$, respectively?

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13. The density of oxygen is $1.43gL^{-1}$ at STP. Determine the density of oxygen at $17^{\circ}C$ and 800 torr.

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14. Volume of a tyre 10 litre when inflated The tyre is inflated to a pressure of 3atm at $17^{\circ}C$ with air Due to driving the temperature of tyre increases to $47^{\circ}C$

(a) What would be the pressure at this temperature

(b) How many litre of air measured at $47^{\circ}C$ and pressure of 1 atm should be let out to restore the tyre of $3cm$ at $47^{\circ}C$? .

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15. Oxygen is present in a $1L$ flask at a pressure of $7.6 \times 10^{-10} mmHg$. Calculate the number of oxygen molecules in the flask at $0^{\circ} C$.

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16. An open flask contains air at $27^{\circ} C$ Calculate the temperature at which it should be heated so that

(a) $\frac{1}{3}$ rd of air measured at $27^{\circ} C$ escapes out

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17. A mixture of CO and CO_2 is found to have a density of $1.5gL^{-1}$ at $30^\circ C$ and 730 torr. What is the composition of the mixture ?

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18. Calculate the value of molar gas contant, 'R' in (i) cc atm $K^{-1}mol^{-1}$ (ii) torr $\mathscr{K}^{-1}mol^{-1}$ (ii) kPa litre $K^{-1}mol^{-1}$

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19. The pressure exerted by $12g$ of an ideal gas at temperature $t^{\circ}C$ in a vessel of volume $V litre$ is $1 atm$. When the temperature is increased by $10^{\circ}C$ at the same volume, the pressure increases by 10%. Calculate the temperature t and volume V. (Molecular weight of the gas is 120).

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20. A 10 litre flask contains 0.2 mole of methane, 0.3 mole of hydrogen and 0.4 mole of nitrogen at $25^{\circ}C$. What is the partial pressure of each component and what is the pressure inside the flask ?

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21. If $200mL$ of N_2 at $25^\circ C$ and a pressure of 250 mm are mixed with $350mL$ of O_2 at $25^\circ C$ and a pressure of 300 mm so that, the volume of resulting mixture is $300mL$, what would be the final pressure of the mixture at $25^\circ C$?

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22. 1.22 g of a gas measured over water at $150^\circ C$ and a pressure of 775 mm of mercury occupied 900 mL. Calculate the volume of dry gas at NTP. Vapour pressure of water at $15^\circ C$ is 14 mm.

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23. When $2g$ of a gas A is introduced into an evacuated flask kept at $25^{\circ} C$, the pressure is found to be $1 atm$. If $3g$ of another gas B is then heated in the same flask, the total pressure becomes $1.5 atm$. Assuming ideal gas behaviour, calculate the ratio of the molecular weights M_A and M_B.

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24. Find the total pressure exerted by $1.6g$ methane and $2.2g CO_2$ contained in a four litre flask at $27^{\circ} C$.

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25. 1500 mL flask contains $400 mg O_2$ and $60 mg H_2$ at $100^\circ C$.

(a) What is the total pressure in the flask ?

(b) If the mixture is permitted to react to form water vapour at $100^\circ C$, what will be left and what will be their partial pressure ?

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26. 20 dm^3 of SO_2 diffuse through a porous partition in 60 s. what volume of O_2 will diffuse under similar conditions in 30 s ?

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27. 50 volumes of hydrogen take 20 min of diffuse out of a vessel. How long will 40 volumes of oxygen take to diffuse out from the same vessel under the same conditions?

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28. Calculate the relative rates of diffusion for

$.^{235}UF_6$ and $.^{238}UF_6$.

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29. $180ml$ of hydrocarbon diffuses through a porous membrane in 15 minutes while $120ml$ of SO_2 under identical conditions diffused in 20 minutes. What is the molecular mass of the hydrocarbon ?

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30. The reaction between gaseous NH_3 and HBr produces a white solide NH_4Br. Suppose a small quantity of gaseous NH_3 and gaseous HBr are introduced simultaneously into opposite ends of an open tube which is one metre long. Calculate the distance of white solid formed from the end which was used to introduce NH_3

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31. At $27^{\circ}C$, hydrogen is leaked through a tiny hole into a vessel for $20 \min$. Another unknown gas at the same temperature and pressure as that of hydrogen is leaked through the same hole for $20 \min$. After the effusion of the gases, the mixture exerts a pressure of $6atm$. The hydrogen content of the mixture is $0.7mol$. If the volume of the container is $3L$, what is the molecular weight of the unknown gas?

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32. The ratio of rate of diffusion of gases A and B is $1:4$. If the ratio of their masses present in the mixture is $2:3$, what is the ratio of their mole fraction ?

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33. A space capsule is filled with neon gas at 1.00 atm and 290 K. The gas effuses through a pin hole into outer space at such a rate that pressure drops by 0.30 torr per second.

(a) If the capsule is filled with ammonia at the same temperature and pressure, what would be rate of pressure drop?

(b) If the capsule is filled with 30.0 mol% helium, 20.0

mol% oxygen and 50.0 mol% nitrogen at a total pressure of 1.0 atm and a temperature of 290 K, what would be the corresponding rate of pressure drop?

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34. One male of nitrogen gas at 0.8 atm takes 38 seconds on diffuse through a pinhole, whereas one mole of a compound of xenon with fluorine at 1.6 atm takes 57 secondes to diffuse through the same hole. Calculate molecular weight of the compound.

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35. $100cm^3$ of NH_3 diffuses through a pin hole in 32.5 second. How much time will 60 of N_2 take to diffuse under the same conditions ?

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36. Calculate the average kinetic energy (in joule) per molecule in $8.0g$ of methane at $27^\circ C$.

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37. Calculate the total kinetic energy of one kilo mole of Oxygen gas at $27^\circ C$

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38. Calculate the pressure exerted by 10^{23} gas molecules each of mass $10^{-22}g$ in a container of volume 1 litre the rms speed is $10^{5}cms^{-1}$

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39. Calculate the root mean square speed of an oxygen molecule at 288 K in SI units.

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40. Calculate the root mean square speed of hydrogen molecule at STP

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41. Oxygen at 1 atmosphere and $0^{\circ}C$ has a density of $1.4290 gL^{-1}$. Find the rms speed of oxygen molecule.

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42. At what temperature will hydrogen molecules have the same root mean square speed as nitrogen molecules at $27^{\circ}C$?

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43. Calculate the root mean square, average and most probable speed of oxygen at $27^{\circ} C$

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44. Calculate the average kinetic energy per mole of CO_2 gas at $27^{\circ} C$ in different units.

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45. A gas bulb of $1L$ capacity contains 2.0×10^{11} molecules of nitrogen exerting a pressure of

$7.57 \times 10^{3} Nm^{-2}$. Calculate the root mean square (rms) speed and the temperature of the gas molecules. If the ratio of the most probable speed to the root mean square is 0.82, calculate the most probable speed for these molecules at this temperature.

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46. Specific heat of a monoatomic gas at constant volume is $315 Jkg^{-1}K^{-1}$ and at a contant pressure is $525 Jkg^{-1}K^{-1}$. Calculate the molar of the gas.

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47. Calculate the pressure exerted by 16 g of methane in a 250 mL container at 300 K using van der Waal's equation. What pressure will be predicted by ideal gas equation ?

$a = 2.253 atm L^2 mol^{-2}, b = 0.0428 L mol^{-1}$

$R = 0.0821 L atm K^{-1} mol^{-1}$

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48. Calculate the temperature of the gas if it obeys van der Waal's equation from the following data. A flask of 2.5 litre contains 10 mole of a gas under 50 atm. Given

$a = 5.46 atm \text{litre}^2 mol^{-2}$ and $b = 0.031$ litre mol^{-1}

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49. Calculate the total pressure in a 10 litre cylinder which contains $0.4g$ of helium, $1.6g$ of oxygen and $1.4g$ of nitrogen at $27^{\circ} C$. Also calculate the partial pressure of helium gas in the cylinder. Assume ideal behaviour of gases. Given $R = 0.082$ litre atm $K^{-1} mol^{-1}$.

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50. An evacuated glass vessel weighs $50.0g$ when empty, $148.0g$ when filled with a liquid of density $0.98 gmL^{-1}$, and $50.5g$ when filled with an ideal gas at $760 mmHg$ at $300K$. Determine the molar mass of the gas.

A. $120g/mol$

B. $123g/mol$

C. $246g/mol$

D. $61.5g/mol$

Answer: B

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51. A vertical cylinder of height 1.52m is fitted with a movable piston of negligible mass and thickness. The lower half of the cylinder contains ideal gas and upper half is filled with Hg. The cylinder is initially at 300K. When the temperature is raised, half of the mercury comes out of cylinder. The temperature is: (Assume no thermal expansion for Hg)

A. 337.5

B. 364.5

C. 546

D. 600

Answer: A

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52. A thin tube of uniform cross-section is sealed at both ends. It lies horizontally, the middle 5 cm containing mercury and the two equal end containing air at the same pressure P. When the tube is held at an angle of 60° with the vetical direction, the length of the air column above and below the mercury column are 46 cm and 44.5 cm respectively. Calculate the pressure P in centimeters of mercury. (The temperature of the system is kept at $30^\circ C$).

A. 75.4 cm of Hg

B. 7.54 cm of Hg

C. 754 cm of Hg

D. 75.4 mm of Hg

Answer: A

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53. A 10 cm column of air is trapped by a column of Hg, 8 cm long, in a capillary tube horizontally fixed as shown below, at 1 atm pressure. Calculate the length of air column when the tube is fixed at the same temperature (a) vertically with open end uup (b) vertically with open end down .

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54. 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

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55. At what temperature is the average velocity of O_2 molecule equal to the root mean square velocity at $27^\circ C$?

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56. The composition of the equilibrium mixture for the equilibrium $Cl_2 \Leftrightarrow 2Cl$ at 1400 K may be determined by the rate of diffusion of mixture through a pin hole. It is found that at 1400 K, the mixture diffuses 1.16 times as fast as krypton diffuses under the same conditions. Find the degree of dissociation of Cl_2 equilibrium

A. 0.1374

B. 0.2748

C. 0.4122

D. 0.637

Answer: A

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57. A gasesous mixture of helium and oxygen is found to have a density of $0.518 gdm^{-3}$ at $25^{\circ} C$ and 720 torr. What is the precent by mass of helium in this mixture?

A. 19.95%

B. 39.90%

C. 9.95%

D. 30%

Answer: A

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58. Find the temperature at which 3 moles of SO_2 will occupy a volume of 10 litre at a pressure of 15 atm

$a = 6.71 atm \text{litre}^2 mol^{-2}, b = 0.0564 \text{ litre } mol^{-1}$

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59. The van der Waals constant b of Ar is $3.22 \times 10^{-5} m^3 mol^{-1}$. Calculate the molecular diameter of Ar.

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

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

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

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

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

Answer: A

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61. The density of the vapour of a substance at $1atm$ pressure and $500K$ is $0.36kgm^{-3}$. The vapour effuses through a small hole at a rate of 1.33 times faster than oxygen under the same condition.

(a) Determine (i) molecular weight, (ii) molar volume ($iii)$ compression factor(Z) of the vapour, and (iv) which forces among the gas molecules are dominating, the attractive or the repulsive?

(b) If the vapour behaves ideally at $1000K$, determine the average translational kinetic energy of a molecule.

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62. The ratio of the rate of diffusion of helium and methane under indentical conditions of pressure and temperature will be

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63. A closed tank has two compartments A and B, both filled with oxygen (assumed to be ideal gas). The partition separating the two compartments is fixed and is a perfect heat insulator (Figure 1). If the old partition is replaced by a new partition which can slide and conduct heat but does NOT allow the gas to leak across (Figure 2), the volume (in m^3) of the compartment A after the system attains equilibrium is ____.

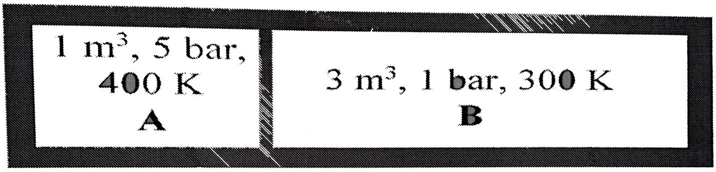

Figure 1

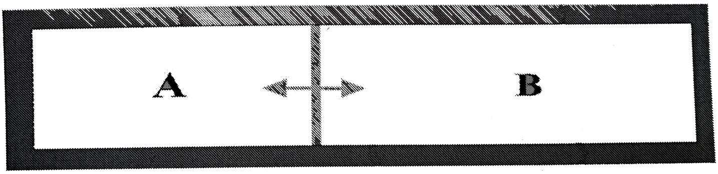

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Illustration

1. 2.5 L of a sample of a gas at $27^{\circ} C$ and 1 bar pressure is compressed to a volume of 500 mL keeping the temperature constant, the precentage increase in the pressure is:

A. 1

B. 4

C. 5

D. 0.8

Answer: B

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2. Which of the following gases will have density of $1.8gL^{-1}$ at 760 torr pressure and $27^{\circ}C$?

A. O_2

B. CO_2

C. NH_3

D. SO_2

Answer: B

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3. $10gC_2H_6$ is filled in a bulb of 1 litre capacity which can withsand a maximum pressure of 10 atm. At what temperature will the pressure of gas reach the bursting limit ?

A. $76^{\circ} C$

B. $361.4^{\circ} C$

C. $92.4^{\circ} C$

D. $120^{\circ} C$

Answer: C

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4. The vapour of phosphine gas at $27^{\circ} C$ and 3 bar pressure has density:

A. $4.09gmL^{-1}$

B. $4.14gL^{-1}$

C. $2.04kgL^{-1}$

D. $2.04gL^{-1}$

Answer: B

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5. Coefficient of volume expansion of a gas is:

A. $\frac{1}{273}$

B. $\frac{2}{273}$

C. $\frac{3}{273}$

D. $\frac{4}{273}$

Answer: A

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

A. 11.2 L

B. 22.4 L

C. 1 L

D. 10 L

Answer: C

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7. When a gas is heated from $25^{\circ} C$ to $50^{\circ} C$ at constant pressure of 1 bar, its volume :

A. increases from V to 2V

B. increases from V to 1.5 V

C. increases from V to 1.084 V

D. increases from V to 1.8 V

Answer: C

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8. The molecular weights of two ideal gases A and B are respectively 100 and 200. One gram of A occupies V litre of volume at STP. What is the volume (in litre) occupied by one gram of B at STP ?

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

B. V

C. V^2

D. $2V$

Answer: A

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9. A bubble of volume V_1 is at the bottom of a pond at $15^\circ C$ and 1.5 atm pressure. When it comes at the surface, it observes a pressure of 1 atm at $25^\circ C$ and has volume V_2, give $\left(\frac{V_2}{V_1}\right)$:

A. 15.5

B. 0.155

C. 155.0

D. 1.55

Answer: D

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10. A gas with molecular formula C_nH_{2n+2} diffuses through a porous plug at a rate $1/6th$ of the rate of diffusion of hydrogen gas under similar condtition. The formula of the gas is:

A. C_2H_6

B. $C_{10}H_{22}$

C. C_5H_{12}

D. C_6H_{14}

Answer: C

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11. Under similar conditions which of the following gases will diffuse four times as quickly as oxygen ?

A. He

B. H_2

C. N_2

D. D_2

Answer: B

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12. The rates of diffusion of hydrogen and deuterium are in the ratio:

A. $1:1$

B. $\sqrt{2}:1$

C. $4:1$

D. $1:4$

Answer: B

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13. The time taken for effusion of 64 mL of oxygen will be as the time taken for the effusion of which of the following gases under identical conditions ?

A. $64mL$ of H_2

B. $100mL$ of N_2

C. $64mL$ of CO_2

D. $45.24mL$ of SO_2

Answer: D

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14. Which of the following pairs of gses will have identical rate of effusion under similar conditions ?

A. Diprotium and dideuterium

B. Carbon dioxide and ethane

C. Dideuterium and helium

D. Ethene and ethane

Answer: C

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15. Two gases bulbs A and B are connected by a tube having a stopcock. Bulb A has a volume of $100 mL$ and contains H_2 gas . After opening the gas from A to the evacuated bulb B , the pressure falls down by 40% . The volume $(mL) of$B` must be

A. 75

B. 150

C. 125

D. 200

Answer: B

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16. At what temperature root mean sqaure of N_2 gas is equal to that of propance gas at STP conditions.

A. $173.7^{\circ} C$

B. $173.7K$

C. $273K$

D. $-40^{\circ} C$

Answer: B

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17. At what temperature is the kinetic energy of a gas molecule half of its value at $327^{\circ} C$?

