CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

STATES OF MATTER : GASES AND LIQUIDS

Examples

1. Ten dm^3 of hydrogen under 1 bar pressure are contained in a cylinder which has a movable piston. The piston is moved in until the same mass of gas occupies $2dm^3$ at the same temperature. Find the pressure in the cylinder.

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2. A weather ballon has a volume of $175dm^3$ when filled with hydrogen gas at a pressure of $1 \cdot 0$ bar. Caculate the volume of the bolloon when it rises to a height where the atmospheric pressure is $0 \cdot 8$ bar. Assume that temperature is constant.

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3. A sample of a gas occupies $100dm^3$ at 1 bar pressure and at 27^oC. If the volume of the gas is reduced to $5dm^3$ at the same temperature, what additional pressure must be be applied?

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4. A human adult breathes in approximately $0 \cdot 50 dm^3$ of air $1 \cdot 00$ bar with each breath. If an air tank holds $100 dm^3$ of air at 200 bar. How many breaths the tank will supply? Assume that the temperature is $37^\circ C$.

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5. A ballon is filled with hydrogen at room temperature. It will burst if pressure exceeds 0.2bar. If at I bar pressure, the gas occupies $2.27 L$ volume, up to what volume can the balloon be expanded?

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6. A sample of helium gas has a volume of $500cm^3$ at $373K$. Calculate the temperature at which the volume become $260dm^3$. Assume that pressure id kept constant.

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7. A jar contains a gas and a few drops of water at TK The pressure in the jar is $830mm$ of Hg The temperature of the jar is reduced by 1% The vapour pressure of water at two temperatures are 300 and 25 mm of Hg Calculate the new pressure in the jar .

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8. A certain amount of a gas at $27^{\circ}C$ and 1 bar pressure occupies a volume of $25m^3$. If the pressure is kept constant and the temperature is raised to $77^{\circ}C$ what will be the volume of the gas?

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9. A flask was heated from $27^{\circ}C$ to $227^{\circ}C$ at constant pressure. Calculate the volume of the flask if $0.1dm^3$ of air measured at $27^{\circ}C$ was expelled from the flask.

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10. A gas cyclinder containing cooking gas can withstand a pressure of $14.9atm$. The pressure gauge of cyclinder indicates $12atm$ at $27^\circ C$. Due to sudden fire in building the temperature starts rising. The temperature at which the cyclinder will explode is

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11. when a ship is sailing in Pacific Ocean where temperature is $23.4^\circ C$, a ballon is filled with 2.0 L of ship reaches Indian Ocean where temperature is $26.1^\circ C$?

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12. A sample of gas occupies volume of $2.74 dm^3$ at 0.9 bar and $27^\circ C$. What will be the volume at 0.75 bar and $15^\circ C$?

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13. At $25^\circ C$ and 760 mm of Hg pressure a gas occupies 600 mL volume. What will be its pressure at a height where temperature is $10^\circ C$and volume of the gas is 640 mL.

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14. A sample of nitrogen gas occupies a volume of $1.0 dm^3$ at a pressure of 0.5 bar and at $40^\circ C$. Calculate the pressure the gas if compressed to $0.225 dm^3$ at $-6^\circ C$.

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15. A vessel of volume $8.0 \times 10^{-3} m^3$ contains an ideal gas at $300K$ and $210kPa$. The gas is allowed to leak till the pressure falls to $135kPa$. Calculate the amount of the gas (in moles) leaked assuming the temperature to remain constant.

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16. A gas occupying a volume of 100 litres is at $20^\circ C$ under a pressure of 2 bar. What temperature will it have when it is placed in an evacuated chamber of volume 175 litres? The pressure of the gas in the chamber is one-third of its initial pressure.

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17. One "mole" of $N_2O_4(g)$ at $300K$ is kept in a closed container under 1 atm. It is heated to $600K$, when $20\,\%$ by mass of $N_2O_4(g)$ decomposes to $NO_2(g)$. The resultant pressure is

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18. A gas at a pressure of 5.0 atm is heated from $0^\circ C$ to $546^\circ C$ and simultaneously compressed to one-third of its original volume. Hence, final pressure is:

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19. The mass of $0.5dm^3$ of hydrogen at a pressure of 1 bar of Hg and at a temperature of $300K$ was found to be $4.0 \times 10^{-2}g$. Calculate the molar mass of hydrogen.

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20. Calculate the mass of $0.120dm^3$ of N_2 at $150^\circ C$ and 0.987 bar pressure.

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21. A $34.0dm^3$ cylinder contains $212g$ of oxygen gas at $21^\circ C$. What mass of oxygen must be released to reduce the pressure in the cylinder to 1.24 bar ?

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22. Air open vessel at $127^{\circ} C$ is heated until $1/5^{th}$ of air in it has been expelled. Assuming that the volume of vessel remains constant the temperature to which the vessel has been heated is

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23. Equal masses of the two gases A and B are kept in two separate vessels at the same temperature and pressure. If the ratio of the molecular masses of A and B is $2:3$, find the ratio of the volumes of the two vessels.

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24. One dm^3 of hydrogen is present in a flask at a pressure of 10^{-12} bar of Hg and at $0^\circ C$. Calculate the number of oxygen molecules in the flask.

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25. A vessel contains $14g$ of hydrogen and $96g$ of oxygen at STP.

(a) Find the volume of the vessel.

(b) Chemical reaction is induced by passing electric spark in the vessel till one of the gases is consumed, The temperature is brought back to its starting value $273K$. Find the pressure in the vessel.

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26. The density of oxygen at N.T.P. is $16gdm^{-3}$.To What temperature should it be heated at a constant pressure so that the density becomes $8gdm^{-3}$?

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27. The density of a gas is found to be $1.56gdm^{-3}$ at 0.98 bar pressure and $65^{\circ}C$. Calculate the molar mass of the gas.

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28. The density of CO_2 is $0.326gdm^{-3}$ at $27^{\circ}C$ and 0.25 bar pressure. What is the density of the gas at $47^{\circ}C$ keeping the pressure constant?

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29. The pressure of $1:4$ mixture of dioxygen and dinitrogen in a vessel is 1.5 atmosphere. What would be the partial pressure of dinitrogen in Nm^{-1} ?

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30. $0.068dm^3$ of a sample of nitrogen is collected over water at $20^\circ C$ and 0.92 bar of Hg. What is the volume of dry nitrogen N.T.P. ? (Aqueous tension of water at $20^\circ C = 0.023\text{bar}$ of Hg)

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31. $1.22g$ of a gas mesured over water at $15^{\circ}C$ and undr a pressure of 1.02 bar of mercury occupied $0.9dm^3$. Calculate the volume of the volume of the dry gas at $N.T.P.$ Vapour pressure of water at $15^{\circ}C$ is 0.018 bar.

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32. Two gases A and B having molecular weight 60 and 45 respectively are enclosed in a vessel. The weight of A is 0.5 g and that of B is 0.2 g. The total pressure of the mixture is 750 mm. Calculate the partial pressure (in mm) of gas A.

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33. 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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34. The pressure of a mixture of H_2 and N_2 in a container is 1200 torr. The partical pressure of nitrogen in the mixture is 300 torr. What is the ratio of H_2 and N_2 molecules in the mixture?

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35. A neon-dioxygen mixture contains 70.6 g dioxygen and 167.5 g neon. If pressure of the mixture of gases in the cylinder is 25 bar. What is the partial pressure of dioxygen and neon in the mixture ?

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36. Calculate the amount of potassium chlorate $(KClO_3)$ which must be heated to produce 2.4 litres of oxygen at $740mm\ Hg$ and at $25^\circ C$.

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37. 0.7 of zinc dust containing Zn and ZnO when dissolved in dilute H_2SO_4 evolved $224mL$ of H_2 at $N.T.P.$ Calculate the percentage of zinc in the dust (Atomic mass of $Zn = 65$).

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38. What volume of carbon dioxide measured at $27^\circ C$ and $746.7mm$ pressure will be obtained by treating $10.0g$ of pure marble with dilute hydrochloric acid ? (Aqueous tension at $27^\circ C$ is $26.7mm$)

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39. The following reaction is carried out at $101.325kPa$ at $380K$ initial amounts of CH_4 and O_2 as 0.01 and 0.03 mole respectively. All reactants and products are gaseous at $380K$. After completion of the reaction the flask is colled to $283K$ at which water is completely condensed. Calculate the total pressure and partial pressures of various species at $283K$.

$2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

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40. Ethane burns in oxygen according to the following equation:

$2C_2H_6(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(I)$

$2.5L$ of ethane are burnal in excess of oxygen at $27^\circ C$ and 1

bar pressure. Calculate how many litre of CO_2 are formed at $50^\circ C$ and 1.5 bar.

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41. $200mL$ of SO_2 diffuse through a porous plug in 600 seconds. What volume of methane (CH_4) will diffuse in the same time ?

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42. 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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43. 80 mL of ammonia gas effuse out form a vessel in 8 mixture at $5^\circ C$ and $500mm$ Hg pressure. How long will 40 mL of a certain gas with molecular mass 68 take to effuse out form the same vessel at the same temperature and pressure ?

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44. 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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45. $1L$ of a gaseous mixture is effused in $5 \text{ min } 11s$, while $1L$ of oxygen takes 10 min. The gaseous mixture contains methane and hydrogen. Calculate

(a) The density of gaseous mixture.

(b) The percentage by volume of each gas in mixture.

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46. For a non-zero value of force of attraction between the gas molecules and zero volume occupied by the gas molecules, give a modified expression of van der Waals' equation.