A. $13.5^{\circ} C$

B. $150^{\circ} C$

C. $27^{\circ} C$

D. $-123^{\circ} C$

Answer: C

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18. The root mean square speed fo molecules of nitrogen gas is v at a certain temperature. When the temperature is doubled, the molecules dissociate into individual atoms. The new rms speed of the atom is:

A. $\sqrt{2}v$

B. $2v$

C. v

D. $4v$

Answer: B

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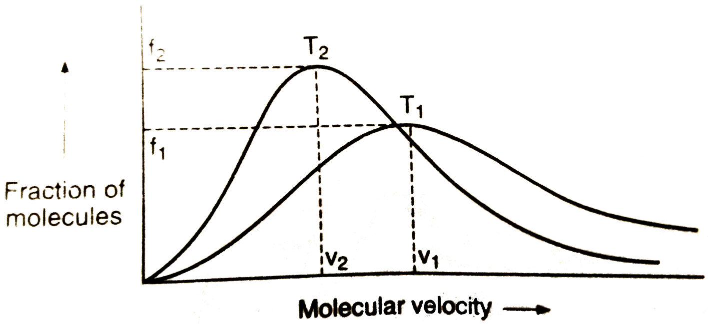
19. Plot of Maxwell's distribution of velocities is given below:



which of following is correct ?

A. $T_1 > T_2$

B. $T_1 < T_2$

C. $v_1 < v_2$

D. $f_1 > f_2$

Answer: A

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20. At what temperature is the rms speed of H_2 molecules the same as that of oxygen molecules at $1327^\circ C$?

A. $173K$

B. $100K$

C. 400 K

D. 523 K

Answer: B

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21. In the temperature of 1 mole of a gas is increased by $50^{\circ} C$. Calculate chagne in kinetic energy:

A. $62.32J$

B. $6.235J$

C. $623.5J$

D. $6235.0J$

Answer: C

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22. At same temperature, calculate the ratio of average velocity of SO_2 to CH_4:

A. $2:3$

B. $3:4$

C. $1:2$

D. $1:6$

Answer: C

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23. If the most probable velocity of methane at a certain temperature is $400ms^{-1}$, the kinetic energy of one mole of methane at the same temperature in J is:

A. 1024

B. 2048

C. 3072

D. 1920

Answer: D

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24. At high temperature and low pressure the van der Waals equation is reduced to .

A. $\left(P+\frac{a}{V^2}\right)V=RT$

B. $PV=RT$

C. $P(V-b)=RT$

D. $\left(P+\frac{a}{V^2}\right)(V-b)=RT$

Answer: B

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25. The constant 'a' in van der Waal's equaton is maximum in:

A. He

B. H_2

C. O_2

D. NH_3

Answer: D

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26. A gas described by van der Waal's equation:

A. $\left(P+\frac{a}{4V^2}\right)\left(\frac{V-b}{2}\right)=\frac{2RT}{2}$

B. $\left(P+\frac{a}{4V^2}\right)(2V-b)=RT$

C. $\left(P+\frac{a}{4V^2}\right)(2V-4b)=RT$

D. $\left(P+\frac{a}{4V^2}\right)=\frac{2RT}{2(V-b)}$

Answer: B

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27. van der Waal's constants of two gases X and Y are as given:

	$a\left(\text{litre - atom } mol^{-2}\right)$	$b\left(\text{litre } mol^{-1}\right)$
Gas X	5.6	0.065
Gas Y	5.1	0.012

What is correct about the two gases ?

A. $T_c(X) > T_c(Y)$

B. $T_c(X) = T_c(Y)$

C. $V_c(X) > V_c(Y)$

D. $V_c(Y) > V_c(X)$

Answer: C

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28. Select the correct statement about van der Waal's constant 'b'

1. It is excluded volume

2.Its unit is mol litre^{-1}

3. It depends on intermolecular force

4. Its value depends on molecular size

A. 2, 3

B. $1, 2, 4$

C. $2, 3, 4$

D. 3, 4

Answer: B

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29. Gases X, Y, Z, P and Q have the van der Waal's constants 'a' and 'b' (in CGS units) as shown below:

$$\begin{vmatrix} & X & Y & Z & P & Q \\ a & 6 & 6 & 20 & 0.05 & 30 \\ b & 0.025 & 0.15 & 0.1 & 0.02 & 0.2 \end{vmatrix}$$

The gas with the highest critical temperature is:

A. P

B. Q

C. Y

D. X

Answer: D

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30. At high pressure, van der Waal's equation becomes:

A. $PV = RT$

B. $PV = RT + \frac{a}{V}$

C. $PV = RT - \frac{a}{V}$

D. $PV = RT + Pb$

Answer: D

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Practice Problems

1. A gas occupies a volume of $250cm^3$ at 745 torr and $25^\circ C$. What additional pressure is required to reduce the volume of the gas to $200cm^2$ at the same temperature ?

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2. A vessel of $120cm^3$ contains a certain mass of a gas at $20^\circ C$ and 750 torr pressure. The gas was transferred to a vessel of volume $180cm^3$. Calculate the pressure of the gas at the same temperature

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3. A gaseous system has a volume of $580cm^3$ at a certain pressure. If its pressure in increased by 0.96 atm, its volume becomes $100cm^3$. Determine the pressure of the system

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4. A gas filled freely collapsible balloon is pushed from the surface level of a lake to a depth of 50 m. Approximately what per cent of its original volume will the balloon finally have, assuming that the gas behaves ideally and temperature is same at the surface and at 50 m depth ?

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5. A sample of gas at room temperature is placed in an evacuated bulb of volume $0.51L$ and is found to exert a pressure of $24kPa$. This bulb is connected to another evacuated bulb whose volume is $0.63L$, and the gas is allowed to fill both bulbs. What is the new pressure of the gas at room temperature ?

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6. It is desired to increase the volume of $800cm^3$ of a gas by 20% keeping the pressure constant. To what temperature should the gas be heated, if the initial temperature is $22^\circ C$?

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7. A chamber of constant volume contains hydrogen gas. When the chamber is immersed in a bath of melting ice $(0^\circ C)$ the pressure of the gas is 800 torr. What pressure will be indicated when the chamber is brought to $100^\circ C$?

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8. Calculate the volume occupied by 4.045×10^2 molecules of oxygen at $27^\circ C$ and having a pressure of 700 torr.

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9. Calculate the moles of hydrogen present in a $500 cm^3$ sample of hydrogen gas at a pressure of 760 mm of Hg and $27^\circ C$

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10. Calculate the volume occupied by 4 mole of an ideal gas at $2.5 \times 10^5 Nm^{-2}$ pressure and 300 K temperature

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11. What is the volume occupied by 11 g of carbon dioxide at $27^\circ C$ and 780 mm of Hg pressure ?

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12. A certain quantity of gas occupies $50mL$ when collected over water at $15^{\circ}C$ and $750mm$ pressure. It occupies $45.95mL$ in the dry state at NTP. Find the partial pressure of water vapour at $15^{\circ}C$.

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13. The density of a gas is found to be $2.07gL^{-1}$ at $30^{\circ}C$ and 2 atmospheric pressure. What is its density at NTP ?

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14. At the top of a mountain, the thermometer reads $0^\circ C$ and the barometer reads $700 mmHg$. At the bottom of the mountain the thermometer reads $30^\circ C$ and the pressure 760 mm Hg. Compare the density of the air at the top with that at the bottom

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15. Calculate the volume occupied by $5.0g$ of acetylene gas at $50^\circ C$ and $740 mm$ pressure.

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16. Calculate the volume occupied by 7 g of nitrogen gas at $27^\circ C$ and 750 mm Hg pressure

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17. A spherical balloon of 21 cm diameter is to be filled up with hydrogen at 1 atm, 273 K from a cylinder containing the gas at 20 atm and $27^\circ C$. If the cylinder can hold 2.82 litre of water, calculate the number of balloons that can be filled up completely.

A. 5

B. 10

C. 15

D. 20

Answer: B

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18. An open vessel at $27^\circ C$ is heated until $3/5$ of the air in it is expelled. Assuming that the volume of the vessel remains constant, find the temperature to which the vessel has been heated.

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19. A gasesous mixture of helium and oxygen is found to have a density of $0.518 gdm^{-3}$ at $25^{\circ} C$ and 720 torr. What is the precent by mass of helium in this mixture?

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20. A sample of natural gas is 85.2% methane and 14.8 % ethane by mass. What is the density of this mixute at $18^{\circ} C$ and 784 mm Hg ?

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21. 125 mL of a gas A of pressure 500 mm is mixed with 200 mL of another gas B at a pressure of 300 mm in a vessel of 150 mL capacity. What will be the total pressure of the resulting mixture if the temperature is kept contant ?

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22. Two vessels whose volumes are in the ratio $2:1$ contains nitrogen and oxygen at 800 mm and 680 mm pressure respectively, when they are connected together, what will be the pressure (in cm of Hg) of the resulting mixture ?

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23. A $10L$ flask at $298K$ contains a gaseous mixture of CO and CO_2 at a total pressure of 2.0bar if 0.20 mole of CO is present, find its partial pressure and also that of CO_2.

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24. Calculate the total pressure in a mixture of $4g$ of oxygen and $2g$ of hydrogen confined in a total volume of $1L$ at $0^\circ C$.

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25. A gas cylinder contains 55% nitrogen, 20% oxygen and 25% carbon dioxide by mass, at 760 mm pressure. Calculate the partial pressure of each gas.

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26. The density of a mixturee of O_2 and N_2 gases at 1 atm and 273 K is 0.0013 gm/mL. If partial pressure of O_2 in the mixture is A, then calculate value of 25 A.

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27. At a definite pressure and temperature, 100 mL of hydrogen diffused in 20 mintue. How long will 40 mL of oxygen take to diffuse under similar conditions ?

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28. At a given temperature and pressure, 20mL of air diffused through a porous membrance in 15 second. Calculate the volume of carbon dioxide which will diffuse in 10 seconds if the vapour density of air is 14.48

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29. At room temperature, ammonia gas at $1atm$ pressure and hydrogen chloride gas at $Patm$ pressure are allowed to effuse through identical pin holes from

opposite ends of a glass tube of $1m$ length and of uniform cross- section. Ammonium chloride is first formed at a distance of $60cm$ from the end through which HCl gas is sent in. What is the value of P?

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30. The rate of effusion of an unknown gas (X) through a pinhole is found to be 0.279 times the rate of effusion of hydrogen gas through the same pinhole, if both are at STP. What is the molecular mass of the unknwon gas ?

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31. In a 2 m long narrow tube, HCl is allowed to diffuse in the tube from one end and NH_3 from the other end. If diffusion is started at the same time, predict at what point the white fumes of NH_4Cl will form ?

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32. The composition of air is approximately 80% N_2 and $20\,\%\,O_2$ by mass. Calculate density of air at 298 K and 76 cm Hg pressure

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33. Calculate the internal energy of one gram mole of nitrogen at $150^\circ C$ assuming it to be an ideal gas

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34. Calculate the kinetic energy of 5 mole of a gas at $27^\circ C$ in erg and calorie

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35. A glass tumbler containing 243 mL of air at 100 k Pa and $20^\circ C$ is tuned upside down and immersed in a water bath to a depth of 20.5 metre. The air in the glass is compressed by the weight of water above it. Calculate the volume of air in the glass assuming the temperature and the barometric pressure have not changed.

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36. Calculate the rms speed of the molecules of ethane gas of colume 1.5 litre at 750 mm of Hg pressure

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37. The density of a gas at 1.5 atm is $1.52 g L^{-1}$. Calculate the rms speed of the molecules of the gas.

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38. At what temperature will the rms speed of hydrogen be the same as that of oxygen at $25^{\circ} C$?

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39. Calculate the average rms and most probable speed of SO_2 molecules at $27^{\circ} C$

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40. The average velocity of CO_2 at the temperature T_1 Kelvin and the most probable veloctiy at T_2 Kelvin is $9.0 \times 10^4 cms^{-1}$. Calculate the values of T_1 and T_2.

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41. How many times would the average molecular speed of nitrogen increase as its temperature is raised from $-73^\circ C$ and $127^\circ C$?

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42. A 4 : 1 molar mixture of He and CH_4 is contained in vessel at 20 per pressure. Due to a hole in the vessel the gas mixture leakes out. What is the compostion of mixture effusing out initially.

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43. Pure O_2 diffuses through an aperture in 224 second, whereas mixture of O_2 and another gas containing 80% O_2 diffuses from the same in 234 second. The molecular mass of gas will be:

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44. 56 g of nitrogen are confined to a 6 litre flask at $37^{\circ} C$. Calculate its pressure using van der Waals' eqation for nitrogen $a = 4.17 atm \text{litre}^2 mol^{-2}$ and $b = 0.037 \text{litre} \ mol^{-1}$

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45. One mole fo carbon dioxide was found to occupy a volume of 1.32 litre at $48^{\circ} C$ under a pressure of 16.4 atm. Calculate the pressure that would have been expected from

(i) the ideal gas equation,

(ii) van der Waal's equation

$\Big(a = 3.59 atm \text{litre}^2 mol^{-1}, b = 4.27 \times 10^{-3} \text{ litre } mol^{-1}$

and $R = 0.0821 \text{litre} - a \to mK^{-1} mol^{-1}\Big)$

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46. Calculate the compressibility factor for SO_2 if 1 mole of it occupies 0.35 litre at $300K$ and 50 atm pressure Comment on the result .

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47. The average velocity of gas molecules is 400 m/sec calculate its rms velocity at the same temperature.

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48. A chamber contains monoatomic 'He' at STP, determine its number density

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49. Two perfect monoatomic gases at absolute temperature T_1 and T_2 are mixed. There is no loss of

energy. Find the temperature of the mixture if the number of moles in the gases aren_1 and n_2.

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50. The speed of ten particles in metre/sec are $0, 1, 2, 3, 3, 4, 4, 5$ and 6. find (a) average speed (b0 the root mean square speed (c) most probable speed

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51. Using van der Waals equation, calculate the constant a when $2mol$ of a gas confined in a $4L$ flasks exerts a pressure of $11.0 atm$ at a temperature of $300 K$. The value of b is $0.05 L mol^{-1}$.

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52. Calculate the pressure excerted by $5 mol$ of CO_2 in $1 L$ vessel at $47^{\circ} C$ using van der Waals equation. Also report the pressure of gas if it behaves ideally in nature.

$\left(a = 3.592 atm L^2 mol^{-2}, b = 0.0427 L mol^{-1}\right)$

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53. An L.P.G. cylinder weight 14.8 kg when empty. When full, it weighs 29 kg and shows a pressure of 2.5 atm. In the course of use at $27^{\circ} C$, the weight of the full cylinder reduced to 23.2 kg. Find out the volume of $n-$ butane in cubic metres used up at $27^{\circ} C$ and 1 atm. [Mol. mass of butane = 58]

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Objective questions

1. At constant temperature the product of pressure and volume of a given amount of a gas is constant. Ths is :

A. Gay -Lussac's law

B. Charles' law

C. Boyle's law

D. pressure law

Answer: C

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2. A curve drawn at constant temperature is called an isotherm. This shown the relationship between :

A. $P \quad \text{and} \quad \frac{1}{V}$

B. $PV \quad \text{and} \quad V$

C. $V \quad \text{and} \quad \frac{1}{P}$

D. $P \quad \text{and} \quad V$

Answer: D

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3. Charles' law is represented mathematically as :

A. $V_t = KV_0t$

B. $V_t = \frac{KV_0}{t}$

C. $V_t = V_0\left(1 + \frac{273}{t}\right)$

D. $V_t = V_0\left(1 + \frac{t}{273}\right)$

Answer: D

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4. In general gas equation, $PV = nRT$, V is the volume of :

A. n moles of a gas

B. any amount of a gas

C. one mole of a gas

D. one gram of a gas

Answer: A

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5. For the given ideal gas equation $PV = nRT$, answer the following questions:

In the above equation, the value of universal gas constant depends only upon

A. the nature of the gas

B. the units of measurement

C. the pressure of the gas

D. the temperature of the gas

Answer: B

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6. The value of gas contant per degree per mol is approximately :

A. 1 cal

B. 2 cal

C. 3 cal

D. 4 cal

Answer: B

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7. Which one of the following is not the value of R ?

A. $1.99 cal K^{-1} mol^{-1}$

B. $0.0821 \text{litre} - atm K^{-1} mol^{-1}$

C. $9.8 kcal K^{-1} mol^{-1}$

D. $8.3JK^{-1}mol^{-1}$

Answer: C

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8. One litre of a gas collected at NTP will occupy at 2 atmospheric pressure and $27^{\circ}C$

A. $\frac{300}{2 \times 273}$ litre

B. $\frac{2 \times 300}{273}$ litre

C. $\frac{273}{2 \times 300}$ litre

D. $\frac{2 \times 273}{300}$ litre

Answer: A

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9. If $10g$ of a gas at atmospheric pressure is cooled from $273^{\circ}C$ to $0^{\circ}C$, keeping the volume constant, its pressure would become

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

B. $\frac{1}{273}atm$

C. $2atm$

D. 273 atm

Answer: A

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10. 56 g of nitrogen and 96 g of oxygen are mixed isothermally at a total pressure of 10 atm. The partial pressures of oxygen and nitrogen (in atm) are respectively:

A. 4, 6

B. 5, 5

C. 2, 8

D. 8, 2

Answer: A

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11. 273 mL of a gas at STP was taken to $27^{\circ} C$ and 600 mm pressure. The final volume of the gas would be :

A. 273 mL

B. 300 mL

C. 380 mL

D. 586 mL

Answer: C

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12. The density of the gas is equal to:

[P = Pressure, V = Volume, T = Temperature, R = Gas constant, n = number of mole, M = molecular mass

A. nP

B. MP/RT

C. P/RT

D. M/V

Answer: B

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13. The density of a gas is $1.964 g dm^{-3}$ at 273 K and 76 cm Hg. The gas is:

A. CH_4

B. C_2H_6

C. CO_2

D. Xe

Answer: C

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14. Compressed oxygen is sold at a pressure of 100 atmosphere in a cylinder of 49 litre. The number of moles of oxygen in the cylinder is:

A. 400

B. 100

C. 300

D. 200

Answer: D

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15. One gram mole of a gas at NTP occupies 22.4 litre as volume. This fact was derived from :

A. Dalton's theory

B. Avogardro's hypothesis

C. Berzelius hypothesis

D. law of gaseous volumes

Answer: B

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16. 4.4 g of CO_2 contains how many litre of CO_2 at STP ?

A. 2.4 litre

B. 2.24 litre

C. 44 litre

D. 22.4 litre

Answer: B

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17. Five grams each of the following gases at $87^{\circ} C$ and 750 mm pressure are taken. Which of them will have the least volume ?

A. HF

B. HCl

C. HBr

D. HI

Answer: D

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18. If molecular mass of O_2 and SO_2 are 32 and 64 respectively. If one litre of O_2 at $15^\circ C$ and 759mm pressure contains N molecules, the number of molecuels in two litre of SO_2 under the same conditions of temperature and pressure will be:

A. $2N$

B. N

C. $N/2$

D. $4N$

Answer: A

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19. The rate of diffusion of a gas is

A. directly proportional to its density

B. directly proportional to its molecular mass

C. directly proportional to the square of its molecular mass

D. inversely proportional to the square root of its molecular mass

Answer: D

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20. The rate of diffusion of hydrogen is about:

A. one-half that of helium

B. 1.4 times that of helium

C. twice that of helium

D. four times that of helium

Answer: B

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21. The rate of diffusion of methane at a given temperature is twice that of a gas X. The molecular weight of X is

A. 64.0

B. 32.0

C. 4.0

D. 8.0

Answer: A

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22. Some moles of O_2 diffuse through a small opening in 18 second. Same number of moles of an unknown gas diffuse through the same opening in 45 second. Molecular mass of the unknown gas is

A. $32 \times \frac{(45)^2}{(18)^2}$

B. $32 \times \frac{(18)^2}{(45)^2}$

C. $(32)^2 \times \frac{45}{18}$

D. $(32)^2 \times \frac{18}{45}$

Answer: A

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23. The critical temperature of a gas is that temperature:

A. above which it can no longer remain in the gaseous state

B. above which it cannot be liquefied by pressure

C. at which it solidifies

D. at which the volume of the gas becomes zero

Answer: B

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24. The van der Waals' equation for a real gas is:

A. $\left(P+\frac{a}{V^2}\right)(V-b)=nRT$

B. $\left(P+\frac{an^2}{V^2}\right)(V-b)=nRT$

C. $\left(P+\frac{a}{V^2}\right)(V+b)=nRT$

D. $P=\frac{nRT}{(V-nb)}-\frac{n^2a}{V^2}$

Answer: D

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25. Non-ideal gases approach ideal behaviour at:

A. high temperature and high pressure

B. high temperature and low pressure

C. low temperature and high pressure

D. low temperature and low pressure

Answer: B

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26. A 5 litre flask containing $1.0g$ of hydrogen is heated from $300K$ to $600K$ Which of the following statement are correct ? .

A. The rate of collision increases

B. The energy of gaseous molecules increases

C. The number of mole of the gas increases

D. Pressure of the gas increases.

Answer: C

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27. Association of molecules in water is due to:

A. covalent bonding

B. hydrogen bonding

C. ionic bonding

D. van der Waals' forces

Answer: B

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28. Which of the following statements is wrong ?

A. Evaporation is a spontaneous process

B. Evaporation is a surface phenomenon

C. Vapour pressure decreases with increase of temperature

D. The vapour pressure of a solution is always less than the vapour pressure of a pure solvent

Answer: C

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29. Which one of the following is the wrong statement about the liquid ?

A. It has intermolecular force of attraction

B. Evaporation of liquid increases with decreases of surface area

C. It resembles a gas near the critical temperature

D. It is an intermediate state between gaseous and solid state.

Answer: B

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30. Water boils at lower temperature on high altitude because:

A. atmospheric pressure is low there

B. atmospheric pressure is high there

C. water is weakly hydrogen bonded there

D. water in pure form is found there

Answer: A

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31. When a student was given a viscometer, the liquid was sucked with difficulty, the liquid may be:

A. benzene

B. toluene

C. water

D. glycerine

Answer: D

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32. Mark the statement which is correct:

A. Surface tension of a liquid increases with temperature

B. Addition of chemicals reduces the surface tension of a liquid

C. Stalagmomter is used for measuring viscosity of the liquid.

D. Viscosity of the liquid does not depend on intermolecular forces.

Answer: B

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33. With the increasing molecular mass of a liquid the velocity:

A. decreases

B. increases

C. no effect

D. all are wrong

Answer: B

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34. The viscosity of which of the following liquid is the maximum.

A. Water

B. Glycol

C. Acetone

D. Ethanol

Answer: B

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35. The rise of a liquid in a capillary tube is due to :

A. viscosity

B. osmosis

C. diffusion

D. surface tension

Answer: D

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36. If η_1 and η_2 are the coefficients of viscosity of two liquids, d_1 and d_2 their densities and t_1 and t_2 the flow times in Ostwald viscometer, then:

A. $\frac{\eta_1}{\eta_2} = \frac{d_1 t_2}{d_2 t_1}$

B. $\frac{\eta_1}{\eta_2} = \frac{d_2 t_2}{d_1 t_1}$

C. $\frac{\eta_1}{\eta_2} = \frac{d_1 t_1}{d_2 t_2}$

D. $\frac{\eta_1}{\eta_2} = \frac{d_2 t_1}{d_1 t_2}$

Answer: C

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37. The rms speed of hydrogen molecules at room temperature is $2400 ms^{-1}$. At room temperature the rms speed of oxygen molecules would be:

A. $400ms^{-1}$

B. $300ms^{-1}$

C. $600ms^{-1}$

D. $1600ms^{-1}$

Answer: C

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38. The molecules of which of the following gas have highest speed ?

A. Hydrogen at $-50^{\circ}C$

B. Methane at 298 K

C. Nitrogen at $1000^{\circ}C$

D. Oxygen at $0^{\circ}C$

Answer: A

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39. Consider a mixture of oxygen and hydrogen kept at room temperature, As compared to a hydrogen molecule an oxygen molecule hits the wall

A. With greater average kinetic energy

B. With smaller average kinetic energy

C. With smaller average speed

D. With smaller average speed and smaller average kinetic energy

Answer: C

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40. XmL of H_2 gas effuses through a hole in a container in $5s$. The time taken for the effusion of the same volume of the gas specified below, under identical conditions, is

A. 10 Second : He

B. 20 second : O_2

C. 25 second : CO

D. 55 second : CO_2

Answer: B

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41. If the universal gas constant is 8.3 joule $mol^{-1}K^{-1}$ and the Avogadro's number is 6×10^{23}. The mean kinetic energy of the oxygen molecules at $327^{\circ}C$ will be :

A. 415×10^{23} joule

B. 2490×10^{-22} joule

C. 1245×10^{-23} joule

D. 830×10^{-22} joule

Answer: C

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42. If increase in temperature and volume of air ideal gas is two times, then intitial pressure of P changes to:

A. 4P

B. 2P

C. P

D. 3P

Answer: C

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43. The average kinetic energy of one molecule of an ideal gas at $27^{\circ}C$ and 1 atm pressure is:

A. $900 cal K^{-1} mol^{-1}$

B. $6.21 \times 10^{-21} JK^{-1} \text{molecule}^{-1}$

C. $336.7 JK^{-1} \text{molecule}^{-1}$

D. $3741.3 JK^{-1} mol^{-1}$

Answer: B

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44. The respective speeds of five molecules are 2, 1.5, 1.6, 1.6 and 1.2 km/sec. The most probable speed in km/sec will be:

A. 2

B. 1.58

C. 1.6

D. 1.31

Answer: D

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45. If one mole of a monoatomic gas $(\gamma = 5/3)$ is mixed with one mole of a diatomic gas $(\gamma = 7/5)$ the value of γ for the mixture is .

A. 1.40

B. 1.50

C. 1.53

D. 3.07

Answer: B

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46. The root mean square speed of hydrogen molecules of an ideal hydrogen gas kept in a gas chamber at $0^{\circ} C$ is 3180 m/s. The pressure on the hydrogen gas is ....

(Density of hydrogen gas is $8.99 \times 10^{-2} kg/m^3$, 1 atmosphere= $1.01 \times 10^5 \frac{N}{m^2}$

A. 1.0 atmosphere

B. 1.5 atmoshpere

C. 2.0 atmosphere

D. 3.0 atmosphere

Answer: D

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47. CH_4 diffuse two times faster than a gas X. The number of molecules present in 32 g of gas X is: (N is Avogardro number)

A. N

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

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

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

Answer: B

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48. At what temperature would the rms speed of a gas molecule have twice its value at $100^{\circ}C$

A. 4192 K

B. 1492 K

C. 9142 K

D. 2491 K

Answer: B

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49. Find the rms speed of an argon molecule at $27^{\circ}C$

(Molecular weight of argon = 40 gm/mol)

A. $234.2m / s$

B. $342.2m / s$

C. $432.2m / s$

D. $243.2m / s$

Answer: C

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50. At a temperature T, K, the pressure of $4.0gm$ argon in a bulb is P. The bulb is put in a bath having temperature higher by $50K$ than the first one 0.8 of argon gas had to be removed to maintain original pressure. The temperature T is

A. 510 K

B. 200 K

C. 100 K

D. 73 K

Answer: B

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51. At $25^\circ C$ and 730 mm pressure, 380 mL of dry oxygen was collected. If the temperature is constant, what volume will be oxygen occupy at $760mm$ pressure ?

A. 265 mL

B. 365 mL

C. 569 mL

D. 621 mL

Answer: B

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52. Which of the following expressions regarding the unit of coefficient of viscosity is not true?

A. dyne cm^{-2} sec

B. dyne $cm^{2}\sec^{-1}$

C. Nm^{-2} sec

D. 1 poise $= 10^{-1} Nm^{-2}$ sec

Answer: B

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53. The boiling point of water, ethyl alcohol and diethyl ether are $100^{\circ} C, 78.5^{\circ} C$ respectively. The intermolecular forces will be in the order of:

A. water $>$ ethyl alcohol $>$ diethyl ether

B. ethyl alcohol $>$ water $>$ diethyl ether

C. diethyl ether $>$ ethyl alcohol $>$ water

D. diethyl ether $>$ water $>$ ethyl alcohol

Answer: A

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54. A bubble of gas released at the bottom of a lake increases to four 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 high, what is the depth of the lake?

A. 80 m

B. 90 m

C. 40 m

D. 70 m

Answer: D

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55. The increasing order of effusion among the gases H_2, O_2, NH_3 and CO_2 is

A. H_2, CO_2, NH_3, O_2

B. H_2, NH_3, O_2, CO_2

C. H_2, O_2, NH_3, CO_2

D. CO_2, O_2, NH_3, H_2

Answer: D

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56. According to Graham's law, at a given temperature, the ratio of the rates of diffusion r_A / r_B of gases A and B is given by

A. $\frac{P_A}{P_B} \cdot \left(\frac{M_A}{M_B}\right)^{1/2}$

B. $\frac{M_A}{M_B} \cdot \left(\frac{P_A}{P_B}\right)^{1/2}$

C. $\frac{P_A}{P_B} \cdot \left(\frac{M_B}{M_A}\right)^{1/2}$

D. $\frac{M_A}{M_B} \cdot \left(\frac{P_B}{P_A}\right)^{1/2}$

Answer: C

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57. The root mean square velocity of an ideal gas to constant pressure varies with density (d) as

A. d^2

B. d

C. $\sqrt{d}$

D. $1/\sqrt{d}$

Answer: D

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58. Match the following

	List- I		List II
A	Inversion temperature	(i)	a/Rb
B	Boyle's temperature	(ii)	$8a/27Rb$
C	Critical temperature	(iii)	$2a/Rb$

A. $A-(i), B-(ii), C-(iii)$

B. $A-(iii), B-(ii), C-(i)$

C. $A-(iii), B-(i), C-(ii)$

D. $A-(i), B-(iii), C-(ii)$

Answer: C

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59. For three different gases values of van der Waals' constant 'a' and 'b' are given. What is the correct order of liquefaction of gases ?

Gases	a	b
X_2	1.3	0.090
Y_2	4.1	0.023
Z_2	2.2	0.075

A. $X_2 > Y_2 > Z_2$

B. $Y_2 > Z_2 > X_2$

C. $Z_2 > Y_2 > X_2$

D. $X_2 > Z_2 > Y_2$

Answer: B

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60. Match the following

	List -I		List -II
A	P_c	(i)	$3b$
B	V_c	(ii)	$8a/27bR$
C	T_c	(iii)	$a/27b^2$

A. $A-(i), B-(ii), C-(iii)$

B. $A-(iii), B-(ii), C-(i)$

C. $A-(ii), B-(iii), C-(i)$

D. $A-(iii), B-(i), C-(ii)$

Answer: D

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61. By what factor does the average velocity of a gaseous molecule increase when the temperature (in Kelvin) is doubled?

A. 1.4

B. 2

C. 2.8

D. 4.0

Answer: A

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62. The van der Waals' constant 'a' for the gases O_2, N_2, NH_3 and CH_4 are 1.36, 1.39, 4.17 and 2.253 respectively, the gas which can be most easily liquefied is :

A. O_2

B. N_2

C. CH_4

D. NH_2

Answer: D

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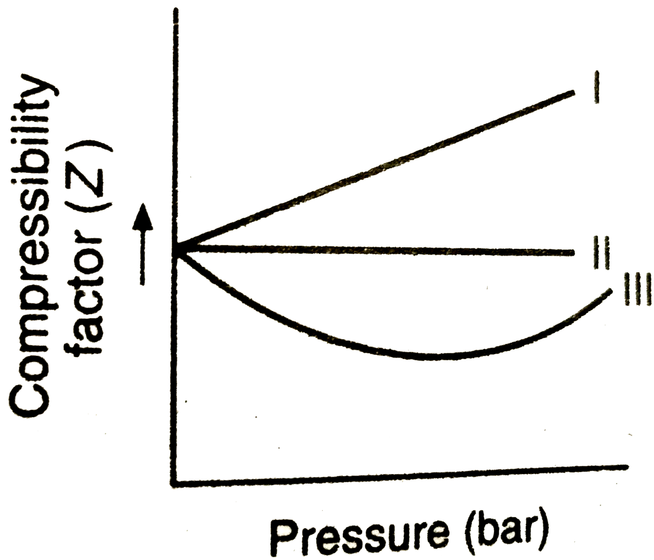
63. The Boyle temperature of three gases are given in the table :

Gas	Boyle Temperature (K)
Ethene	735
Oxygen	400
Hydrigen	110

If the compressibility factor was measured at 400 K, the gases are :



A. I-ethene, II-oxygen, III-hydrogen

B. I-hydrogen, II-ethene, III-oxygen

C. I-hydrogen, II-oxygen, III-ethene

D. I-oxygen, II-ethene, III-hydrogen

Answer: C

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64. Joule-Thomson coefficient is zero at:

A. critical temperature

B. inversion temperature

C. absolute temperature

D. Boyle's temperature

Answer: A

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65. Two gases A and B having the same volume diffuse through a porous partition in 20 and 10 seconds respectively, the molecular mass of 'A' is 49 amu. Molecular mass of 'b' will be:

A. 25 amu

B. 50 amu

C. 12.25 amu

D. 6.50 amu

Answer: C

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66. 5 g of unknown gas has pressure P at a temperature T K in a vessel. On increasing the temperature by $50^{\circ} C$, 1 g of the gas was given out to maintain the pressure P. The original temperature was :

A. 73 K

B. 100 K

C. 200 K

D. none of these

Answer: B

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67. Which of the following expressions correctly represents the relationship between the average molar kinetic energies (KE) of CO and N_2 molecules at the same temperature?