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47. The speed of six different molecules in a gas are $25ms^{-1}, 20ms^{-1}, 30ms^{-1}, 15ms^{-1}, 10ms^{-1}$ and

$25ms^{-1}$. Calculate the average speed and also the root mean square of the gas.

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48. A number of particles each of mass $10g$ are in motion. $20\,\%$ of the particles have speed $10ms^{-1}$, $50\,\%$ of particles speed $30ms^{-1}$ and $30\,\%$ have speed $40ms^{-1}$. Calculate the root mean square speed of the particles.

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49. Calculate the average kinetic energy of one mole of CO_2 at $450K$ in Joules.

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50. At what temperature will He atoms have the same r.m.s. speed as H_2 molecules have at $27^\circ C$?

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51. Gases possess characteristic critical temperature which depends upon the magnitude of intermolecular forces between the gas particles. Critical temperatures of ammonia and carbon dioxide are 405.5 K and 304.10 K respectively. Which of these gases will liquify first when you start cooling from 500 K to their critical temperature ?

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52. Calculate critical temperature and critical pressure of oxygen if the values of the van der Waal's constants a and b are $1.32 dm^6 \text{bar} mol^{-2}$ and $0.0312 dm^3 mol^{-1}$ respectively.

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53. The values of the van der Waals constants for a gas a = $4.10 dm^6 \text{bar} mol^{-2}$ and $b = 0.035 dm^3 mol^{-1}$. Calculate the values of the critical temperature and critical pressure for the gas.

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Exercise Fully Solved

1. What will be the minimum pressure required to compress 500 dm^3 of air at 1 bar to 200 dm^3 at $30^\circ C$?

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2. a vessel of 120 mL capacity contains a certain amount of gas at 1.2 bar pressure and $35^\circ C$. The gas is transferred to another vessel of volume 180 mL at $35^\circ C$. What would be its pressure?

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3. Using the equation of state $pV = nRT$, show that at a given temperature the density of gas is proportional to gas pressure p.

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4. At $0^\circ C$ the density of a gaseous oxide at 2 bar is same as that of nitrogen at 5 bar What is the molecular mass of the oxide ? .

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5. Pressure of $1g$ of an ideal gas A at $27^\circ C$ is found to be 2 bar when $2g$ of another ideal gas B is introduced in the same flask at same temperature the pressure becomes 3 bar. Find a relationship thieir molecular masses .

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6. The drain cleaner Drainex contains small bits of aluminium which react with caustic soda to produce hydrogen What volume of hydrogen at $20^{\circ}C$ aand one bar will be released when $0.15g$ of aluminium reacts ? .

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7. What will be the pressure exerted by a mixture of $3.2g$ of methane and $4.4g$ of carbon dixide contained in a $9dm^3$ flask at $27^{\circ}C$? .

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8. What will be the pressure of the gas mixture when $0.5L$ of H_2 at 0.8 bar $2.0L$ of oxygen at 0.7 bar are introduced in a

$1L$ vessel at $27^\circ C$?

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9. Density of a gas is found to be $5.46 / dm^3$ at $27^\circ C$ at 2 bar pressure What will be its density at STP ? .

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10. $34.05mL$ of phosphorus vapours weighs $0.0625g$ at $546^\circ C$ and 0.1 bar pressure. What is the molar mass of phossphorus ?

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11. A student forgot to add the reaction mixture to the round bottomed open flask at $27^{\circ} C$ and put it on the flame After a lapse of time he realized his mistake using a pyrometer he found the temperature of the flask was $477^{\circ} C$ What fraction of air would have been expelled out ? .

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12. Calculate the temperature of $4.0 mol$ of a gas occupying $5 dm^3$ at 3.32 bar.

Strategy : List the variables with the proper units. Then solve the ideal gas equation for T by substituting the values.

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13. Calculate the total number of electrons presents in $1.4g$ of nitrogen gas.

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14. How much time would it take to distribute one Avogadro number of wheat grains, if 10^{10} grains are distributed each second?

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15. Calculate the total pressure in a mixture og $8g$ of oxygen and $4g$ hydrogen confined in a vessel of $1dm^3$ at $27^\circ C$. $\left(R = 0.083 \text{bar} dm^3 K^{-1} mol^{-1}\right)$

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16. Pay load is defined as the difference between the mass of displaced air and the mass of the ballon Calculate the pay-load when a balloon of radius $10m$ mass $100kg$ is filled with helium at 1.66 bar at $27^{\circ}C$ (Density of air $= 1.2kgm^{-3}$ and $R = 0.083$ nar $dm^{-3}K^{-1}mo1^{-1}$) .

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17. Calculate the volume occupied by 8.8 g of CO_2 at $31.1^{\circ}C$ and 1 bar pressure. R= 0.083 bar L $K^{-1}mol^{-1}$.

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18. $2.9g$ of a gas at $95^\circ C$ occupied the same volume as $0.184g$ of hydrogen at $17^\circ C$ at same pressure What is the molar mass of the gas ? .

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19. A mixture of hydrogen and oxygen at 1 bar pressure contains $20\,\%$ of hydrogen by weight. Calculate the partial pressure of hydrogen.

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20. What would be the SI unit for the quantity pV^2T^2/n?

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21. In terms of Charles' law, explain why $-273^{\circ}C$ is the lowest possible temperature?

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22. The critical temperatures of carbon dioxide and methane are $31.1^{\circ}C$ and $-81.9^{\circ}C$, respectively. Which of them has stronger intermolecular forces and why?

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23. Explain the physical significance of vanderWaals parameters.

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Short Answer Type Questions

1. If 1 g of each of the following gases are takes at STP, which of the gases will occupy (a) greatest volume and (b) smallest volume ?

Co, H_2O, CH_4, NO

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2. Physical properties of ice, water and steam are very different. What is the chemical composition of water in all the three states ?

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3. The behaviour of matter in different state is governed by various physical law. According to you, what are the factors that determine the state of matter ?

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4. Use the information and data given below to answer the question (a) to (c),

Stronger intermolecular forces result in higher boiling point. Strength of London forces increases with the number of electrons in the molecule.

Boiling point of HF, HCl, HBr and HI are 293 K, 189 K, 206 K and 238 K respectively.

(a) which type of intermolecular forces are present in the

molecules HF, HCl, HBr and HI ?

(b) Looking at the trend of boiling points of HCl, HBr and HI, explain out of dipole-dipole interaction and London interaction, which one is predominant here.

(c) Why is boiling point of hydrogen fluoride highest while that of hydrogen chloride lowest ?

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5. What will be the molar volume of nitrogen and argon at 273.15 K and 1 atm ?

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6. Two different gases 'A' and 'B' are filled in separate containers of equal capacity under the same condition of temperature and pressure. On increasing the pressure slightly the gas 'A' liquefies but gas B does not liquify even on applying high pressure until it is cooled. Explain this phenomenon.

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7. Two different gases 'A' and 'B' are filled in separate containers of equal capacity under the same condition of temperature and pressure. On increasing the pressure slightly the gas 'A' liquefies but gas B does not liquify even on applying high pressure until it is cooled. Explain this phenomenon.

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8. Value of universal gas constant (R) is same for all gases. What is its physical significance ?

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9. One of the assumptions of kinetic theory of gases states that "there is no force of attraction between the molecules of a gas". How far is this statement correct ? Is it possible to liquefy an ideal gas ? Explain.

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10. the magnitude of surface tension of liquid dpends on the attractive forces between the molecules. Arrange the following in increasing order of surface tension :

Water, alcohol (C_2H_5OH) and hexane $\left[CH_3(CH_2)_4CH_3)\right]$.

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11. Pressure exerted by saturated water vapour is called aqueous tension. What correction term will you apply to the total pressure to obtain pressure of dry gas ?

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12. Name the energy which arises due to motion of atoms of molecules in a body. How is this energy effected when the temperature is increased ?

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13. Name two intermolecular forces that exist between HF molecules in liquid state.

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14. One of the assumptions of kineti theory of gases is that there is no force of attraction between the molecules of a gas.

State and explain the evidence that shows that the assumption is not applicable for real gases.

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15. Compressibility factor, Z of a gas is given as $Z = \frac{pV}{nRT}$

(i) What is the value of Z for an ideal gas ?

(ii) For real gas what will be the effect on value of Z above boyle's temperature ?

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16. The critical temperature (T_c) and critical pressure (p_c) of CO_2 are $30.98^\circ C$ and 73 atm respectively. Can $CO_2(g)$ be liquefied at $32^\circ C$ and 80 atm pressure ?

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17. For real gases the relation between p, V and T is given by c=van der Waal's equation

$$\left(p+\frac{an^2}{V^2}\right)(V-nb)=nRT$$

where, 'a' and 'b' are van der Waal's constanrs, 'nb' is approximately equal to the total volume of the molecules of a gas. 'a' is the measure of magnitude of intermolecular attraction.

(i) Arrange the following gases in the increasin order of 'b'. give reason.

O_2, CO_2, H_2, He

(ii) Arrange the following gases in the decreasing order of magnitude of 'a'. Give reason.

CH_4, O_2, H_2

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18. The relation between pressure exerted by an ideal gas (p_{ideal}) and observed pressure (p_{real}) is given by the equation,

$$p_{\text{ideal}} = p_{\text{real}} + \frac{an^2}{V^2}$$

(i) If pressure is taken in NM^{-2}, number of moles in mol and volume in m^3, calculate the unit of 'a'.

(ii) What will be the unit of 'a' when pressure is in atmosphere and volume in dm^3?