A. $\overline{KE_{CO}} = \overline{KE_{N_2}}$

B. $\overline{KE_{CO}} > \overline{KE_{N_2}}$

C. $\overline{KE_{CO}} < \overline{KE_{N_2}}$

D. Cannot be predicted unless the volumes of the gases are given

Answer: A

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68. Which of the following exhibits the weakest intermolecular forces?

A. NH_3

B. HCl

C. He

D. H_2O

Answer: C

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69. The compressibility of a gas is less than unity at STP, therefore,

A. $V_m > 22.4$ litre

B. $V_m < 22.4$ litre

C. $V_m = 22.4$ litre

D. $V_m = 44.8$ litre

Answer: B

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70. The compressibilty factor for a real gas at high pressure is:

A. $1+\frac{RT}{Pb}$

B. 1

C. $1+\frac{Pb}{RT}$

D. $1-\frac{Pb}{RT}$

Answer: C

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71. The rms velocity of hydrogen is $\sqrt{7}$ times the rms velocity of nitrogen. If T is the temperature of the gas :

A. $T(H_2) = T(N_2)$

B. $T(H_2) > T(N_2)$

C. $T(H_2) < T(N_2)$

D. $T(H_2) = \sqrt{7}T(N_2)$

Answer: C

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72. Kinetic energy of a molecule is zero at $0^\circ C$

A. zero

B. 3408 J

C. 2 cal

D. $5.66 \times 10^{-21} J$

Answer: D

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73. Densities of two gases are in the ratio $1:2$ and their temperatures are in the ratio $2:1$, then the ratio of their respective pressure is

A. $1:1$

B. $1:2$

C. $2:1$

D. $4:1$

Answer: A

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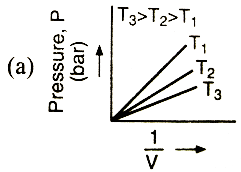
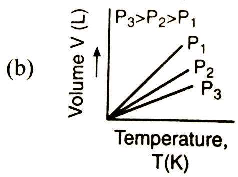
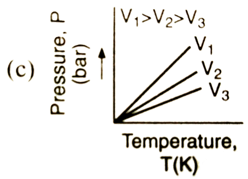
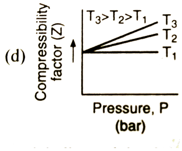
74. For a fixed mass of an ideal gas the correct representation is:

A. 

B. 

C. 

D. 

Answer: B

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75. 4.4 g of a gas at STP occupies a volume of 2.24 L. The gas can be :

A. O_2

B. CO

C. NO_2

D. CO_2

Answer: D

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76. At $0^\circ C$ and one atm pressure, a gas occupies 100 cc. If the pressure is increased to one and a half-time and temprature is increased by one-third of absolute temperature, then final volume of the gas will be:

A. 80 cc

B. 88.9

C. 66.7

D. 100

Answer: B

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77. Calculate the total pressure in a mixture of $4g$ of oxygen and $2g$ of hydrogen confined in a total volume of $1L$ at $0^\circ C$.

A. 25.215 atm

B. 31.205 atm

C. 45.215 atm

D. 15.210 atm

Answer: A

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78. Density ratio of O_2 and H_2 is $16:1$. The ratio of their rms velocities will be :

A. $4:1$

B. $1:16$

C. $1:4$

D. $16:1$

Answer: C

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79. The rate of diffusion of a gas having molecular weight just double of nitrogen gas is $56mLs^{-1}$. The rate of diffusion of nitrgoen will be :

A. $79.19mLs^{-1}$

B. $112.0mLs^{-1}$

C. $56mLs^{-1}$

D. $90.0mLs^{-1}$

Answer: A

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80. The density of air is 0.00130 g/mL. The vapour density of air will be :

A. 0.00065

B. 0.65

C. 14.4816

D. 14.56

Answer: D

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81. For an ideal gas, number of moles per litre in terms of its pressure P, gas constant R and temperature T is

A. PT/R

B. PRT

C. P/RT

D. RT/P

Answer: C

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82. The following is a method to determine the surface tension of liquids :

A. single capillary method

B. refractometic method

C. polarimetric method

D. boiling point method

Answer: A

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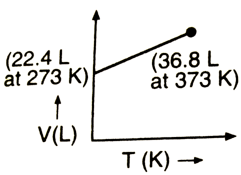
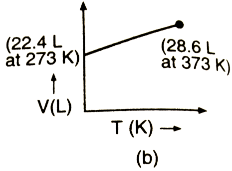
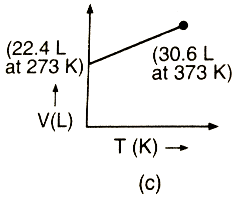
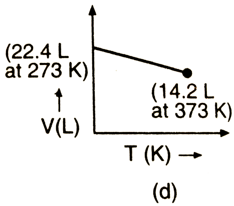
83. Which of the following volume-temperature $(V - I)$ plots represents the behaviour of 1mole of an ideal gas at the atmospheric pressure?

A. 

(a)

B. 

C. 

D. 

Answer: C

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84. The maximum number of molecules is present in

A. 15 L of H_2 gas at STP

B. 5 L of N_2 gas at STP

C. 0.5 g of H_2 gas

D. 10 g of O_2 gas

Answer: A

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85. The root mean square speed of one mole of a monoatomic gas having molecular mass M is u_{rms} The relation between the average kinetic energy (E) of the gas and $u_9rms)$ is .

A. $U_{rms} = \sqrt{\frac{3E}{2M}}$

B. $U_{rms} = \sqrt{\frac{2E}{3M}}$

C. $U_{rms} = \sqrt{\frac{2E}{M}}$

D. $U_{rms} = \sqrt{\frac{E}{3M}}$

Answer: B

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86. Which of the following is not a property of liquid state ?

A. Intermolecular force of attraction in a liquid is quite large

B. All liquids accompanied by cooling on evaporation

C. Lower the boiling point of a liquid, greater is its vapour pressure at room temperature

D. A liquid boils at higher temperature at the top of a mountain than at the sea level

Answer: D

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87. A one litre glass bulb is evacuated and weighed. The weight is 500 g. It is then filled with an ideal gas at 1 atm pressure at 312.5 K. The weight of the filled bulb is 501.2

g. The molar weight of the gas is : $(R = 8 \times 10^{-2} LatmK^{-1}mol^{-1})$

A. 28

B. 32

C. 30

D. 24

Answer: C

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

A. The most probable speed increases.

B. The fraction of the molecules with 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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89. A gas can be liquefied

A. above its critical temperature

B. at its critical temperature

C. below its critical tempeature

D. at any temperature

Answer: C

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90. To what temperature must a neon gas sample be heated to double its pressure, if the initial volume of gas at $75^{\circ} C$ is decreased by 15.0% by cooling the gas

A. $319^{\circ} C$

B. $592^{\circ} C$

C. $128^{\circ} C$

D. $60^{\circ} C$

Answer: A

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91. Which of the following liquids has the maximum surface tension at a given temperature ?

A. C_2H_5OH

B. CH_3OH

C. H_2O

D. C_6H_6

Answer: C

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92. If a volume containing gas is compressed to half, how many moles of gas remained in the vessel ?

A. Just double

B. just half

C. same

D. More than double

Answer: C

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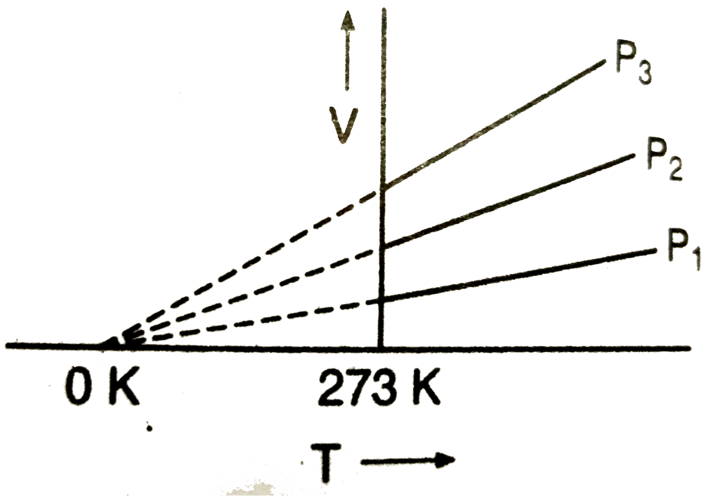
93. The volume-temperature graphs of a given mass of an ideal gas at constant pressure are shown below. What is the correct order of pressure ?



A. $P_1 > P_3 > P_2$

B. $P_1 > P_2 > P_3$

C. $P_2 > P_3 > P_1$

D. $P_2 > P_1 > P_3$

Answer: B

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

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

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

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

Answer: D

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95. a' and 'b' are van der Waals' constants for gases Chlorine is more easily liquefied than ethane because .

A. a' for $Cl_2 > 'a'$ for C_2H_6 but 'b' for $Cl_2 < 'b'$ for C_2H_6

B. a' and 'b' for $Cl_2 > 'a'$ and 'b' for C_2H_6

C. a' and 'b' for $Cl_2 < 'a'$ and 'b' for C_2H_6

D. a' for $Cl_2 < 'a'$ for C_2H_6 but 'b' for $Cl_2 > 'b'$

Answer: A

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96. The term that corrects for the attractive forces present in a real gas in the van der Waal's equation is

A. nb

B. $\frac{an^2}{V^2}$

C. $\frac{-an^2}{V^2}$

D. $-nb$

Answer: B

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97. The van der Waals' coefficient of the inert gases He, Ar and Xe are given below :

Inert Gas	$a(\text{atm } dm^6 mol^{-2})$	$b(10^{-2} dm^3 mol^{-1})$
He	0.34	2.38
Ar	1.337	3.20
Xe	4.137	5.16

Choose the appropriate pair to complete the following statement, "The increase in the value of 'a' signifies the increasing importance of .... interaction while increase in the value of 'b' is due to...."

A. Ion-ion, increased atomic volume

B. Induced dipole-induced depole, increased atomic volume

C. Induced dipole-dipole, dipole-dipole interaction

D. Dipole-dipole, decreasing ionization energies.

Answer: B

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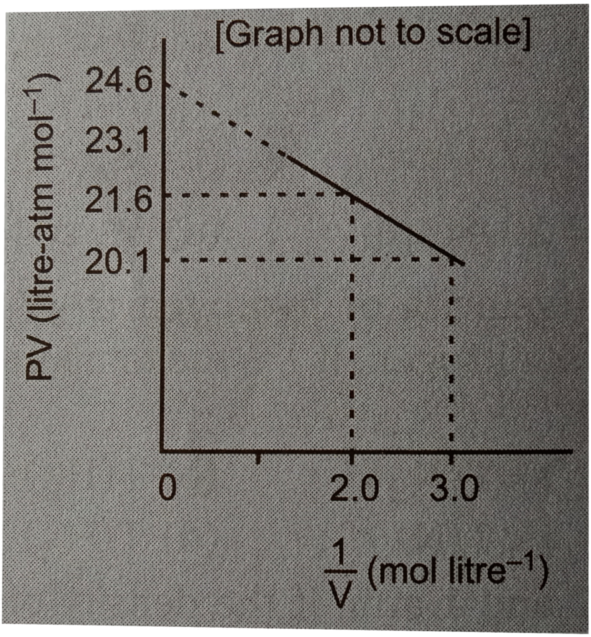
98. For one mole of a van der Waals gas when $b = 0$ and $T = 30K$ the $PV vs 1/V$ plot is shown below The value of the van Waals constant a $\left(\text{atm litre}^2 mol^{-2}\right)$ is



A. 1.0

B. 4.5

C. 1.5

D. 3.0

Answer: C

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99. For gaseous state, if most probable speed is denoted by C^* average speed by $\overline{C}$ and root square speed by C, then for a large number of molecules, the ratios of these speeds are

A. $\dot{C}:\overline{C}:C = 1:1.128:1.225$

B. $\dot{C} : \overline{C} : C = 1 : 1.225 : 1.128$

C. $\dot{C} : \overline{C} : C = 1.225 : 1.128 : 1$

D. $\dot{C} : \overline{C} : C = 1.128 : 1.225 : 1$

Answer: A

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100. If Z is a compressibility factor, van der Waals' equation at low pressure can be written as

A. $Z = 1 - \frac{Pb}{RT}$

B. $Z = 1 + \frac{Pb}{RT}$

C. $Z = 1 + \frac{RT}{Pb}$

D. $Z = 1 - \frac{a}{VRT}$

Answer: D

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101. The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is

A. hydrogen bond

B. ion-ion interaction

C. ion-dipole interaction

D. London force

Answer: C

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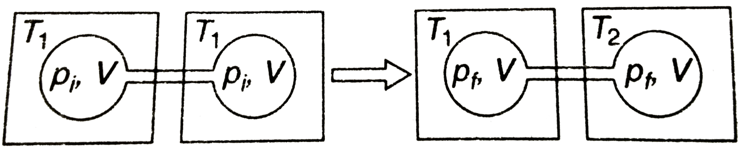
102. Two closed bulbs of equal volume (V) containing an ideal gas initially at pressure P_i and temperature T_1 are connected through a narrow tube of negligible volume as shown in the figure below. The temperature of one of the bulbs is then raised to T_2. The final pressure P_f is :



A. $p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$

B. $2p_i\left(\frac{T_1}{T_1+T_2}\right)$

C. $2P_i\left(\frac{T_2}{T_1+T_2}\right)$

D. $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$

Answer: C

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103. The process of real gases is less than the pressure of an ideal gas because of:

A. Intermolecular attraction

B. Finite size of particles

C. Increase in the number of collisions

D. Increase in the kinetic energy of the molecules

Answer: A

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104. If the rms speed of nitrogen at a certain temperature is 3000 ms^{-1}, the approximate kinetic energy of one mole of nitrogen at that temperature in kJ is :

A. 9.0

B. 126.0

C. 90.0

D. 12.6

Answer: B

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105. The compressibility factor for an ideal gas is

A. 0

B. 1

C. -1

D. $+2$

Answer: B

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Set 2

1. If force of attraction between the molecules is negligible, van der Waals' equation (for one mole) will become:

A. $PV = RT + Pb$

B. $P + \frac{RT}{V-b} - \frac{a}{V^2}$

C. $PV = RT + a/V$

D. $PV = RT - a/V$

Answer: A

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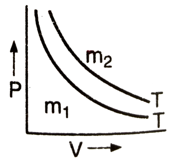
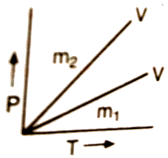
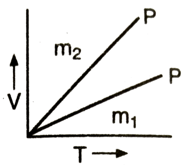
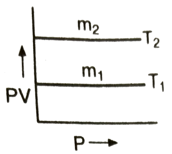
2. If m_1, m_2 are masses of an ideal gas, then which of the graph represents $m_2 > m_1$?.

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: A::B::C

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3. van der Waals' constants for three different gases are given :

Gases	a	b
X	3.0	0.025
Y	10.0	0.030
Z	6.0	0.035

Which is correct ?

A. Maximum critical temperature $-Y$

B. Most ideal behaviour $-X$

C. Maximum molecular voume $-Z$

D. All are correct

Answer: D

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4. What is the ratio of mean speed of an O_3 molecule to the rms speed of an O_3 molecule to the rms speed of an O_2 molecule at the same T ?