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19. Name two phenomena that can be explained on the basis of surface tension.

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20. Viscosity of a liquid arises due to strong intermolecular forces existing between the molecules. Stronger the intermolecular forces, greater is the viscosity. Name the intermolecular forces existing in the following liquids and arrange them in the increasing order of their viscosities. Also give reason for the assigned order in one line.

water, hexane $(CH_3CH_2CH_2CH_2CH_2CH_3)$, glycernine $(CH_2OHCH(OH)CH_2OH)$

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21. Explain the effect of increasing the temperature of a liquid, on intermolecular forces operating between its

particles. What will happen to the viscosity of a liquid if its temperature is increased ?

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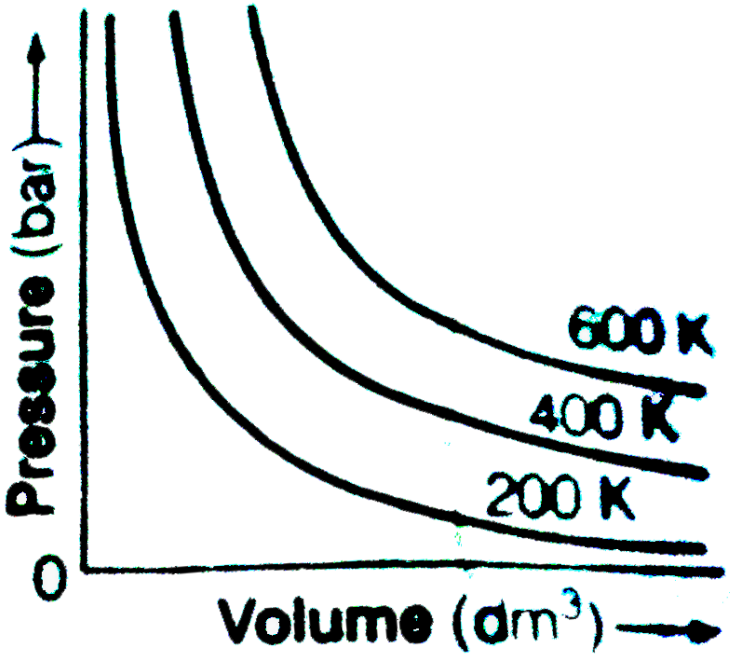
22. The variation of pressure with volume of the gas at different temperatures can be graphically represented as shown in figure. On the basis of this graph answer the following question.

(i) How will the volume of a gas change if its pressure is increased at constant temperature ?

(ii) At a constant pressure, how will the volume of a gas change if the temperature is increased from 200 K to 400 K

?



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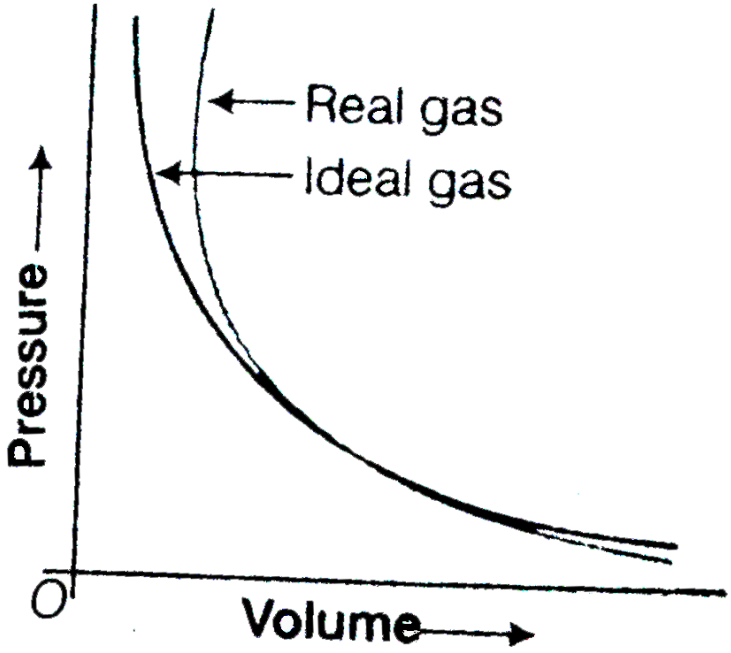
23. Pressure versus volume graph for real gas and are shown in figure. Answer the following question on the basis of this graph.



(i) Interpret the behaviour of real gas with respect to ideal gas at low pressure.

(ii) Interpret the behaviour of real gas with respect to ideal gas at high pressure.

(iii) Mark the pressure and volume by drawing a line at the point where real gas behaves as an ideal gas.

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24. Isotherms of carbon dioxide at various temperature are represented in Fig.

Answer the following questions bases of this figure.

(i) In which state will CO_2 exist between the point a and b at temperature T_1?

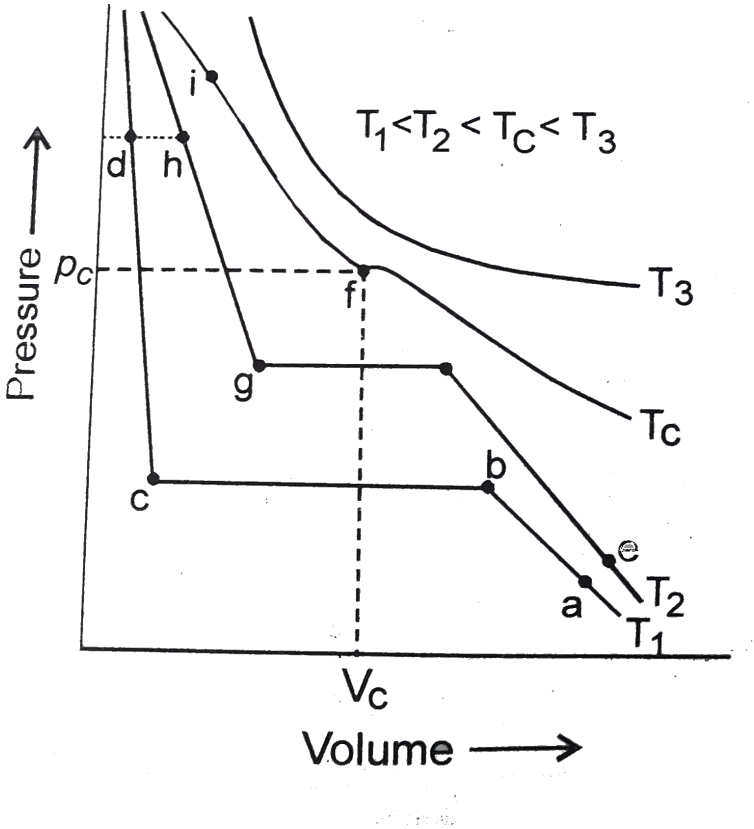
(ii) At what point will CO_2 start liquefying when temperature is T_1?

(iii) At what point will CO_2 be completely liquified when temperature is T_2.

(iv) Will condensation take places when the temperature is T_3.

(v) What portion of the isotherm at T_1 represents liquid and

gaseous CO_2 at equilibrium ?



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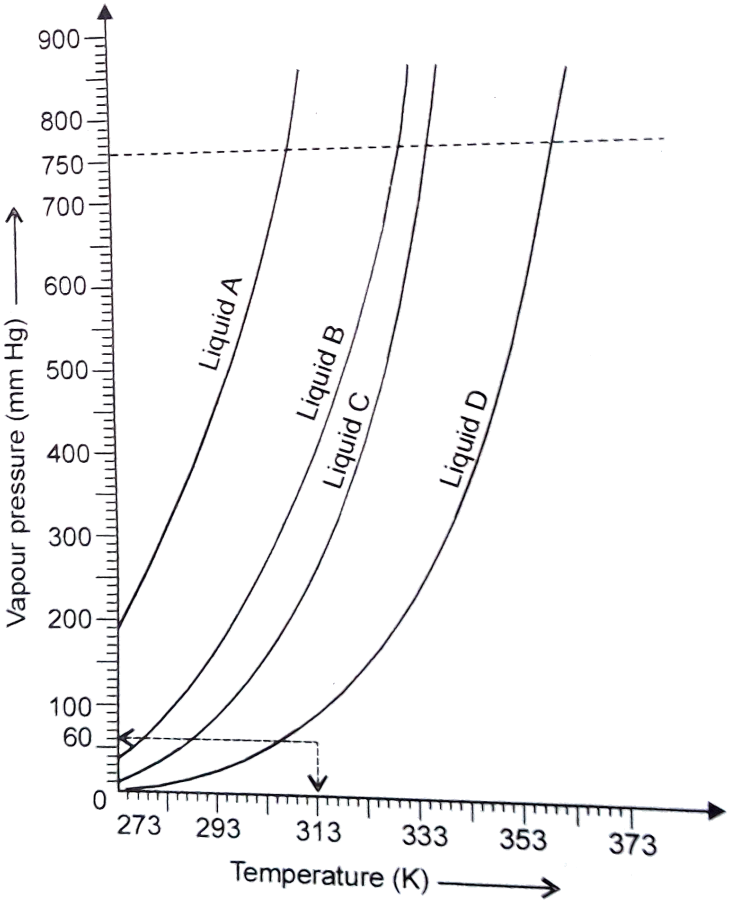
25. The variation of vapour pressure of different liquids with temperature is shown in the figure.

(i) Calculate graophically boiling points of liquids A and B.

(ii) If we take liquid C in a closed vessel and heat it continuosly, at what tempeature will it boil ?