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

B. $(16/9\pi)^{1/2}$

C. $(3\pi)^{1/2}$

D. $(4\pi/9)^{1/2}$

Answer: B

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5. Boyle's law may be expressed as

A. $\left(\frac{dP}{dV}\right)_T = K/V$

B. $\left(\frac{dP}{dV}\right)_T = -\frac{K}{V}$

C. $\left(\frac{dP}{dV}\right) = -\frac{K}{V^2}$

D. $\left(\frac{dP}{dV}\right)_T = \frac{K}{V^2}$

Answer: A

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6. If the pressure of a gas contained in a closed vessel is increased by 0.4% when heated by $1^\circ C$, then its initial temperature must be:

A. 100 K

B. $100^\circ C$

C. $250K$

D. $250^\circ C$

Answer: A

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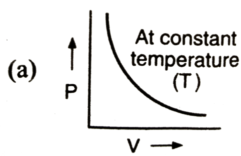
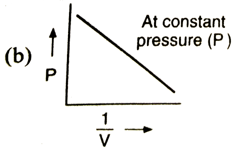
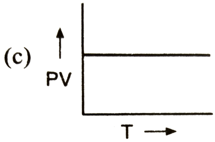
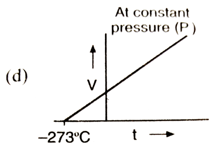
7. The graph that does represent the behaviour of an ideal gas is :

A. 

B. 

C. 

D. 

Answer: B::C

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8. According to Charles' law :

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

B. $\left(\frac{dV}{dT}\right)_P = K$

C. $\left(\frac{dT}{dV}\right)_P = K$

D. $\left(\frac{1}{T} - \frac{V}{T^2}\right)_P = 0$

Answer: B::C::D

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9. In the following statements :

(A) Ideal gases are liquefied only at very low temperature

(B) Ideal gases cannot be liquefied

(C) Ideal gas behaviour is observed by real gases at low pressure

(D) Ideal gases do not exist

The correct statements are :

A. A, B, C and D

B. A, B and C

C. B, C and D

D. C and D

Answer: C

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10. Which of the following relationships is/are not true ?

A. Most probable velocity $= \sqrt{\frac{2RT}{M}}$

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

C. Compressibility factor $Z = \frac{PV}{nRT}$

D. Average kinetic energy of gas $=\frac{1}{2}kT$

Answer: D

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11. According to kinetic theory of gases, for a datomic molecule.

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

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

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

D. the mean translatioal KE of the molecule is directly proportional to the absolute temperature

Answer: B::D

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12. A gas described by van der Waals equation .

A. behaves similare to an ideal gas in the limit of large molar volume

B. behaves similar to an ideal gas in the limit of lare pressure

C. is characterised by van der Waals' constant that are dependent on identity of the gas but are independent of the temperature

D. has the pressure that is lower than the pressure exerted by the same behaving ideally

Answer: A::C

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13. According to kinetic theory of gases:

A. collisions are always elastic

B. heavier molecules transfer more momentum of the wall of 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::C::D

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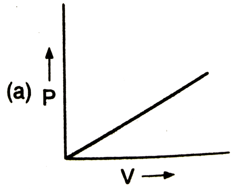
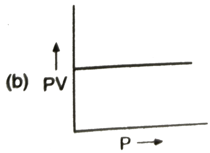
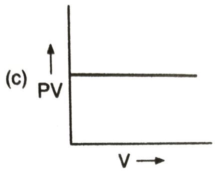
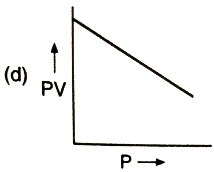
14. Which of the following graph represent Boyle's law ?

A. 

B. 

C. 

D. 

Answer: B::C

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15. Which of the following equation (s) is/are correct on the basis of ideal gas equation ?

Where, N = number of molecules, $N_A =$ Avogdro's number

$k_B =$ Boltzmann constant

A. $PV = \frac{N}{N_A}RT$

B. $PV = Nk_BT$

C. $PV = \frac{d}{m}RT$

D. $PV = dRT$

Answer: A::B

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16. Assertion: A gas can be easily liquefied at any temperature below is critical temperature.

Reason: Liquification of a gas takes place when the average kinetic energy of the molecules is low.

A. When its unversion temperature equals the Boyle's temperature

B. under reversible adiabatic expansion

C. under pressure when it is cooled below the critical temperature

D. at low pressure and above critical temperature

Answer: B::C

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

A. The kinetic energy of 1 mole

B. The kinetic energy of 1 g

C. The number of molecules in 1 mole

D. The number of molecules in 1 g

Answer: A::C

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18. Which of the following statements are correct ?

A. Helium diffuses at a rate 8.65 times as much as CO does

B. Helium diffuses at a rate 2.65 times as fast as CO does

C. Helium diffuses at a rate of 4 times faster than CO_2

D. Helium diffuses at a rate 4 times as fast as SO_2 does

Answer: A::D

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19. The viscosity of a liquid molecule depends on :

A. the volume of the liquid

B. the temperature of the liquid

C. the surface area of the liquid

D. the structure of the molecule

Answer: B::D

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20. Viscosity si property of

A. liquid

B. gases

C. solids

D. all of these

Answer: A::B

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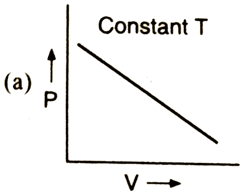
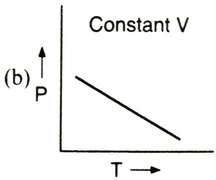
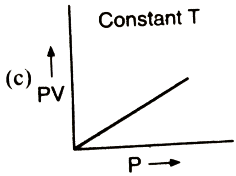
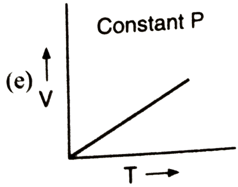
21. Which of the following diagrams correctly decribes the behavior of a fixed mass of an ideal gas ? (T is measured in K)

A. 

B. 

C. 

D. 

Answer: D

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22. The Ne atom has 10 times the mass of H_2 molecule.

Which of the following statements is true?

I. At $25^\circ C$ both of them have the same kinetic energy.

II. Ten moles of H_2 would have the same volume as 1 mole of Ne at same temp. and pressure.

III. One mole of Ne exerts the same pressure as one mole of H_2 at STP.

IV. A H_2 molecule travels 10 times faster than Ne atom at same temperature.

V. At STP, one litre of Ne has 10 times the density of 1 litre of H_2.

A. Both these gases have same kinetic energy at $27^\circ C$

B. H_2 molecule will travel 10 times faster than Ne atom at same temperature

C. Pressure of 1 mole Ne atom and 1 mole H_2 molecules will be same

D. Ten mole of H_2 and 1 mole of Ne will have same volume at a temperature of $27^\circ C$

Answer: A::B::C

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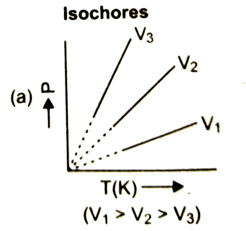
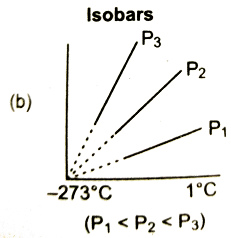
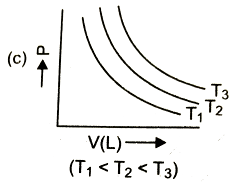
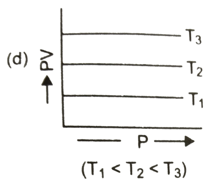
23. Select the correct conditions indicated below the following plots :

A. 

B. 

C. 

D. 

Answer: A::C::D

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24. Assertion: Sulphur dioxide and chlorine are bleaching agents.

Reason: Both are reducing agents.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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25. Assertion: Nitrogen is unreactive at room temperature but becomes reactive at elevated temperature (on heating or in the presence of catalysts).

Reason: In nitrogen molecule, there is extensive delocalisation of electrons.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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26. Assertion: Noble gases can be liquefied.

Reason: Attractive forces can exist between nonpolar molecules.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: A

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27. Assertion: Under similar conditions 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 true and R is the correct explanation of A

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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28. 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 true and R is the correct explanation of A

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: D

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29. Assertion: The plot of volume (V) versus pressure (P) at constant temperature is a hyperbola in the first quadrant.

Reason: $V \propto 1/P$ at constant temperature.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: A

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30. Assertion: At constant temperature, if pressure on the gas is doubled, density is also doubled.

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

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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31. Assertion: If H_2 and Cl enclosed separately in the same vessel exert pressure of 100 and $200mm$ respectively, their mixture in the same vessel at the same temperature will exert a pressure of $300mm$

Reason: Dalton's law of partial pressures states that total pressure is the sum of partial pressures.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: D

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32. Assertion: Most probable velocity is the velocity possessed by maximum fraction of molecules at the same temperature.

Reason: On collision, more and more molecules acquire higher speed at the same temperature.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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33. Assertion: Compressibility factor (Z) for non ideal gases is always greater than 1.

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

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: D

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34. 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 true and R is the correct explanation of A

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: B

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35. Assertion: Helium shows only positive deviations from ideal behaviour.

Reason: Helium is an inert gas.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: B

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36. Assertion: Gases are easily absorbed on the surface of metals, especially transition metals.

Reason: Transition metals have free valencies

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: A

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37. 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 true and R is the correct explanation of A

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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38. (A) Diffusion is used in the enrichment of U^{235}

(R) A lighter gas diffuse more rapidly than a heavier gas.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: B

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39. Assertion: Effusion rate of oxygen is smaller than nitrogen.

Reason: Molecular size of nitrogen is smaller than oxygen.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: C

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40. Assertion: Compressibility factor for hydrogen varies with pressure with positive slope at all pressures.

Reason: Event at low pressures, repulsive forces dominate hydrogen gas.

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

B. If both A and R are true but R is not the correct explanation of A

C. If A is true but R is false

D. If both A and R are false

Answer: A

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Objective questions Level B

1. Which of the following graphs is not a straight line for an ideal gas ?

A. $V \rightarrow T$

B. $T \rightarrow P$

C. $n \rightarrow \dfrac{1}{T}$

D. $n \rightarrow \dfrac{1}{P}$

Answer: D

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2. The quantity $(PV / K_B T)$ represents

A. number of molecules in the gas

B. mass of the gas

C. number of moles of the gas

D. translational energy of the gas

Answer: A

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3. 1 litre of N_2 and $7/8$ litre 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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4. A box is divided into two equal compartments by a thin partition and they are filled with gases X and Y respectively. The two compartments have a pressure of 250 torr each. The pressure after removing the partition will be equal to:

A. 125 torr

B. 500 torr

C. 250 torr

D. 750 torr

Answer: C

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5. The density of a gas A is twice that of a gas B at the same temperature. The molecular mass of gas B is thrice that of A. The ratio of the pressure acting on A and B will be

A. $6:1$

B. $7:8$

C. $2:5$

D. $1:4$

Answer: A

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6. In the corrections made to the ideal gas equation for real gases, the reduction in pressure due to attractive forces is directly proportional to :

A. n/V

B. nb

C. $\frac{n^2}{V^2 b}$

D. $\frac{n^2}{V^2}$

Answer: D

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7. Which of the following is most suitable for liquefaction?

A. $T > T_c, P > P_c$

B. $T < T_c, P < P_c$

C. $T = T_c, P = P_c$

D. $T = T_c, P < P_c$

Answer: B

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8. An ideal gas of certain mass is heated in a small vessel and then in a large vessel, such that their volume remains unchanged. The $P - T$ curves are :

A. parabolic with same curvature

B. parabolic with different curvatures

C. linear with same slope

D. linear with different slope

Answer: D

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9. 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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10. It is eaiser to liquefy oxygen than hydrogen because.

A. oxygen has a higher critical temperature and lower inversion temperature than hydrogen

B. oxygen has a lower critical temperature and higher inversion temperature than hydrogen

C. oxygen has a higher critical temperature and a higher inversion temperature than hydrogen

D. the critical temperature and inversion temperature of oxygen is very low

Answer: C

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11. $2mol\ He$ is mixed with $2gm$ of H_2. The molar heat capacity at constant pressure for the mixture is

A. $\frac{17R}{6}$

B. $\frac{11R}{6}$

C. $4R$

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

Answer: A

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12. The van der Waals' constant 'a' for the gases $O_2, N_2, NH_3$and CH_4 are 1.36, 1.39, 4.17 and 2.253

respectively, the gas which can be most easily liquefied is

:

A. O_2

B. N_2

C. NH_3

D. CH_4

Answer: C

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13. At what temperature will the molar kinetic energy of $0.3 mol$ of $'He'$ be the same as that of $0.4 mol$ of argon at $400 K$?

A. 700 K

B. 500 K

C. 800 K

D. 400 K

Answer: D

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14. Let P and P_s be the partial pressure of water and saturated partial pressure of water vapours, then relative humidity is given by .

A. $\frac{P_s + P}{P_s} \times 100$

B. $\frac{P}{P_s} \times 100$

C. $\frac{P_s}{P} \times 100$

D. $(P + P_s) \times 100$

Answer: B

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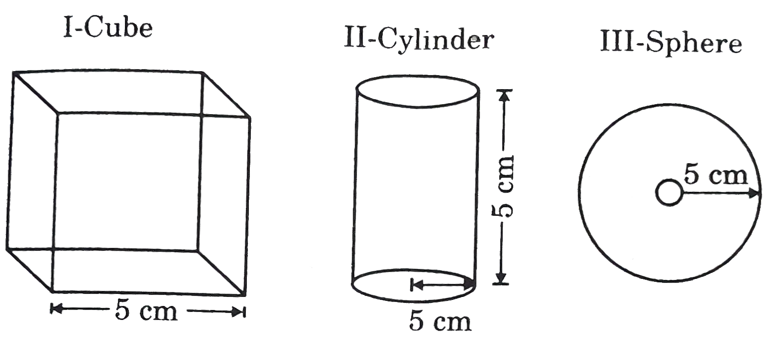
15. 

There are three closed containers in which equal moles of gas is filled if the containers are placed at the same temperature, then which of the following is correct?

A. Pressure in (I) is maximum

B. Pressure in (II) is maximum

C. Pressure in (III) is maximum

D. All the vessels have equal pressure

Answer: A

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16. 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. $P(O_2) = 0.785P(N_2)$

B. $P_{O_2} = 8.75P(N_2)$

C. $P(O_2) = 11.4P(N_2)$

D. $P(O_2) = 0.875P(N_2)$

Answer: D

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17. Which of the following is incorrect ?

A. A real gas behaves like ideal gas over a wide range of pressure $(\sim 100 atm)$ at Boyle point

B. A real gas behaves like an ideal gas over a wide range of pressure $(\sim 100 atm)$ at critical temperature of the gas

C. $\left(\frac{\partial U}{\partial V}\right)_T = 0$ for an ideal gas

D. $\left(\frac{\partial U}{\partial V}\right)_T = \frac{a}{V^2}$ for a real gas obeying van der Waals' equation

Answer: C

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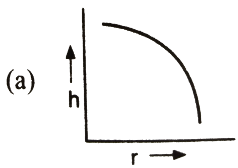
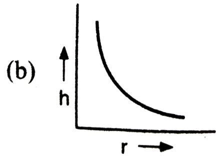
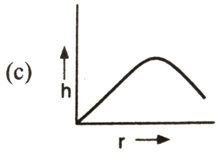
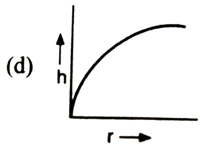
18. Which of following correctly represents the relation between capillary rise h and capillary radius r?

A. 

B. 

C. 

D. 

Answer: B

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19. There is a depression in the surface of the liquid in a capillary when

A. the cohesive force is smaller than the adhesive force

B. the cohesive force is greater than the adhesive force

C. the cohesive and adhesive forces are equal

D. none of the above is true

Answer: B

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20. Surface tension does not vary with

A. temperature

B. vapour pressure

C. the size of surface

D. concentration

Answer: C

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21. Which among of the following has least surface tension?

A. Benzene

B. Acetic acid

C. Diethyl ether

D. Chlorobenzene

Answer: C

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22. The SI unit of viscosity coefficient is

A. $Ns^{-1}m^{-1}$

B. Nsm^{-2}

C. $Ns^{-2}m^{-2}$

D. $Ns^{-1}m^{-2}$

Answer: B

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23. Under critical conditions, the compressibility factor for a gas is .

A. $3/8$

B. $8/3$

C. 1

D. $1/4$

Answer: A

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24. The critical temperature of water is higher than that of O_2 because the H_2O molecule has

A. greater dipole moment

B. V-shape

C. lesser number of electrons

D. it has only sigma bonds

Answer: A

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25. The ratio a/b (the terms used in van der Waals' equation) has the unit .