(iii) At high altitude, atmosopheric pressure is low (say $60mmHg$). At what temperature liquid D boils?



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26. Why does the boundary between liquid phase and gaseous phase disappear on heating a liquid upto critical temperature in a closed vessel ? In this situation what will be the state of the substance ?

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27. Why does sharp glass edge become smooth on heating it upto its melting point in a flame ? Explain which property of liquids is responsible for this phenomenon.

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28. Explain the term 'laminar flow'. Is the velocity of molecules same in all the layers in Laminar flow ? Explain you answer.

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29. Define gaseous state of a substance.

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30. What is the cause of gas pressure ? How is it measured ?

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31. The pressure of a gas is $2.5atm$. Calculate the value in torr.

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32. What is the difference between barometer and manometer?

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33. BOYLE'S LAW

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34. In what respect does Gay Lussac's law differ form the Charles's law ?

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35. What is the equation of state of an ideal gas ? Why is it so called ?

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36. Show what universal gas constant represents work done per degree per mole ?

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37. Calculate the value of R in :

(i) SI units , (II) Cal $\text{degree}^{-1}\text{mol}^{-1}$, (iii) Litre atm $K^{-1}\text{mol}^{-1}$

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38. DALTON'S LAW OF PARTIAL PRESSURE

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39. State the law which relates the rate of diffusion of gases to their densities?

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40. Derive a relation between density and molar mass of the gas.

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41. How will you justify that the collision among the gas molecules are perfectly eleastic?

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42. Define most probable speed, average speed and root mean square speed of a gas. How are they related to each other ?

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43. Discuss in brief the significance of the van der Waal's connstants. Also write their units.

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44. The values of van der Waals constant a for a gas is zero. What does it signify ?

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45. Why do He and H_2 shows exceptional behaviour as compared to rest of the gases ?

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Concept Based Questions

1. Out of CO_2 and NH_3 gases, which is expectd to show more deviation from the ideal gas behaviour ?

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2. Can we apply Daltan's law of partial pressures to a mixture of carbon monoxide and oxygen ?

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3. Why dry air is heavier than moist air?

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4. Carbon dioxide is heavier than oxygen and nitrogen but it does not form the lower layer of the atmosophere. Exoplain.

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5. NH_3 and SO_2 gases are being prepared at two corners of a laboratory. The gas that will be detected first in the middle of the laboratory is:

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6. Both N_2O and CO_2 have similar rates of diffusion under same conditions of temperature and pressure. Explain

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7. The molecular speeds of gaseous molecules are analogous to those to rifle bullets , why do then odour of the gaseous molecular not detected so fast ?

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8. Why are aerated water bottles kept under water during summer ?

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9. Give reasons for the following in one or two sentences.

(a) A bottle of liquor ammonia should be cooled before

open it the stopper.

(b) Equal volumes of gases contain equal number of moles.

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10. Why are tyres of automobiles inflated to lesser pressure in summmer than in water ?

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11. The size of the weather ballon becomes larger and larger as it ascends up into higher altitude. Assign reason.

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12. What would have happened to the pressure of a gas if the collisions of its molecules had not been elastic?

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13. Under what conditions does the behavior of real gases deviate most from that predicted by the ideal gas law?

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14. For real gases, at high temperature $Z = 0$.

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15. Gases like CO_2 and CH_4 show more deviation from the ideal gas behaviour as compared to gases like H_2 and He, Explain

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16. How will you justify that the collision among the gas molecules are perfectly elastic?

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17. What is the basic difference between boiling and evaportion ?

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18. Why does the boiling point of liquid rise on increasing pressure ?

Watch Video Solution

19. A drop of liquid takes nearly a spherical shape because .

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20. When a capillary tube is immersed vertically in mercury, the level of mercury in the capillary is observed to be depressed. This is due to –

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21. Water meniscus in a glass tube is concave while that of mercury is convex. Why ?

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22. Liquids like ether and acetone are kept in coll places.

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23. Why are we able to sip hot tea or milk faster from a saucer rather than a cup?

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24. What is the effect of temperature on :

(a) Density , (b) Surface tension , (c) Viscosity and (d) Vapour pressure of a liquid ?

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25. Name the liquid with higher vapour pressure in the following pairs :

(a) Alcohol, glycerine , (b) Petrol, kerosene, (c) mercury, water.

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26. Why does our palm feel cold when we put some acetone or petror or perfume on it?

Watch Video Solution

27. Two flask of equal volumes contains N_2 and O_2 gases at the same temperature and pressure. Which will have greater number of molecules?

Watch Video Solution

28. If volume mass and temperture of two gases H_2 and O_2 kept in spearate vessles are the same, in which vessel the pressure will be greater and how many times ?

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29. Ordinary rubber filled with hydrogen get deflated after sometimes. Assign reason.

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30. In the Van der Waals equation $\left(P+\frac{n^2a}{V^2}\right)(V-nb)=nRT$, why is the term n^2a/V^2 positive in sign.

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31. When air is pumped in a football bladder, both volume and pressure increase simultanoeusly wheraes the

temperature remains constant. Is it not a violation of the Boyle's law?

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32. Answer the following ?

(i) Under the conditions do real gases tend to show ideal gas behaviour ?

(ii) What is volume and carbon of Avogadro's number of molecules at $N.T.P.$?

Both propane and carbon dioxide diffuse at the same rate under identical conditions of temperature and pressure. Why ?

(iv) If the number of moles of a gas are doubled by keeping the temperature and pressure constant, what will happen to the volume ?

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Additional Important Questions

1. Why is it not possible to cool a gas to a temperature of absolute $(0K)$?

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2. What is molar volume of an ideal gas under N.T.P. conditions ?

Watch Video Solution

3. Why vegetables are cooked with difficulty at a hill station?

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4. The values of van der Waals constant a for a gas is zero. What does it signify ?

Watch Video Solution

5. Which two postulates of kinetic theory of gases are responsible for the deviation of gases from the ideal gsa behaviour ?

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6. Out of NH_3 and N_2, which will have

(a) larger value of a

(b) larger value of b

Watch Video Solution

7. What is Boyle's temperature ?

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8. Why cooling is caused by evaporation?

Watch Video Solution

9. What is the relation between mass and number of moles of the gas ?

Watch Video Solution

10. SI unit of pressure is

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11. What is the nature of curve by plotting P against PV at constant temperature for a gas ? What is the name assigned to this curve ?

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12. Which is Kelvin scale of temperature better than celsius scale?

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13. Can Dalton's law of partial pressure be applied to a gaseous mixture of $CO(g)$ and $O_2(g)$?

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14. Why do the gases occupy that entire space available to them ?

Watch Video Solution

15. Arrange the gases, H_2, N_2, He, O_2 in increasing rate of diffusion.

Watch Video Solution

16. Out of CO_2 and N_2 which will deviate more from the ideal gas beheviour ?

Watch Video Solution

17. The compressibility factor (Z) for a gas is less than one.What does it signify ?

Watch Video Solution

18. The boiling point to water is more than that of ethyl alcohol. What does it singify.

Watch Video Solution

19. Out of glycerine and water, which more viscous ?

Watch Video Solution

20. The real gases show deviations from ideal gas behaviour. It is observed that real gases donot follow Boyle's law, Charles law and Avogadro law perfectly under all conditions. The deviations from ideal behaviour can be measured in terms of compressiblity factor Z.

what is meant by the term Compressiblity ? (b) What is the value of Compressibility factor for ideal gases and real gases ?

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21. Gases exert pressure equally in all directions, Why ?

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22. At $27^{\circ}C$ a gas under a pressure of 750 mm of Hg occupies a volume of 76 mL. Calculate the volume of gas at N.T.P.

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Problem

1. A straight glass tube has two inlets x and y at two ends. The length of the tube is $200cm$. HCl gas through inlet x and NH_3 gas through inlet y are allowed to enter the tube at the same time. White flames first appear at a point P inside the tube. Find the distance of P from x.

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2. From two identical holes, nitrogen and an unknown gas are leaked into a common vessel of $3L$ capacity for $10\ \text{min}$, at $27^\circ C$. The resulting pressure is 4.18 bar and the mixture contains $0.4mol$ of nitrogen. What is the molar mass of the unknown gas?

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3. Equal volumes of two gases A and B diffuse through a porous pot in 20 and 10 seconds respectively if the molar mass of A be 80 find the molar mass of B .

Watch Video Solution

4. A manometer is connected to a gas containing bulb The open arm reads $43.7cm$ where as the arm connected to the bulb reads $15.6cm$ If the barometric pressure is 743mm mercury What is the pressure of gas in bar ? .

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5. Assuming a nitrogen molecule spherical in shape and occupying the radius 200 pm calculate

(a) The volume of single molecule of gas

(b) the percentage of empty space in one mole of N_2 gas at NTP ? .

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6. An iron cylinder contains helium at a pressure of $250kPa$ at $300K$. The cylinder can withstand a pressure of $1 \times 10^5 Pa$. The room in which the cylinder is placed catches fire. Predict whether the cylinder will blow before it melts or not (m.p of cylinder $= 1800K$)

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7. 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.

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8. The ratio of velocities of diffusion of gases A and B is $1:4$. If the ratio of their masses present in the mixture is $2:3$, calculate the ratio of their mole fractions.

Watch Video Solution

9. An LPG cylinder weighs $14.8kg$ when empty. When full it weighs $29.0kg$ and the weight of the full cylinder reduces to $23.2kg$. Find out the volume of the gas in cubic metres used up at the normal usage conditions and the final pressure inside the cylinder. Assume LPG to be n-butane with normal boiling point of $0^{\circ}C$.

Watch Video Solution

10. 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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11. One mole of nitrogen gas at $0.8atm$ takes $38s$ to diffuse through a pinhole, while $1mol$ of an unknown fluoride of xenon at $1.6atm$ takes $57s$ to diffuse through the same hole. Calculate the molecular formula of the compound.

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Value Based Question

1. We know that gases which donot react chemically intermix irrepective of their nature. This is known as diffusion. The law of gravitation does not apply to diffusion which means that lighter gases can more downward while the hevier ones can move upwards.

(i) State Graham's Law of diffusion.

(ii)Give Its mathemartical form.

(iii) What is the value associated with the phenomenon of diffusion of gases?

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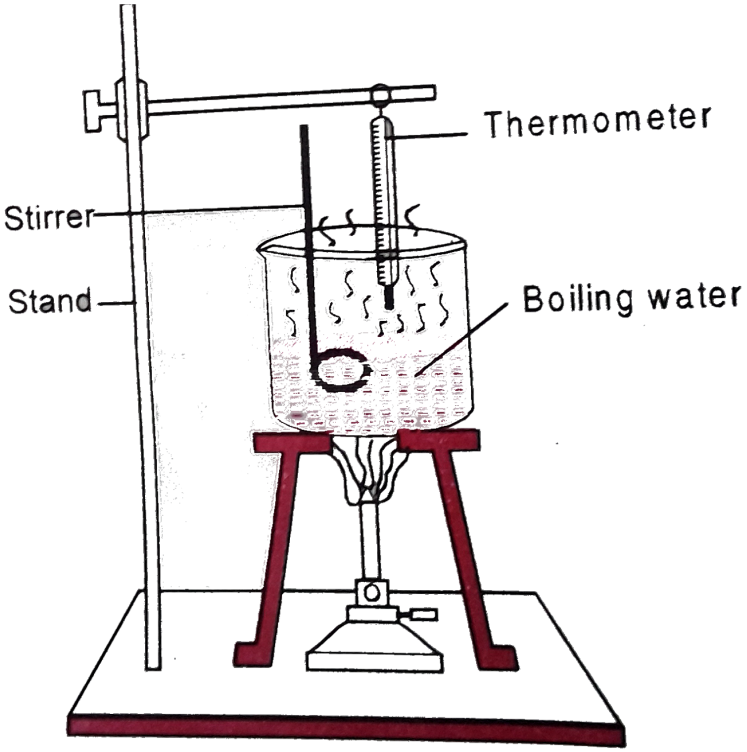
2. Mohan was asked by his teacher to determine the boiling point of a liquid. He set up the appartus as shown in the figure. He rocorded the boiling point of the liquid as $140^{\circ}C$ and reported the reading to this teacher. The teacher asked him to repeat the experiment after dipping the bulb of the thermometer in the liquid and also placing the beaker on a tripod stand covered with a wire gauze. After reading this narration, answer the following question :

(i) Was the reading taken by the student correct ?

(ii) What was the necessity of wire gauze?

(iii) How did teacher help the student?

(iv) What is teh value based information associated with this?



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3. Ashutosh was getting late for the office. He tried to sip boiling hot coffee from a cup. He felt very uncomfertable. His wife immediately brought a plate and asked him to sip the coffee from the plate. Ashutosh followed the advice and did not face any problem.

(a) Why was Ashutosh feeling uncomfortable

(b) How did sipping coffee from a plate was more comfertable.

(c) how did wife help Ashutosh ?

(d) what is the value associated with it?

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Practice

1. What is the volume of a sample of oxygen at a pressure of 3.5bar if its volume at 1bar is $3.15L$ at th same temperature?

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2. A gas occupies a volume of $250mL$ at 0.98 bar of Hg and $25^\circ C$. What additionl pressure is required to reduce the volume of the gas to $200mL$ at the same temperature ?

Watch Video Solution

3. What pressure must be applied to a given sample of a gas in order to compress it to three- fourth of its original

volume ?

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4. $5L$ of nitrogen measured at $750mm$ have to be compressed into an iron cylinder of $1L$ capacity. If temperature is kept constant, calculate the pressure in atmospheres required to do so.

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5. A gas occupies $0.6dm^3$ under a pressure of 0.92 bar. Find under what pressure, the volume of gas will be reduced by 20 precent of its original volume, temperature remaining constant.

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6. 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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7. 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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8. A sample of gas is found to occupy a volume of $900cm^3$ at $27^\circ C$. Calculate the temperature at which it will occupy a volume of $300cm^3$, provided the pressure is kept constant.

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9. At what temperature in centigrade will the volume of a gas at $0^\circ C$ double itself, pressure remaining constant?

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10. A balloon is inflated with air in a warm living room $(24^\circ C)$ to a volume $2.5L$. It is taken out on a very cold

winter's day $(-30^{\circ}C)$. Assuming that mass of air and pressure inside the balloon.

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11. A gas occupies a certain volume at 600 torr pressure and $27^{\circ}C$. If pressure is reduced to 500 torr, what temperature should be employed to keep the volume constant?

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12. Certain amount of gas occupies a volume of $400mL$ a $17^{\circ}C$. To What temperature should it is beated so that the volume is reduced to half?

Watch Video Solution

13. What is the volume at $N.T.P.$ of a gas that occupies $43.0mL$ at $-3^{\circ}C$ and 0.98bar ?

Watch Video Solution

14. The volume of a certain quantity of oxygen is $200cm^3$ at $15^{\circ}C$ and 0.98 bar pressure of Hg. What should be the temperature so that the volume becomes $180cm^3$ under a pressure of 1bar of Hg?

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15. The volume of a certain mass of gas at $N.T.P.$ is $27.5cm^3$. What pressure will be necessary to keep the

volume same at $27^{\circ} C$?

Watch Video Solution

16. At $27^{\circ} C$ and one bar pressure a has volume VL. What will be its volume at $177^{2} C$ and under pressure of $1.5 \mathrm{bar}$?

A.

B.

C.

D.

Answer: VL

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17. Calculate the number of moles of hydrogen contained in 18 litres of the gas at $27^{\circ}C$ and 70 cm pressure. Given that R=0.0821 litre atm K^{-1}. Further, if the mass of hydrogen taken as above is found to be 1.350 g, calculate the molecular mass of hydrogen.

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18. Calculate the pressure of 10^{23} molecules of sulphur dioxide (SO_2) when enclosed in a vessel of $2.5L$ capacity at a temperature of 27^2C.

Watch Video Solution

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

Watch Video Solution

20. Calculate the number of molecules of oxygen in one litre flask at $0^\circ C$ and under a pressure of 10^{-12} bar.

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21. Calculate the volume occupied at $27^\circ C$ and 2 bar pressure of a gas evolved from 2 mL of solid carbon dioxide. Given the density of solid carbon dioxide is $1.53gmL^{-1}$.

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22. A gas having molecular mass $84.5 g mol^{-1}$ enclosed in a flask at $27^{\circ} C$ has a pressure of $1.5 \mathrm{bar}$. Calculate the density of the gas under the same conditions.

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23. $38.0 mL$ of moist nitrogen were collected at $27^{\circ} C$ and 0.98 bar pressure. Calculate the volume of the gas $N. T. P.$ Aqueous tension at $27^{\circ} C$ is $0.035 \mathrm{bar}$.

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24. A given mass of gas occupies 919.0 mL of dry state at N.T.P. The mass when collect over water at $15^{\circ} C$ and

0.987bar pressure occupies one litre volume. Calculate the vapour pressure of water at $15^\circ C$.

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25. What is the presser exerted by a mixture of $3.5g$ of nitrogen and 2 g of helium when confined in a vessel of volume 40 lires at $0^\circ C$?

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26. 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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27. A dry gas occupies $127mL$ at $N.T.P.$ If the same mass of the gas is collected over water at $23^\circ C$ and a total pressure of 0.98bar, what volume will it occupy ? The vapour pressure of water at $23^\circ C$ is 0.028bar.

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28. 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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29. 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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30. At $25^{\circ} C$ and 760 mm of Hg pressure a gas occupies 600 mL volume. What will be its pressure at a height where temperature is $10^{\circ} C$and volume of the gas is 640 mL.

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31. What volume of O_2 at 2.00 atm pressure and $27^\circ C$ is requried to burn 10.0 g of heptane (C_7H_{16}) ?

$C_7H_{16} + 11O_2 \rightarrow 7CO_2 + 8H_2O$

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32. Butane (C_4H_{10}) gas burns in oxygen to give carbon dioxide and water accoding to the reaction.

$2C_4H_{10}(g) + 13O_2(g) \rightarrow 8CO_2(g) + 10H_2O(l)$

When $5.0L$ of butane ware burnt ini excess of oxygen at $67^\circ C$ and 2 bar pressure, calculate the dioxide evolved.

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33. Calculate the volume of hydrogen librated at N.T.P. when $500cm^3$ of $0.5N$ sulphuric acid react with excess of zinc.

Watch Video Solution

34. What volume of air at N.T.P containing 21 % oxygen by volume is required to completely burn 1000 g of sulphur containing 4 % incombustible matter ?

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35. In an experiment $100mL$ of hydrogen take 5 second and 100 mL of an unknown gas take 20 seconds to diffuse

through a porous membrane. Determine the density of the unknown gas relative to that of hydrogen.

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36. 300 mL of nitrogen gas diffuse througha a porous memebrane in 100 seconds. How long will it take for $400mL$ of CO_2 to diffuse through the same membrane under similar conditions of temperature and pressure ?