A. atm litre^{-1}

B. litre - atm mol^{-1}

C. litre - atm mol^{-2}

D. litre mol^{-1}

Answer: B

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26. Select the correct order of the following temperature:

$$\begin{array}{ccc} \text{Boyl tempe.} & \text{Critical temp.} & \text{Inversion temp.} \\ T_B & T_C & T_I \end{array}$$

A. $T_B > T_i > T_C$

B. $T_C > T_B > T_i$

C. $T_B > T_C > T_i$

D. $T_i > T_B > T_C$

Answer: D

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27. The gas equation for a real gas is:

$P(V-b) = RT$

Here, the parameter 'b' is van der Waals' constant. The graph of pressure against temperature (isochore) will give straight line of slope :

A. zero

B. $\frac{R}{(V-b)}$

C. R/P

D. negative

Answer: B

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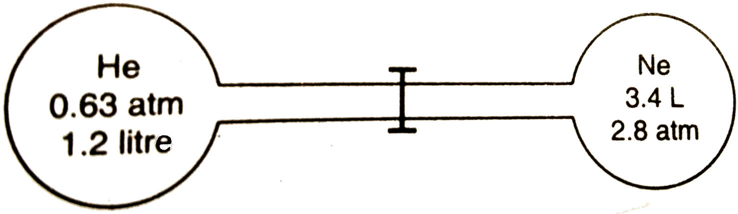
28. Two gas bulbs are connected by a thin tube. Calaculate the partial pressure of helium after the connective value is opened at a constant temperature of

$27^{\circ} C$



A. 1 atm

B. $0.328 atm$

C. $1.64 atm$

D. $0.166 atm$

Answer: D

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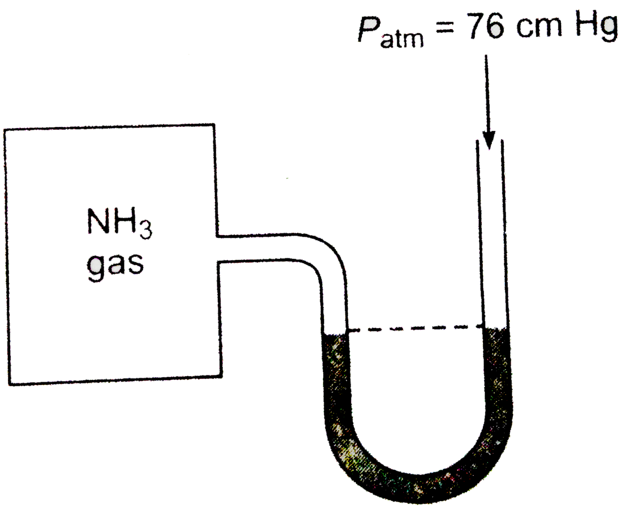
29. A manometer attached to a flask contains with ammonia gas have no difference in mercury level initially as shown in diagram. After sparking into the flask, ammonia is partially dissociated as $2NH_3 \text{ (g)} \rightarrow N_2 \text{ (g)} + 3H_2 \text{ (g)}$ now it have difference of 6 cm in mercury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



A. 18 cm Hg

B. 9 cm Hg

C. 27 cm Hg

D. 24 cm Hg

Answer: C

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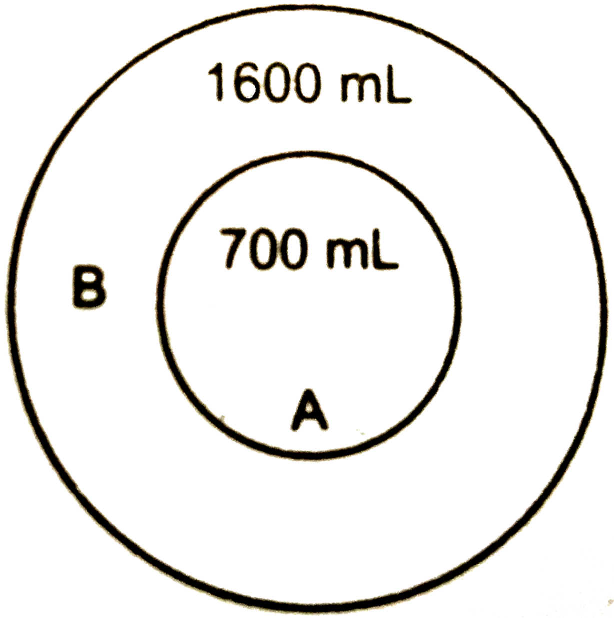
30. Two balloon A and B are taken at 300 K. Maximum capacity of balloon A and balloon B are 800 mL and 1800 mL respectively. When the balloon system is heated, which one will burst first ?



A. Inner balloon A

B. Outer balloon B

C. Both balloon's simultaneously

D. cannot be predicted

Answer: B

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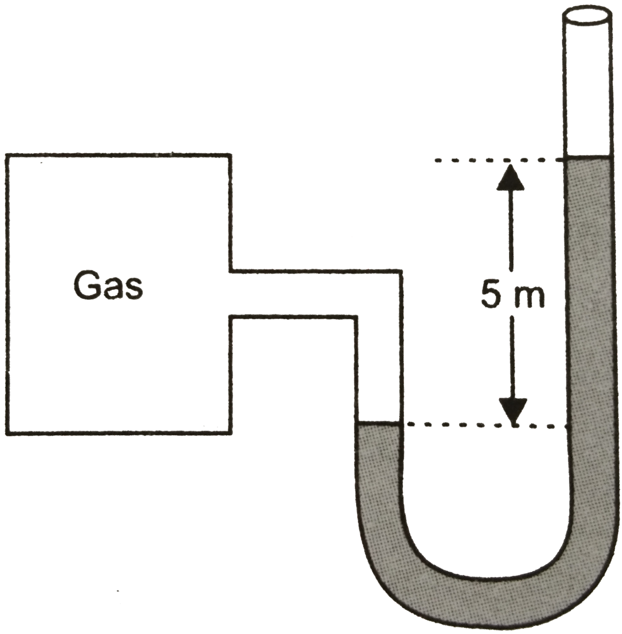

31.

A gas jar of 10 litre volume filled with O_2 at 300 K is connected to glycerine manometer. The maonometer shows 5 m difference in the level as shown in figure.

What will be the number of moles of O_2 in the gas jar ?

(Given $d_{\text{glycerine}} = \frac{2}{72} g/mL$, $d_{\text{mercury}} = 13.6 g/mL$)

A. $0.64 mol$

B. $0.4 mol$

C. $0.94 mol$

D. $0.36 mol$

Answer: C

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32. Two non-reactive monoatomic ideal gases have their atomic masses in the ratio $(2:3)$. The ratio of their partial pressure, when enclosed in a vessel kept at a constant temperature, is $(4:3)$. The ratio of their densities is :

A. $1:4$

B. $1:2$

C. $6:9$

D. $8:9$

Answer: D

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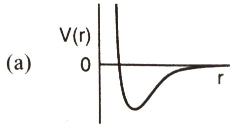
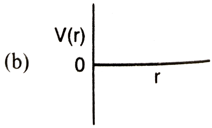
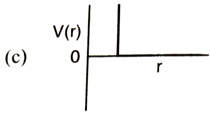
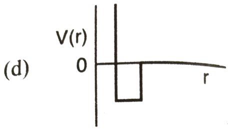
33. One mole of a monoatomic real gas satisfies the equation $p(V-b)=RT$ where b is a constant. The relationship of interatomic potential $V(r)$ and interatomic distance r for gas is given by

A. 

B. 

C. 

D. 

Answer: C

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34. The qualitative sketches I,II and III given below show the variation of surface tension with molar concentration of three different aqueous solution KCl, CH_3OH and $CH_3(CH_2)_{11}OSO_3NA^{+}$ at room temperature. The correct assignment of the sketches is

A. I: KCl II : CH_3OH III: $CH_3(CH_2)_{11}OSO_3^{-}Na^{+}$

B. I: $CH_3(CH_2)_{11}OSO_3^{-}Na^{+}$ II: CH_3OH III KCl

C. I : KCl II : $CH_3(CH_2)_{11}OSO(3)^{-}OSO_3^{-}Na^{+}$ III : CH_3OH

D. I: CH_3OH II: KCl III : $CH_3(CH_2)_{11}OSO_3^{-}Na^{+}$

Answer: D

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Assertion-Reason

1. Assertion: The heat absorbed during the isothermal expansion of an ideal gas against vacuum is zero.

Reason: The volume occupied by the molecules of an ideal gas is zero.

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 A is incorrect but R is correct

Answer: B

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

Reason: Frequency of collisions and their impact both increase in proportion of 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 A is incorrect but R is correct

Answer: C

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3. Assertion: $C_P - C_V = R$ for an ideal gas.

Reason: $\left(\frac{\partial E}{\partial V}\right)_T = 0$ for an ideal 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 A is incorrect but R is correct

Answer: B

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4. Assertion: A lighter gas diffuses more rapidly than 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 A is incorrect but R is correct

Answer: A

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5. Assertion: On cooling, the brown colour of nitrogen dioxide disappears.

Reason: On cooling, NO_2 undergoes dimerisation resulting in the pairing of the odd electron in NO_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 A is incorrect but R is correct

Answer: A

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6. Assertion: The value of van der Waals constant a is larger for ammonia than for nitrogen.

Reason: Hydrogen bonding is present in ammonia.

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 A is incorrect but R is correct

Answer: A

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7. Assertion (A): The Joules -Thomon coefficient for an ideal gas is zero.

Reason (R) : There are no intermlecular attactive forces in an ideal 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 A is incorrect but R is correct

Answer: A

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8. (A) At $27^{\circ} C$, the kinetic energy of 8 gram of methane is equal to the kinetic energy of 16 gram of oxygen

(R) The total heat change in a reaction is the same whether the chemical reaction takes place in one single step or in several steps

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 A is incorrect but R is correct

Answer: B

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9. (A) A closed cylinder containing high pressure gas tends to rise against gravity when the gas is allowed to escape through an orifice at the bottom

(R) The velocity of escaping gas develops an upward thrust proportional to the area of cross-section of the orifice

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 A is incorrect but R is correct

Answer: C

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10. (A) Meniscus of a liquid disappears at the critical temperature.

(R) Density of liquid and its gaseous phase become equal at the 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 A is incorrect but R is correct

Answer: A

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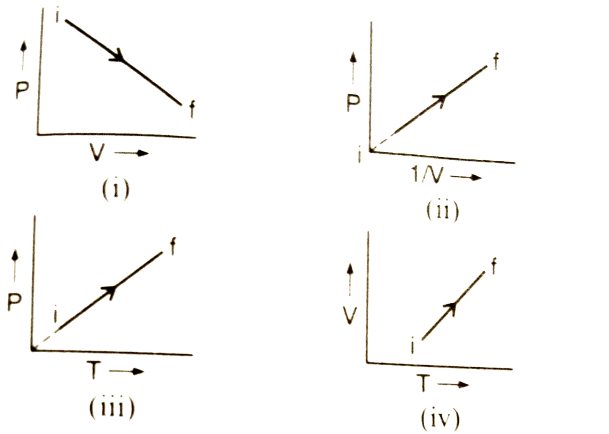
Matrix Matching type questions

1. The diagrams below depict the different process for a give amount of an ideal gas. Match the column -I with Column-II



i → initial state,
f → final state

Column-I	Column-II
(a) Fig. (i) : System proceeding from initial state to final state	(p) Temperature will remain constant
(b) Fig. (ii) : System proceeding from initial state to final state	(q) Pressure will decrease
(c) Fig. (iii) : System proceeding from initial state to final state	(r) Volume will be constant
(d) Fig. (iv) : System proceeding from initial state to final state	(s) Temperature may increase or decrease or may first increase and then decrease

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2. Match the column I and with Column II for ideal gases.

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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3. Match the Column -I with Column -II

Column-I	Column-II
(a) Real gas at high pressure	(p) $PV = RT + Pb$
(b) Force of attraction among gas molecules is negligible	(q) $PV = nRT$
(c) At high temperature and low pressure	(r) $Z = 1$
(d) Real gas at NTP	(s) $\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$

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4. Match the Column -I with Column-II

Column-I	Column-II
(a) Internal energy of gas	(p) $\frac{3}{2}RT$
(b) Translational kinetic energy of gas molecules	(q) $\frac{5}{2}RT$
(c) The temperature at which there is no molecular motion	(r) $-273^\circ C$
(d) The lowest possible temperature at which gas molecules have no heat	(s) 3.716 kJ at 298 K

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5. Match the column-I with Column-II

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 liquefied above this temperature, on applying pressure
(d) Critical pressure	(s) $a/27b^2$

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6. Match the column-I with Column-II

Column-I	Column-II
(a) Root mean square velocity	(p) $\sqrt{\frac{3P}{d}}$
(b) Average velocity	(q) $\sqrt{\frac{3RT}{m}}$
(c) Most probable velocity	(r) $\sqrt{\frac{8P}{\pi d}}$
(d) Velocity possessed by maximum fraction of molecules	(s) $\sqrt{\frac{2RT}{m}}$

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7. Match the Column-I with Column-II for van der Waals' equation

Column-I	Column-II
(a) High pressure	(p) $PV = RT + Pb$
(b) Low pressure	(q) $PV = RT - \frac{a}{V}$
(c) Force of attraction is negligible	(r) $PV = RT + \frac{a}{V}$
(d) Volume of molecules is negligible	(s) $\left(P + \frac{a}{V^2}\right)(V - b) = RT$

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Integer answer

1. How many moles of SO_2 will occupy a volume of 10 litre at a pressure of 15 atm and temperature 624 K ? (a = 6.71 atm $L^2 mol^{-2}$, b = 0.0564 litre mol^{-1})

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2. 3.2 g of oxygen (At. wt. = 16) and 0.2 g of hydrogen (At. wt. = 1) are placed in a $1.12L$ flask at $0^{\circ}C$. The total pressure of the gas mixture will be

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3. A mixture of nonreacting gases exert a pressure of 5 atm. If one of the gases occupu 40% volume of the mixture, what would be its partial pressure in atm ?

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4. A gas is found to have the formula $(C_3O_2)_n$. Its vapour density is 34. The value of n will be....

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5. The weight of hydrogen gas obtained from 42 g of CaH_2 by treatment with water is....gm

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6. 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

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

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

.

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9. 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 diffusion coefficient of this gas increases x times. The value of x is........

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Linked comprehension type question

1. The gases which strictly follow the general equation $(PV = nRT)$ are called ideal or perfect gases. Actually, there is no gas which is perfect or ideal. A real gas is one which actually exists, whether it obeys gas laws strictly or not. Under ordinary conditions, only those gases nearly behave as ideal or perfect which have very low boiling points such as nitrogen, hydrogen ect. The most easily liquefiable and highly soluble gases such as ammonia, carbon dioxide, sulphur dioxide show large deviation

A very convenient method of studying deviation of real gases from ideal behaviour is through a compressibility factor (Z)

$$Z = \frac{PV}{nRT}$$

(i) $Z = 1$, for ideal gases.

(ii) $Z \neq 1$, for real gases.

Consider the equation $Z = \frac{PV}{nRT}$, 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. Compressibility factor $Z = \frac{PV}{RT}$. Considering ideal gas, real gas, and gases at critical state, answer the following questions:

The cpmpressibility factor of a gas is less than unity at STP, therefore

A. $V_m > 22.4L$

B. $V_m < 22.4L$

C. $V_m = 22.4L$

D. $V_m = 44.8L$

Answer: B

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3. The gases which strictly follow the general equation $(PV = nRT)$ are called ideal or perfect gases. Actually, there is no gas which is perfect or ideal. A real gas is one which actually exists, whether it obeys gas laws strictly or not. Under ordinary conditions, only those gases nearly behave as ideal or perfect which have very low boiling points such as nitrogen, hydrogen ect. The most easily liquefiable and highly soluble gases such as ammonia, carbon dioxide, sulphur dioxide show large deviation

A very convenient method of studying deviation of real gases from ideal behaviour is through a compressibility factor (Z)

$$Z = \frac{PV}{nRT}$$

(i) $Z=1$, for ideal gases.

(ii) $Z \neq 1$, for real gases.

At low pressure, the van der Waals' equation is reduced to :

A. $Z=\frac{PV_m}{RT}=1-\frac{aP}{RT}$

B. $Z=\frac{PV_m}{RT}=1+\frac{bP}{RT}$

C. $PV_m=RT$

D. $Z=\frac{PV_m}{RT}=1-\frac{a}{RT}$

Answer: A

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4. The gases which strictly follow the general equation $(PV = nRT)$ are called ideal or perfect gases. Actually, there is no gas which is perfect or ideal. A real gas is one which actually exists, whether it obeys gas laws strictly or not. Under ordinary conditions, only those gases nearly behave as ideal or perfect which have very low boiling points such as nitrogen, hydrogen ect. The most easily liquefiable and highly soluble gases such as ammonia, carbon dioxide, sulphur dioxide show large deviation

A very convenient method of studying deviation of real gases from ideal behaviour is through a compressibility factor (Z)

$$Z = \frac{PV}{nRT}$$

(i) $Z = 1$, for ideal gases.