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37. A saturated hydrocarbon having molecular formula C_nH_{2n+2} diffuses through a porous membrane twice as fast

as sulpjur dioxide.

Determine the molecualr mass of hydrocarbon and name it.

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38. Calculate the molecular weight of a gas X which diffuses four times as fast as another gas Y, which in turn diffuses twice as fast as another Z. Molecular weight of the gas Z is 128.

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39. A teacher enters a classroom from front door while a student from back door. There are 13 equidistant rows of benches in the classroom. The teacher releases N_2O, the

laughing gas, from the first bench while the student releases the weeping gas $(C_6H_{11}OBr)$ from the last bench. At which row will the students starts laughing and weeping simultaneously?

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40. The rate of diffusion of a gas X is $\sqrt{2}$ times that of Y. If the molecular masss X is 16, what is the molecular mass of gas y?

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Multiple Choice Question

1. A person living in shimla observd that cooking without using pressure cooker takes more time. The reason for this observation is that at high altitude

A. pressure increases

B. temperature decreases

C. pressure decreases

D. temperature increases

Answer: C

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2. Which of the following property of water can be used to explain the spherical shape of rain droplets ?

A. viscosity

B. surface tension

C. critical phenomena

D. pressure.

Answer: B

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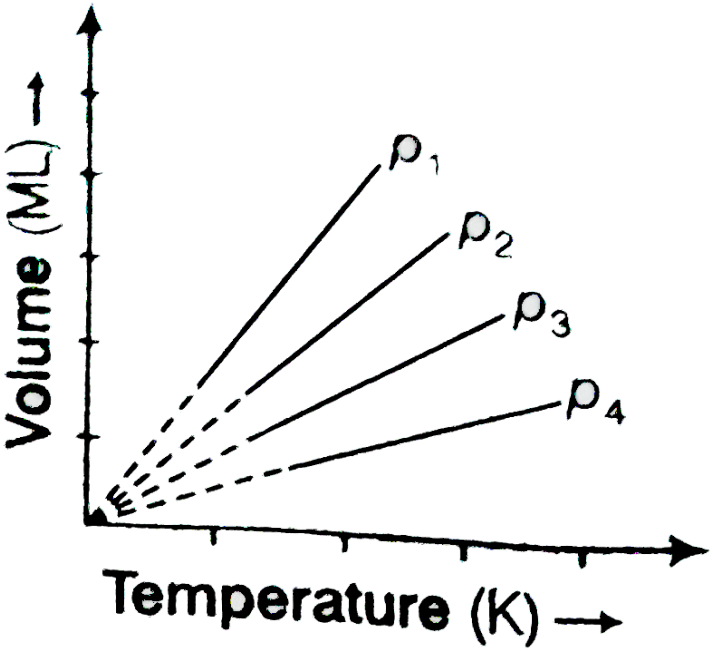
3. A plot of volume (V) versus temperature (T) for a gas at constant pressure is a straight line passing through the origin. The plots at different values of pressure are shown in figure. Which of the following order of pressure is correct

for this gas ?



A. $p_1 > p_2 > p_3 > p_4$

B. $p_1 = p_2 = p_3 = p_4$

C. $p_1 < p_2 < p_3 < p_4$

D. $p_1 < p_2 = p_3 < p_4$

Answer: C

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4. the interaction energy of London force is inversely proportional to sixth power of the distance between two interaction particles but their mahnitude depends upon

A. charge on interacting partices

B. mass of interacting particles

C. polarsablity of interacting particles

D. strength of permanent dipoles in the particles.

Answer: C

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5. Dipole-dipole forces act between the molecules possessing permanent dipole. Ends of dipoles possess 'partial charges'. The partial charge is

A. more than unit electronic charge

B. equal to unit eletronic charge

C. less than unit electronic charge

D. double the unit electronic charge.

Answer: C

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6. the pressure of a $1:4$ mixture of dihydrogen and dioxygen enclosed in a vessel is one atmosphere. What would be the partial pressure of dioxygen ?

A. $0.8 \times 10^5 atm$

B. $0.008 Nm^{-2}$

C. $8 \times 10^4 Nm^{-2}$

D. $0.25 atm$

Answer: C

Watch Video Solution

7. As the temperature increases, average kinetic energy of molecules increases. What would be the effect of increase of

temperature on pressure provided the volume is constant ?

A. Increase

B. decreases

C. remains same

D. becomes half

Answer: A

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8. Gases posses characteristic critical temperature which depends upon the magnitude of intermolecular forces between the particles. Following are the critical temperatures of some gases.

Gases	H_2	He	O_2	N_2
Critical temperature in kelvin	33.2	5.3	154.3	126

From the above data what would be the order of liquefaction of these gases ? Start writing the order from the gas liquefying first

A. H_2, He, O_2, N_2

B. He, O_2, H_2, N_2

C. N_2, O_2, He, H_2

D. O_2, N_2, H_2, He

Answer: D

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9. What is SI unit of viscosity coefficient (η) ?

A. Pascal

B. Nsm^{-2}

C. $Km^{-2}s$

D. Nm^{-2}

Answer: B

Watch Video Solution

10. Atmospheric pressure recorded in different citie are as follows

Cities	Shimla	Bangalore	Delhi	Mumbai
p in N/m^2	1.01×10^5	1.2×10^5	1.02×10^5	1.21×10^5

Consider the above data mark the place at which liquid will boil first.

A. Shimla

B. Bangalore

C. Delhi

D. Mumbai

Answer: A

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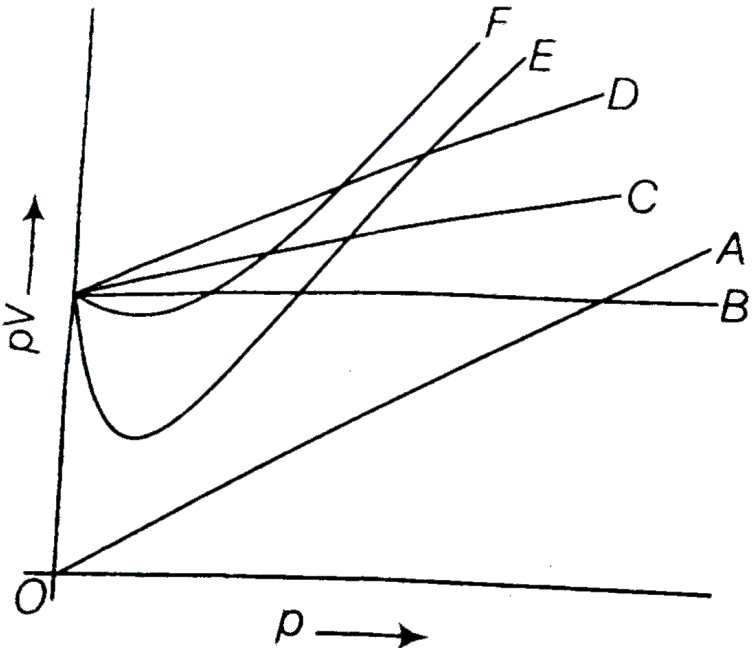
11. Which curve in figure represents the curve of ideal gas ?



A. B olny

B. C and d only

C. E and F only

D. A and B only.

Answer: A

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12. Increase in kinetic energy can overcome intermolecular forces of attraction. How will the viscosity of liquid be affected by the increase in temperature ?

A. Increase

B. No effect

C. Decrease

D. No regular pattern will be followed

Answer: C

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13. How does the surface tension of a liquid vary with increase in temperature ?

A. Remains same

B. decreases

C. increases

D. No regular pattern is followed

Answer: B

Watch Video Solution

14. With regard to the gaseous state of matter which of the following statemen are correct ?

A. Complete order of molecules

B. Complete disorder of molecules

C. Random motion of molecules

D. Fixed position of molecules

Answer: B::C

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15. Which of the following figures does not represent 1 mole of dioxygen gas at STP ?

A. 16 grams of gas

B. 22.7 litres of gas

C. 6.022×10^{23} dioxygen molecules

D. 11.2 litres of gas

Answer: A::D

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16. Under which of the following conditions applied together, a gas deviates most from the ideal behaviour ?

A. Low pressure

B. High pressure

C. Low temperature

D. High temperature

Answer: B::C

Watch Video Solution

Watch Video Solution

17. Which of the following changes decrease the vapour pressure of water kept in a sealed vessel ?

A. Decreasing the quantity of water

B. Adding salt to water

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

D. Decreasing the temperature of water.

Answer: B::D

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18. Match the graphs between the following variables with their names.

Graphs	Names
A. Pressure *vs* temperature graph at constant molar volume	1. Isotherms
B. Pressure *vs* volume graph at constant temperature	2. Constant temperature curve
C. Volume *vs* temperature graph at constant pressure	3. Isochores
	4. Isobars

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19. Match the following gas laws with the equation representing them.

A. Boyle's law	1. $V \propto n$ at constant T and p
B. Charle's law	2. $p_{\text{mixture}} = p_1 + p_2 + p_3 + \ldots$ at constant T, V
C. Dalton's law	3. $\frac{pV}{T} = \text{constant}$
D. Avogadro's law	4. $V \propto T$ at constant n and p
	5. $p \propto \frac{1}{V}$ at constant n and T

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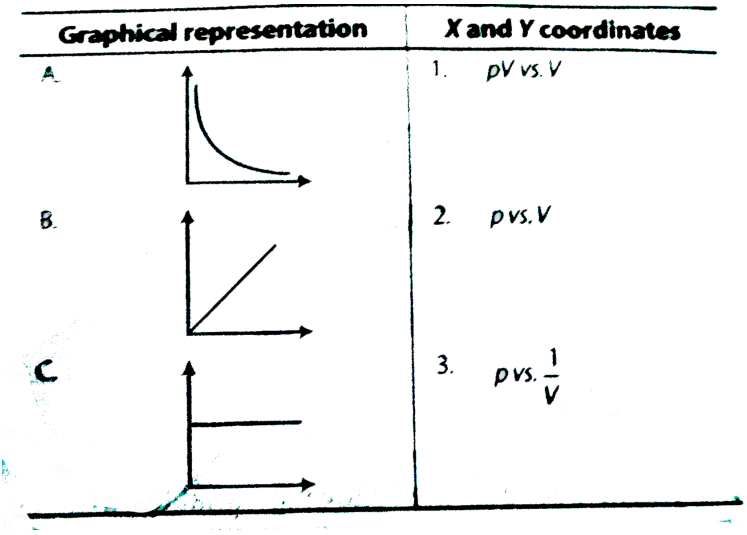
20. Match the following graphs of ideal gas with their coordinates.



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21. Assertion (A) Three states of matter are the result of balance between intermolecular forces and thermal energy of the molecules.

Reason (R) Intermolecular forces tend to keep the molecules together but thermal energy of molecules tends to keep tham apart.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is true.

Answer: A

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22. Assertion : — At constant temperature PV vs V plot for real gas is not a straight line.

Reason : — At high pressure, all gases have $Z > 1$ but at low pressure most gases have $Z < 1$

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is true.

Answer: B

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23. Assertion (A) The temperature at which vapour pressure of a liquid is equal to the external pressure is called boiling temperature.

Reason (R) At high altitude atmospheric pressure is high.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is true.

Answer: C

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24. Assertion (A) Gases do not liquefy above their critical temperature, even on applying high pressure.

Reason (R) Above critical temperature, the molecular speed is high and intermolecular attractions cannot hold the molecules together because they escape because of high speed.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is true.

Answer: A

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25. Assertion (A) At critical temperature liquid passes into gaseous state imperceptibly and continuously.

Reason (R) The density of liquid and gaseous phase is equal to critical temperature.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is true.

Answer: A

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26. Assertion (A) Liquids tend to have maximum number of molecules at their surface.

Reason (R) Small liquid drops have spherical shape.

A. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true but R is false.

D. A is false and R is true.

Answer: D

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Multiple Choice Question Select The Correct Answer

1. At constant temperture, the product of pressure and volume of a given amount of a gas is constant. This is :

A. Gay-Lussac law

B. Charles's law

C. Boyle's law

D. None of these.

Answer: C

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2. A curve drawn at costant temperature is called on isotherm. This shows the relationship between :

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

B. PV and V

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

D. P and V.

Answer: D

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3. Correct gas equation is :

A. $\frac{P_1V_1}{P_2V_2} = \frac{T_1}{T_2}$

B. $\frac{V_1T_2}{P_1} = \frac{V_2T_1}{P_2}$

C. $\frac{P_1T_1}{V_1} = \frac{P_2T_2}{V_2}$

D. $\frac{V_1V_2}{T_1T_2} = P_1P_2.$

Answer: A

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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. In the equation of state of an ideal gas `PV = nRT, the value of universal gas constant would depend only on :

A. the nature of the gas

B. the units of measurement

C. the pressure of the gas

D. the pressure of the gas

Answer: B

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6. Rate of diffustion of a gas is :

A. directly proportional to its density

B. directly proportional to its molecular mass

C. diectly proportional to th squre of its molecular mass

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

Answer: D

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7. 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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8. At constant volume for a fixed number of mole of a gas the pressure of a gas increase with rise of temperature due to .

A. increase in average molecular speed

B. increased rate of collisions amongst molecules

C. increase in molecular attraction

D. decrease in mean free path.

Answer: A

Watch Video Solution

9. No-ideal gases approach ideal beheaviour under :

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

Watch Video Solution

10. The kinetic theory of gases predicts that total kinetic energy of a gaseous assembly depends on

A. perssure of the gas

B. temperature of the gas

C. volume of the gas

D. pressure, temperature and volume of the gas

Answer: B

Watch Video Solution

11. If a gas is allowed to expand at constant temperature, then :

A. number of molecules of the gas decreases

B. the kinetic energy of the gas molecules decreases

C. the kinetic energy of the gas molecules increases

D. the kinetic energy of the gas molecules remains the same

Answer: D

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12. Gases deviate from ideal behaviour because mole-cules:

A. are colourless

B. are spherical

C. attract each other

D. have high speed.

Answer: C

Watch Video Solution

13. The temperature at which the volume of a gas is zero

A. $0^\circ C$

B. $0K$

C. $0^\circ C$

D. None of these.

Answer: B

Watch Video Solution

Assignment Very Short Answer Question

1. Name the measurable propperties of the gases.

Watch Video Solution

2. What is the SI unit of mass ?

Watch Video Solution

3. How is the unit 'L' releated to $'dm^3'$?

Watch Video Solution

4. Which instrument is used to measure atmospheric pressure ?

Watch Video Solution

5. Why mercury is used in barometer instead of water ?

Watch Video Solution

6. SI unit of pressure is

Watch Video Solution

7. How is pressure in atm releated to the pressure in pascals?

Watch Video Solution

8. How is kelvin scale of temperature releated to the Celsius scale?

Watch Video Solution

9. Under what conditions, is Boyle's law applicable?

Watch Video Solution

10. What do we get for a plot between V and $1/P$?

Watch Video Solution

11. Define absolute zero temperature?

Watch Video Solution

12. Why is it not possible to cool a gas to a temperature of absolute $(0K)$?

Watch Video Solution

13. Why is Kelvin scale of temperature regarded bettter than Calsius scale?

Watch Video Solution

14. State the combined gas law.

Watch Video Solution

15. IDEAL GAS EQUATION

Watch Video Solution

16. Name the universal gas constant. What is its value in SI unit ?

Watch Video Solution

17. Wha is the value if R when its units are L atm $K^{-1}mol^{-1}$?

Watch Video Solution

18. How is density of gas related to its molar mass ?

Watch Video Solution

19. To which type of gaseous mixture can Dalton's law be applied ?

Watch Video Solution

20. Dalton's law of partial pressure are applicable to

Watch Video Solution

21. GRAHAM'S LAW OF DIFFUSION

Watch Video Solution

22. Out of N_2 and CO which will diffuse at a faster rate ?

Watch Video Solution

23. Which of the following gases will diffuse fastest ?

Nitrogen, Oxygen, Hydrogen, Helium.

Watch Video Solution

24. Why dry air is heavier than moist air?

Watch Video Solution

Long Answer Question

1. State and explain Boyle's law. Represent the law graphically.

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2. State Charles's law. What are the major scales of measuring temperature? How are they related to each other ?

Watch Video Solution

3. With the help of gas laws, deduce an expression for the gas equation. What is the utility of the gas equation ?

Watch Video Solution

4. What is universal gas constant ? Derive its value in different scales of measurements.

Watch Video Solution

5. EFFUSION AND DIFFUSION AND GRAHAM'S LAW OF DIFFUSION OR EFFUSION

Watch Video Solution

6. State the postulates of kinetic theory of gases?

Watch Video Solution

7. Derive an expression for the van der Waals equation. Give the significance of the constants used in equation.

Watch Video Solution

Very Short Answer Questions

1. Why can a gas be compressed to any extent ?

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2. MOST PROBABLE SPEED

Watch Video Solution

3. What is the relation between average speed and root mean square speed for a gas ?

Watch Video Solution

4. COMPRESSIBILITY FACTOR

Watch Video Solution

5. The compressibility factor (Z) for a gas is less than one.What does it signify ?

Watch Video Solution

6. Under what conditions to gases show maximum deviations from ideal gas behaviour ?

Watch Video Solution

7. Out of CO_2 and N_2 which will deviate more from the ideal gas beheviour ?

Watch Video Solution

8. What is the signification of 'a' in the van der Waal's equation ?

Watch Video Solution

9. Write the units of van der Waals' constant 'a' and 'b'.

Watch Video Solution

10. Why liquids have a definite volume but no definite shape?

Watch Video Solution

11. Why liquids diffuse slowly as compared to gases?

Watch Video Solution

12. EVAPORATION

Watch Video Solution

13. Why cooling is caused by evaporation?

Watch Video Solution

14. Which will evaporation faster, water or alcohol ?

Watch Video Solution

15. Define molar heat of vaporsation.

Watch Video Solution

16. Why has water higher vapour pressure than mercury ?

Watch Video Solution

17. What is the nature of equilibrium between the liquid surface and its vapours in a closed vessel ?

Watch Video Solution

18. Why does water boil at a lower temperature in Nainital than in Delhi.

Watch Video Solution

19. Define normal boiling point of a liquid.

Watch Video Solution

20. What is the effect of temperature on the surface tension of a liquid ?

Watch Video Solution

21. Out of glycerine and water, which more viscous ?

Watch Video Solution

22. How does the rate of evaporation of a liquid depend on (i) temperature , (ii) surface area?

Watch Video Solution

23. Explain why cooking is faster in a pressure cooker.

Watch Video Solution

24. Give the main points of distinction between boiling and evaporation.

Watch Video Solution

25. Define surface tension. Out of water and ethyl alcohol, which has higher surface tension at room temperature ?

Watch Video Solution

Question Bank Mcq

1. One litre of a gas weighs $2g$ at $300K$ and 1 tm pressure. If the pressure is changed to 0.75 atm at which of the following temperatures, will one litre of the same gas weight $1g$?