(ii) $Z \neq 1$, for real gases.

At Boyle's temperature, compressibility 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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5. The gases which strictly follow the general equation $(PV = nRT)$ are called ideal or perfect gases. Actually, there is no gas which is perfect or ideal. A real gas is one which actually exists, whether it obeys gas laws strictly or not. Under ordinary conditions, only those gases nearly behave as ideal or perfect which have very low boiling points such as nitrogen, hydrogen ect. The most easily liquefiable and highly soluble gases such as ammonia, carbon dioxide, sulphur dioxide show large deviation

A very convenient method of studying deviation of real gases from ideal behaviour is through a compressibility factor (Z)

$$Z = \frac{PV}{nRT}$$

(i) $Z = 1$, for ideal gases.

(ii) $Z \neq 1$, 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 :

A. the constant 'a' is negligible but not 'b'

B. the constant 'b' is negligible but not 'a'

C. both constant 'a' and 'b ' are negligible

D. both the constant 'a' and 'b' are not negligible

Answer: A

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6. The gases which strictly follow the general equation $(PV = nRT)$ are called ideal or perfect gases. Actually, there is no gas which is perfect or ideal. A real gas is one which actually exists, whether it obeys gas laws strictly or not. Under ordinary conditions, only those gases nearly behave as ideal or perfect which have very low boiling points such as nitrogen, hydrogen ect. The most easily liquefiable and highly soluble gases such as ammonia, carbon dioxide, sulphur dioxide show large deviation

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$$Z = \frac{PV}{nRT}$$

(i) $Z = 1$, for ideal gases.

(ii) $Z \neq 1$, for real gases.

The units of compressibility factor are :

A. atm L^{-1}

B. atm^{-1}

C. L^{-1}

D. unitless

Answer: D

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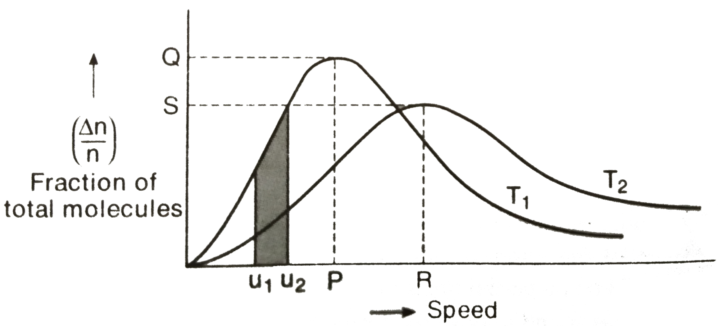
p 2

1. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



In the above graph the point 'P' refers to :

A. root mean square speed at T_1

B. average speed at T_1

C. most probable speed at T_1

D. highest possible speed at T_1

Answer: C

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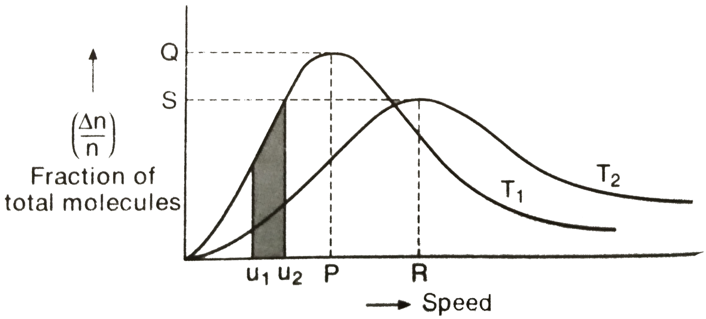
2. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



The shaded area represents :

A. number of molecules having speed between u_1 and u_2

B. number of molecules having speed less than the most probable speed

C. number of molecules having v_{rms} at T_1

D. fraction of molecules having average speed

Answer: A

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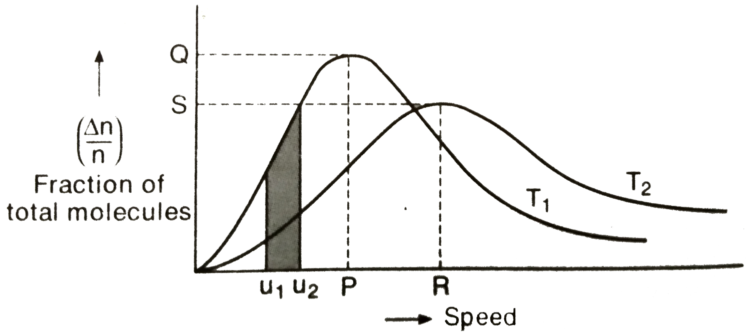
3. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



The point Q refers to:

A. number of molecules with speed at P

B. fraction of total molecules with speed at P

C. root mean square speed

D. total kinetic energy of molecules at P

Answer: B

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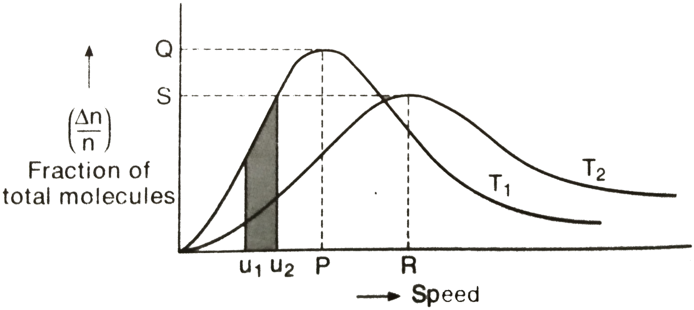
4. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



Relation between T_1 and T_2 is :

A. $T_1 = T_2$

B. $T_1 > T_2$

C. $T_1 < T_2$

D. cannot be predicted

Answer: C

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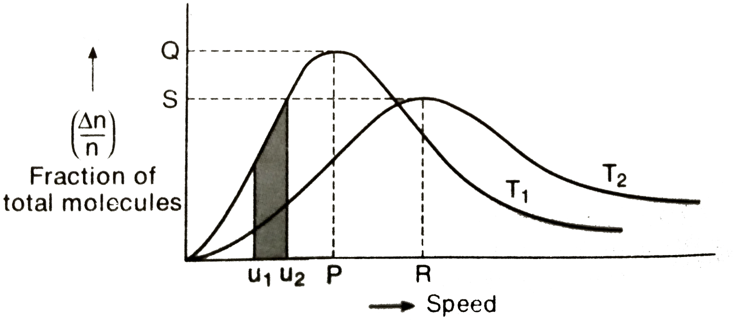
5. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



Total area under the curve at T_1 is :

A. equal to that under curve at T_2

B. less than that under curve at T_2

C. greater than that under curve at T_2

D. can be greater or less than that under curve at T_2, depending on the nature of the gas

Answer: A

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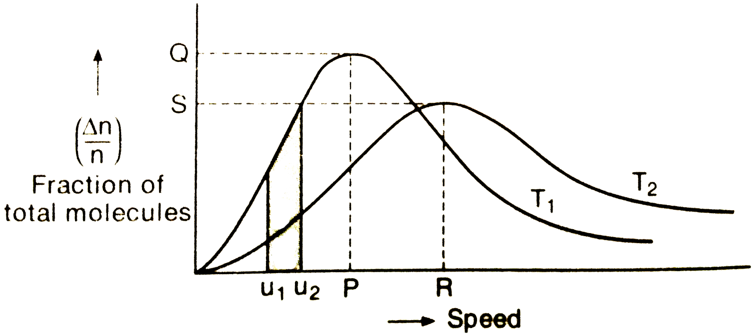
6. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



Select the correct statement (s):

A. Most probable speed increases with increase in temperature

B. Fraction of total molecules with most probable velocity decreases with increase in temperature

C. Area under the curve increases with increase in the temperature

D. none of the above

Answer: A::B

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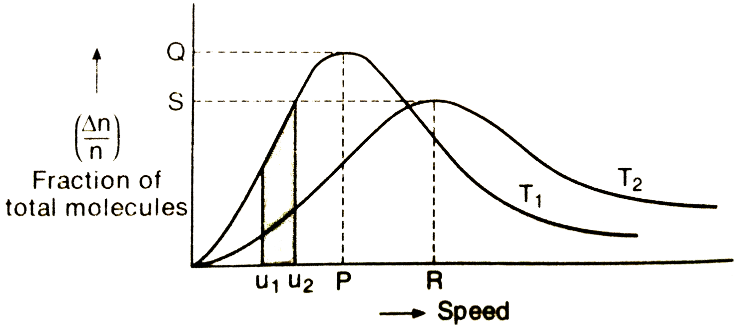
7. The gas molecules randomly move in all directions and collide with each other and with the wall of the container. If is difficult to determine the speed of an individual molecule but it had become passible to work out the distribution of molecules among different molecular speeds. This is known as Maxwell Boltzmann distribution

consider the following graph about Maxwell's distribution of speed at two different temperature T_1 and T_2



The curve has which of the following characteristics ?

(i) It has symmetrical distribution of molecules against molecular velocity

(ii) The area under the curve gives the total number of molecules.

(iii) The maxima of teh curve shifts towards right as the temperature is raised.

(iv) The area under the curve is independent of temperature

Select the correct statements from the codes given below:

A. (i), (ii)

B. (i), (ii) and (iii)

C. (ii), (iii) and (iv)

D. all are correct

Answer: C

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p 3

1. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

The relationship between P_c, V_c and T_c is :

A. $P_cV_c = RT_c$

B. $P_cV_c = 3RT_c$

C. $P_cV_c = \frac{3}{5}RT_c$

D. $P_cV_c = \frac{3}{8}RT_c$

Answer: D

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2. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

Which of the following parameters is three times the van der Waals' constant 'b' ?

A. Critical volume

B. Critical temperature

C. Vapour density

D. Critical pressure

Answer: A

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3. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

The critical temperature of :

A. a substance means the temperature above which the substance is in vapour form

B. a gas is the temperature below which it can be liquefied by application of pressure

C. water is $100^\circ C$

D. none of the above

Answer: B

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4. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

The pressure required to liquefy a gas at the critical temperature is called :

A. reduced pressure

B. critical pressure

C. vapour pressure

D. atmospheric pressure

Answer: B

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5. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

Gases	A	B	C	D
$P_c(atm)$	2.2	14	35	45
$T_c(K)$	5.1	33	127	140

Which of the above gases cannot be liquefied at 100 K and 50 atm ?

A. D only

B. A only

C. A and B

D. C and D

Answer: C

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6. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

At critical point, the meniscus between liquid and vapour disappears due to:

A. zero refractive index

B. zero surface tension

C. zero viscosity

D. zero critical temperature

Answer: B

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7. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

Gas A and can be liquefied at room temperature by applying pressure but gas B cannot. This reflects:

A. critical temperature of B is less than that of A

B. critical temperature of B is greater than that of A

C. A and B have critical temperature greater than room temperature

D. critical temperature of both are equal

Answer: A

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8. The essential conditions for liquefaction of gases were discovered by Andrews in 1869 as a result of his study of pressure-volume-temperature relationship for CO_2. If was found that above a certain temperature, it was impossible to liquefy a gas whatever the pressure was applied. The temperature below which the gas can be liquefied by the application of pressure alone is called critical temperature (T_c). The pressure required to liquefy a gas at this temperature is called the critical pressure (P_c). The volume occupied by one mole of the substance at the critical temperature and pressure is called critcal volume. Critical constants are related with van der Waals' constant as follows:

$$V_c = 3b, P_c = \frac{a}{27b^2}, T_c = \frac{8a}{27Rb}$$

The values of criticla volumes of four gases A, B, C and D are 0.025 L, 0.312 L, 0.245 L and 0.432 L respectively. The gas with larger diameter will be :

A. A

B. D

C. B

D. C

Answer: B

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p 4

1. Kinetic theory of gases is a generalization offered by Maxwell. Boltzmann, Clausius, etc. to explain the behaviour of ideal gases. This theory assumes that ideal gas molecules neither attract nor repel each other. Average kinetic energy of gas molecules is directly proportional to the absolute temperature. A gas equation called kinetic gas equation was derived on the basis of kinetic theory

$$PV = \frac{1}{3}mv^2$$

Gas	Density
A	$0.82 g L^{-1}$
B	$0.26 g L^{-1}$
C	$0.51 g L^{-1}$

Pick up the correct statement/statements

1. Gas A will tend to lie at the bottom

2. The number of atoms fo various gases A, B and C are

same.

3. The gases will diffuse to form homogeneous mixture.

4. Average kinetic energy of each gas is same

A. 2, 4

B. 1, 4

C. 1

D. 3, 4

Answer: D

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2. Kinetic theory of gases is a generalization offered by Maxwell. Boltzmann, Clausius, etc. to explain the behaviour of ideal gases. This theory assumes that ideal gas molecules neither attract nor repel each other. Average kinetic energy of gas molecules is directly proportional to the absolute temperature. A gas equation called kinetic gas equation was derived on the basis of kinetic theory

$$PV = \frac{1}{3}mv^2$$

Select the incorrect statement(s) about the real gases.

(1) The molecules attract each other.

(2) They show deviation from Boyle's and Charles' law.

(3) Volume of gas molecules are negligible

(4) The molecules have negligible mass

A. 2, 4

B. 1, 4

C. 1

D. 3, 4

Answer: D

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3. Kinetic theory of gases is a generalization offered by Maxwell. Boltzmann, Clausius, etc. to explain the behaviour of ideal gases. This theory assumes that ideal gas molecules neither attract nor repel each other. Average kinetic energy of gas molecules is directly proportional to the absolute temperature. A gas equation called kinetic gas equation was derived on the basis of kinetic theory

$$PV = \frac{1}{3}mv^2$$

The average kinetic energy per molecule of an ideal gas is equal to :

A. $0.5kJ$

B. $0.5RT$

C. $1.5kT$

D. $1.5RT^2$

Answer: C

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4. Kinetic theory of gases is a generalization offered by Maxwell. Boltzmann, Clausius, etc. to explain the behaviour of ideal gases. This theory assumes that ideal gas molecules neither attract nor repel each other. Average kinetic energy of gas molecules is directly proportional to the absolute temperature. A gas equation called kinetic gas equation was derived on the basis of kinetic theory

$$PV = \frac{1}{3}mv^2$$

Which of the following do not pertain to the postulates of kinetic theory of gaes ?

A. The gas molecules are perfectly elastic

B. Speed of gas molecules are ever changing

C. Pressure exerted by the gas is due to the collision of molecules with the walls of the container

D. Kinetic energy of a gas is given by the sum of 273 and temperature in Celsius scale

Answer: A::D

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5. Kinetic theory of gases is a generalization offered by Maxwell. Boltzmann, Clausius, etc. to explain the behaviour of ideal gases. This theory assumes that ideal gas molecules neither attract nor repel each other.

Average kinetic energy of gas molecules is directly proportional to the absolute temperature. A gas equation called kinetic gas equation was derived on the basis of kinetic theory

$$PV = \frac{1}{3}mv^2$$

The kinetic energy of 2.8 g of nitogen gas at $127^\circ C$ is nearly :

A. $2 \times 249.3J$

B. $2 \times 200.4J$

C. $2 \times 2.5J$

D. $20.5J \times 2$

Answer: A

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6. Kinetic theory of gases is a generalization offered by Maxwell. Boltzmann, Clausius, etc. to explain the behaviour of ideal gases. This theory assumes that ideal gas molecules neither attract nor repel each other. Average kinetic energy of gas molecules is directly proportional to the absolute temperature. A gas equation called kinetic gas equation was derived on the basis of kinetic theory

$$PV = \frac{1}{3}mv^2$$

If the absolute temperature of a gas in a fixed volume is quadrupled, then the velocity in intial and final states would be related as :

A. $v_f = 4v_i$

B. $v_f = v_i / 4$

C. $v_f = v_i / 4$

D. $v_f = v_i / 2$

Answer: D

Watch Video Solution

p 5

1. Surface tension of a liquid is a molecular phenomenon of liquids involving the force of cohension along the liquid molecules. It is scalar quantity and is numberically equal to the surface energy. Numerically, it is proved that the potential soluble salts and surfce active substance. Sparingly soluble salts and surface acitve substances decrease the surface tension of the liquid. However, the fairly soluble solutes increase the surface tension of the liquid. Surface tension of a liquid is independent of surface area but it depends on the intemolecular forces and the temperature.

Which among the following is not the unit of surface tension ?

A. dyne/cm

B. newton/m

C. J/m^2

D. erg/cm

Answer: D

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2. Surface tension of a liquid is a molecular phenomenon of liquids involving the force of cohesion among the liquid molecules. It is a scalar quantity and numerically equal to the surface energy. Numerically, it is proved that the potential enenergy of a liquid is maximum on the surface. Sparingly soluble salts and surface active substances decrease the surface tension of the liquid, however, the fairly soluble solute increase is independent of surface area but if depends on the intermolecular force and the temperature.

Surface tension of a liquid is zero at:

A. inversion temperature

B. boiling point

C. critical point

D. saturation point

Answer: C

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3. Surface tension of a liquid is a molecular phenomenon of liquids involving the force of cohesion among the liquid molecules. It is a scalar quantity and numerically equal to the surface energy. Numerically, it is proved that the potential enenergy of a liquid is maximum on the surface. Sparingly soluble salts and surface active substances decrease the surface tension of the liquid, however, the fairly soluble solute increase is independent of surface area but if depends on the intermolecular force and the temperature.

Surface tension of a liquid does not depend on :

A. temperature

B. intermolecular force

C. surface area

D. solute dissolved force

Answer: C

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4. Surface tension of a liquid is a molecular phenomenon of liquids involving the force of cohesion among the liquid molecules. It is a scalar quantity and numerically equal to the surface energy. Numerically, it is proved that the potential enenergy of a liquid is maximum on the surface. Sparingly soluble salts and surface active substances decrease the surface tension of the liquid, however, the fairly soluble solute increase is independent of surface area but if depends on the intermolecular force and the temperature.

When oil is placed on the surface of hot water, formation of droplets takes place because :

A. surface tension of hot water = surface tension of oil

B. surface tension of hot water $<$ surface tension of oil

C. surface tension of hot water $>$ surface tension of oil

D. none of the above

Answer: B

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5. Surface tension of a liquid is a molecular phenomenon of liquids involving the force of cohesion among the liquid molecules. It is a scalar quantity and numerically equal to the surface energy. Numerically, it is proved that the potential enenergy of a liquid is maximum on the surface. Sparingly soluble salts and surface active substances decrease the surface tension of the liquid, however, the fairly soluble solute increase is independent of surface area but if depends on the intermolecular force and the temperature.

Which of the following has the highest surface tension ?

A. water

B. soap in water

C. Detergent in water

D. Glycerol in water

Answer: D

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6. Surface tension is the property of a liquid by virtue of which the free space of the liquid at rest tends to have minimum area and as such it behaves as if covered with a stretched membrane. It is measured as the force acting an unit length of a line imagined to be drawn tangentially anywhere on the free surface of liquid at rest. It acts at right angles to this line on both sides and along the tangent to the liquid surface.

Surface tension is a scalar quantity :

(a) True (b) False

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7. Surface tension is the property of a liquid by virtue of which the free space of the liquid at rest tends to have minimum area and as such it behaves as if covered with a stretched membrane. It is measured as the force acting an unit length of a line imagined to be drawn tangentially anywhere on the free surface of liquid at rest. It acts at right angles to this line on both sides and along the tangent to the liquid surface.

Raindrops are spherical in shape because each drop tends to acquire maximum surface area :

(a) True (b) False

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8. Surface tension is the property of a liquid by virtue of which the free space of the liquid at rest tends to have minimum area and as such it behaves as if covered with a stretched membrane. It is measured as the force acting an unit length of a line imagined to be drawn tangentially anywhere on the free surface of liquid at rest. It acts at right angles to this line on both sides and along the tangent to the liquid surface.

The iron needle will floats on clean water but sink when some detergent is added to this water

(a) True (b) False

Watch Video Solution

9. Surface tension is the property of a liquid by virtue of which the free space of the liquid at rest tends to have minimum area and as such it behaves as if covered with a stretched membrane. It is measured as the force acting an unit length of a line imagined to be drawn tangentially anywhere on the free surface of liquid at rest. It acts at right angles to this line on both sides and along the tangent to the liquid surface.

When a razor bladed floats on water, then the force of surface tension acts on the circumference of the blade acting tangentially to the liquid surface :

(a) True (b) False

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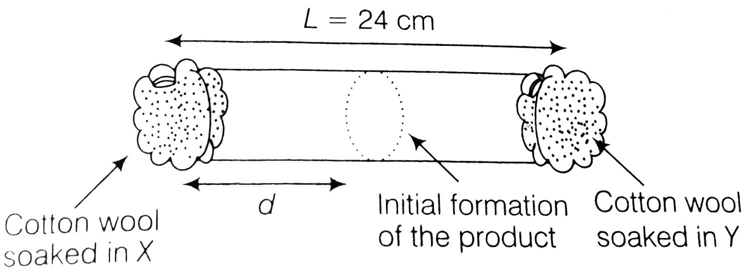
p 6

1. X and Y are two volatile liquids with molar weights of $10gmol^{-1}$ and $40gmol^{-1}$ respectively. Two cotton plugs, one soaked in X and the other soaked in Y, are simultaneously placed at the ends of a tube of length $L = 24$ cm, as shown in the figure.

The tube is filled with an inert gas at 1 atm pressure and a temperature of $300K$. Vapours of X and Y react to form a product whichh is first observed at a distance d

cm from the plug soaked in X.

Take X and Y to have equal molecular diameters and assume ideal behaviour for the inert gas and two vapours.



The value of d in cm (shown in figure), as estimated from Graham's law, is

A. 8

B. 12

C. 16

D. 20

Answer: C

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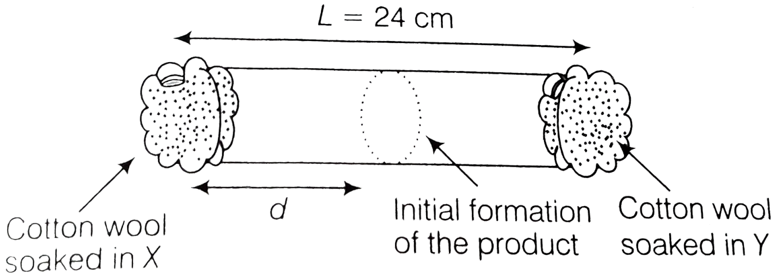
2. X and Y are two volatile liquids with molar weights of $10gmol^{-1}$ and $40gmol^{-1}$ respectively. Two cotton plugs, one soaked in X and the other soaked in Y, are simultaneously placed at the ends of a tube of length $L = 24$ cm, as shown in the figure.

The tube is filled with an inert gas at 1 atm pressure and a temperature of $300K$. Vapours of X and Y react to form a product whichh is first observed at a distance d cm from the plug soaked in X.

Take X and Y to have equal molecular diameters and assume ideal behaviour for the inert gas and two vapours.



The experimental value of d is found to be smaller than the estimate obtained using Graham's law. This is due to

A. larger mean free path for X as compared to that to Y

B. larger mean free path for Y as compared to that of X

C. increased collision frequencey of Y with the inert gas as compared to that of X with the inert gas

D. increased collision frequency of X with the inert gas as compared to that of Y with the inert gas

Answer: D

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Self Assess,ent

1. Boyle's temperature of four gases are given below:

Gases	A	B	C	D
T_B	$120K$	$25K$	$500K$	$410K$

Which gas can be liquefied most easily ?

A. A

B. B

C. C

D. D

Answer: C

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2. A gas is enclosed in a vessel of volume V at temperature T_1 and P, the vessel is connected to another vessel of volume $V/2$ by a tube and a stopcock. The second vessel is initially evacuated. If the stopcock is opened, the temperature of second vessel becomes T_2.

The first vessel is maintained at a temperature T_1. What is the final pressure P_1 in the apparatus ?

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

B. $\dfrac{2PT_1}{T_2 + 2T_1}$

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

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

Answer: A

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3. If the ratio of the rates of diffusion of two gases A and B is 4:1 the ratio of their density is

A. $\frac{1}{8}$

B. $\frac{1}{12}$

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

D. $\frac{1}{24}$

Answer: D

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4. Density of a gas STP is $2g/L$ while the expected density is $1.8g/L$ assuming its ideal behaviour. Then:

A. gas behaves ideally

B. forces of attraction are dominant among gas molecules

C. force of repulsion are dominant among gas molecules

D. none of the above

Answer: B

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5. An ideal gas:

A. can be liquefied if its temperature is more than critical temperature

B. can be liquiefied if its pressure is more than critical pressure

C. cannot be liquefied at any pressure and temperature

D. can be liquefied if its temperature

Answer: C

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6. If the graph is plotted for 1 mole gas in such a way that PV is plotted against 'P', then intercept of the graph for real gas will be:

A. $RT + Pb + a$

B. RT

C. $RT - Pb + a$

D. $RT + Pb + ab + a$

Answer: B

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7. The ratio of Boyle's temperature and critical temperature for a gas is:

A. $\frac{8}{27}$

B. $\frac{27}{8}$

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

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

Answer: B

Watch Video Solution

8. Kinetic energy and pressure of a gas of unit mole are related as :

A. $P = 2E$

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

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

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

Answer: B

9. At constant temperature of $273K$, $\frac{1}{V}$ vs P are plotted for two ideal gases A and B as given below. Ratio of number of moles of A and B are:

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

B. $\frac{1}{\sqrt{3}}$

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

D. $\frac{\sqrt{3}}{1}$

Answer: D

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10. At low pressure, the graph of $PV vs \frac{1}{V}$ for a given amount at a constant temperature for a real gas is:

A. straight line parallel to x-axis

B. straight line having positive intercept and negative slope

C. straight line passing through origin having positive slope

D. none of the above

Answer: B

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11. Which of the following measure the deviation from ideal behaviour of gas?

A. Collision diameter

B. Collision frequency

C. Compressibility factor

D. van der Waal's constant 'a'

Answer: C::D

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12. Which of the following mixtures of gases at room temperature follow Dalton's law of partial pressures ?

A. $NO \quad \text{and} \quad O_2$

B. $CO \quad \text{and} \quad CO_2$

C. $NH_3 \quad \text{and} \quad HCl$

D. $SO_2 \quad \text{and} \quad O_2$

Answer: A::B::D

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13. A real gas can be liquefied:

A. under adiabatic expansion

B. above critical temperature

C. when cooled below critical temperature under applied pressure

D. at temperature lower than critical temperature and pressure higher than critical pressure

Answer: A::C::D

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14. In the equation $PV = nRT$, the value of 'R' will not depend on:

A. nature of gas

B. pressure

C. temperature

D. units of measurements

Answer: A::B::C

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15. Which of the following processes would lead to an increase in the average speed of the molecules of an ideal gas system?

A. Lowering the temperature of gas

B. Compressing the gas with pistion

C. Expanding the gas into vacuum

D. Heating the system at constant volume and pressure

Answer: B::D

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16. Statement-I : The pressure inside the LPG cylinder remains constant even when it is in use at room temperature

Because

Statement -2 : Vpour pressure of any liquid is independent of its amount, it depends only on temperature

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

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

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

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

Answer: C

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17. Statement-I : If a gas has compressilbility factor (Z) greater than unity, then repulsive forces are dominant.

Because

Statement -2 : Value of Z decrease with increases in pressure.

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

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

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

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

Answer: C

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18. Statement-I : The value of Boyle's temperature for a real gas is $\left(T_B = \frac{a}{Rb}\right)$

Because

Statement -2 : At Boyle's temperature, T_B, real gases behave ideally over a long range of pressure

A. Statement -1 is true , statement -2 is true, statement-2 is a correct explanation of statement-3

B. Statement-1 is true , statement -2 is true, statement-2 is not a correct explanation of statement -3

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

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

Answer: B

View Text Solution

19. Statement-I : A gas effuses our from a flask through an orifice (pinhole), rate of effusion decreases linearly with time

Because

Statement -2 : Pressure of the gas in the flask decreases with passage of time

A. Statement -1 is true , statement -2 is true, statement-2 is a correct explanation of statement-4

B. Statement-1 is true , statement -2 is true, statement-2 is not a correct explanation of statement -4

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

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

Answer: D

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20. Statement-I : van der Waals' constant 'a' depends on the intermolecular forces.

Because

Statement -2 : van der Waals' constant 'b' depends on the radius of gas molecule

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

5

B. Statement-1 is true , statement -2 is true, statement-2 is not a correct explanation of statement -5

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

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

Answer: B

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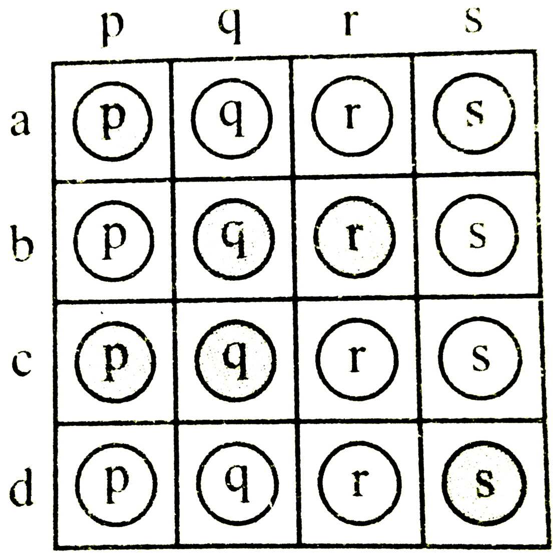
21. This section contains 2 questions. Each question contains statement given in two columns which have to be matched. Statements (a, b, c and d) in Column-I have to be matched with statement (p, q, r and s) in Column-II. The answers to these questions have to be appropriately bubbled as illustrated in the following examples:

If the correct matches are (a-p, s), (c-p, q) and (d-s), then correct bubbled 4×4 matrix should be as follows:



Match the Column-I with Column -II

Column-I	Column-II
(a) High temperature	(p) $Z \neq 1$
(b) Extremely low pressure	(q) $Pb < \frac{a}{V}$
(c) Very high pressure	(r) $Z = 1$
(d) Low pressure	(s) $Pb > \frac{a}{V}$

View Text Solution

22. This section contains 2 questions. Each question contains statement given in two columns which have to be matched. Statements (a, b, c and d) in Column-I have to be matched with statement (p, q, r and s) in Column-II. The answers to these questions have to be appropriately bubbled as illustrated in the following examples:

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	p	q	r	s
a	p	q	r	s
b	p	q	r	s
c	p	q	r	s
d	p	q	r	s

Match the Column -I with Column -II

Column-I	Column-II
(a) Boyle's temperature	(p) Depends on nature of gas
(b) Free volume	(q) Constant quantity of gas
(c) Critical temperature	(r) Depends on pressure of gas
(d) Compressibility factor	(s) Depends on radius of gas molecules

View Text Solution

23. Compressibility factor for ideal gas will be equal to ...

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24. 400 mL of ammonia gas at a pressure of 300 mm and 200 mL of hydrogen chloride gas at a pressure of 600 mm are mixed in a one litre evacuated flask. The pressure at normal temperature is....

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25. A mixture of 2 g hydrogen and 64 g oxygen exerts a pressure of 3 atm. Partial pressure of oxygen will be.....

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26. Air enters in the lungs in a tiny cavity called alveoli. Oxygen diffuses into our blood from alveoli. The average radius of alveoli is 0.005 cm and air inside it contains 21% O_2 and 79% N_2. Assuming that the pressure in the aveoli is 1 atm at body temperature of $37^\circ C$.

Volume of single alveoli is :

A. $5.23 \times 10^{-7} cm^3$

B. $5.23 \times 10^{-9} cm^3$

C. $5.23 \times 10^{-6} cm^3$

D. $5.23 \times 10^{-8} cm^3$

Answer: A

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27. Air enters in the lungs in a tiny cavity called alveoli. Oxygen diffuses into our blood from alveoli. The average radius of alveoli is 0.005 cm and air inside it contains 21% O_2 and 79% N_2. Assuming that the pressure in the aveoli is 1 atm at body temperature of $37^\circ C$.

Number of O_2 molecules in one alveoli is :

A. 2.6×10^{12}

B. 2.6×10^{13}

C. 2.6×10^{14}

D. 2.6×10^{15}

Answer: A

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28. Air enters in the lungs in a tiny cavity called alveoli. Oxygen diffuses into our blood from alveoli. The average radius of alveoli is 0.005 cm and air inside it contains 21% O_2 and 79% N_2. Assuming that the pressure in the aveoli is 1 atm at body temperature of $37^\circ C$.

Number of N_2 molecules in one alveoli is :

A. 9.8×10^{13}

B. 9.8×10^{12}

C. 9.8×10^{14}

D. 9.8×10^{15}

Answer: B

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