A. $450K$

B. $600K$

C. $800K$

D. $900K$

Answer: a

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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

A. 1 atm

B. 4 atm

C. 3 atm

D. 2 atm

Answer: b

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3. If rate of diffusion of A is 5 times that of B, what will be the density ratio of A and B ?

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4. Two separate bulbs contain ideal gas A and B. The density of a gas A is twice that of a gas B. The molecular mass of A is half that of gas B. The two gases are at the same temperature. The ratio of the pressure of A to that gas B is

A. 2

B. $1/2$

C. 4

D. $1/4$

Answer: c

Watch Video Solution

5. 50 mL of hydrogen diffuse through a small hole from a vessel in 20 mintues time. Time taken for 40 ml of oxygen to diffuse out under similar conditions will be :

A. 12 min.

B. 64 min.

C. 8 min.

D. 32 min.

Answer: b

Watch Video Solution

6. An ideal gas obeying the kinetic theory of gases can be liquefied if

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

B. can be liquefied at any value of T and P.

C. cannot be liquefied under any value of T and P.

D. can be liquefied if its pressure is more than critical pressure.

Answer: c

Watch Video Solution

7. 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. 365 mL

B. 449 mL

C. 569 mL

D. 621 mL

Answer: a

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8. A container contains CO and H_2 in equal molar concentrations at the same temperature. What is the ratio

of the average molar kinetic energy of the two gases ?

A. Depends upon volume

B. $1:1$

C. $KE_{CO} > KE_{H_2}$

D. $KE_{H_2} > KE_{CO}$

Answer: B

Watch Video Solution

9. It P is the pressure and ρ is the density of a gas, then P and ρ are realted as :

A. $P \propto \rho$

B. $P \propto \rho^2$

C. $P \propto 1/\rho$

D. $P \propto 1/\rho^2$

Answer: A

Watch Video Solution

10. Van der Waals real gas acts an ideal gas at which conditions?

A. high temperature, low pressure

B. low temperature, high pressure

C. high temperature, high pressure

D. low temprature, low pressure

Answer: A

Watch Video Solution

11. The kinetic energy of 4 mol of nitrogen gas at $127^{\circ}C$ is ..... $cal\left(R = 2calmol^{-1}K^{-1}\right)$

A. 4400 cals

B. 3200 cals

C. 4800 cals

D. 1524 cals

Answer: C

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12. Absolute temperature is the temperature at which

A. all molecular motion ceases

B. volume ceases to zero

C. mass becomes zero

D. none of these.

Answer: A

Watch Video Solution

13. The coefficient of viscosity (η) of a fluid moving steadily between two surface is given by the formula $(f) = \eta A dV / dx$ where f is the frictional force on the fluid, A is the area in the fluid, and dV / dx is velocity gradient

inside the fluid at that area. The SI unit of viscosity is given as :

A. $kgm^{-1}s^{-1}$

B. $Nm^{-2}s$

C. Nil

D. Newtons

Answer: B

Watch Video Solution

14. A gas can be liqufied

A. above its critical temperature

B. at its critical temperature

C. below its critical temperature

D. at any temperature

Answer: C

Watch Video Solution

15. The surface tension of which of the following liquids is the maximum ?

A. C_2H_5OH

B. CH_3OH

C. H_2O

D. C_6H_6

Answer: C

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16. Dominance of strong repulsive forces among the molecules of the gas ($Z =$ compressibility factor)

A. depends on Z and indicates that $Z = 1$

B. depends on Z and indicates that $Z > 1$

C. depends on Z and indicates that $Z < 1$

D. is independent of Z

Answer: B

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17. If a gas expands at constant temperature, it indicates that

A. kinetic energy of the molecules remians the same

B. number of the molecules of the gas increases

C. kinetic energy of the molecules decreases

D. pressure of the gas increases.

Answer: A

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18. $50mL$ of each gas A and of gas B takes 150 and 200 seconds respectively for effusing through a pin hole under

the similar conditon. If molecular mass of gas B is 36, then the molecular mass of gas A will be

A. 95

B. 128

C. 20

D. 64

Answer: C

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19. A certain gas takes three times as long to effuse out as helium. Its molar mass will be

A. 27u

B. 36u

C. 64u

D. 9u

Answer: B

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20. For real gases, van der Waals' equation is written as

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

where a and b are van der Waals' constants.

Two sets of gases are:

$(I) O_2, CO_2, H_2$ and $He (II) CH_4, O_2$ and O_2 and H_2

The gases given in set I in increasing order of b and gases

given in set II in decreasing order of a are arranged below.

Select the correct order from the following :

A. (I) $He < H_2 < CO_2 < O_2$, (II) $CH_4 > H_2 > O_2$

B. (I) $O_2 < He < H_2 < CO_2$, (II) $H_2 > O_2 > CH_4$

C. (I) $H_2 < He < O_2 < CO_2$, (II) $CH_4 > O_2 > H_2$

D. (I) $H_2 < O_2 < He < CO_2$, (II) $O_2 > CH_4 > H_2$.

Answer: C

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21. Maximum deviation from ideal gas is expected from

A. NH_3

B. H_2

C. N_2

D. $CH_4(g)$

Answer: A

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22. A mixture of gases contains H_2 and O_2 gases in the ratio of $1:4(w/w)$. What is the molar ratio of the two gases in the mixture?

A. $16:1$

B. $2:1$

C. $1:4$

D. $4:1$

Answer: D

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23. A gas such as carbon monoxide would be most likely to obey the ideal gas law at

A. low temperature and high pressure

B. high temperature and high pressure.

C. low temperature and low pressure

D. high temperature and low pressure

Answer: D

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24. Equal masses of He, O_2 and SO_2 are taken in a closed container. The ratio of the partial pressures of gases He, O_2 and SO_2 would be

A. $1:2:8$

B. $8:16:1$

C. $16:8:1$

D. $16:2:1$

Answer:

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25. Which one of the following gases has the highest critical temperature ?

A. Nitrogen

B. Ammonia

C. Water vapours

D. Carbon dioxide

Answer: C

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26. Equal moles of hydrogen and oxygen gases are placed in a container with a pin-hole through which both can escape. What fraction of the oxygen escapes in the time required for one-half of the hydrogen to escape ?

A. $3/8$

B. $1/2$

C. $1/8$

D. $1/4$

Answer: C

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Select The Correct Answer

1. A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2. The partial pressure ratio is :

A. $p_{NO_2} = p_{CO}$

B. $p_{CO} = 0.875 p_{N_2}$

C. $p_{CO} = 2\rho_{N_2}$

D. $p_{CO} = 1/2p_{N_2}$.

Answer: A

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2. The ratio of the partical pressure of a gaseosy component to the total vapour pressure of the mixtuer is equal to :

A. mass of the component

B. mole fraction of the component

C. mass percent of the component

D. molecular mass of the component.

Answer: B

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3. A closed vessel contains equal number of nitrogen and oxygen molecules at pressure of Pmm. If nitrogen is removed from the system, then the pressure will be :

A. P

B. $2P$

C. $P/2$

D. P^2

Answer: C

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4. The ideal pressure exerted by a number of non-reacting gases is equal to the sum of the partial pressures of the gases under the same conditions. This statement is according to :

A. Boyle's Law

B. Charle' Law

C. Avogardro's Law

D. Dalton's Law of partial pressures.

Answer: D

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5. Which of the following pairs will effuse at the same rate through a porous plug .

A. CO, NO_2

B. NO_2, CO_2

C. NH_3, PH_3

D. NO, C_2H_6

Answer: D

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6. In a closed vessel of 5 liters capacity, 1 g of O_2 is heated from 300 to $600K$. Which statement is not correct ?

A. Pressure of the gas increases

B. The rate of collisions increases

C. The no. of moles of the gas increases

D. The energy of the gaseous molecules increases

Answer: C

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

A. PT / R

B. PRT

C. P / RT

D. RT / P

Answer: C

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8. Value of gas constant R is .

A. $0.082 J \text{litre} atm$

B. $0.987 cal \text{mol}^{-1} K^{-1}$

C. $8.314 J \text{mol}^{-1} K^{-1}$

D. $83 erg mol^{-1} K^{-1}$

Answer: C

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9. Kinetic theory of gases proves .

A. only Boyle's law

B. only Charle's law

C. only Avogardro's law

D. all of these.

Answer: D

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10. According to kinetic theory of gases in an ideal gas between two successive collisions a gas molecule travles .

A. in a wavy path

B. in a straight line path

C. with an acclerated velocity

D. in a circular path.

Answer: B

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11. Critical temperature of a substance is defined as :

A. the temperature above which a substance decomposes

B. the substance can exist only as a gas

C. melting point of the substance

D. boiling point of the substance.

Answer: B

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12. NH_3 can be liquefied at ordinary temperature without the application of pressure. But O_2 cannot be because :

A. its critical temperature is very high

B. its critical temperature is very low

C. its critical temperature is modrate

D. its critical temperature is higher than that of ammonia.

Answer: B

Watch Video Solution

13. The constant 'a' in van der Waal's equation is maximum in

A. Helium

B. Hydrogen

C. Oxygen

D. Ammonia.

Answer: D

14. Which set of conditions represent the easiest way to cool a gas ?

A. Low temperature and high pressure

B. High temperature and low pressure.

C. Low temperature and low pressure

D. High temperature and low pressure

Answer: A

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15. The term which accounts for intermolecular force in van der Waal's equation is :

A. $(V - b)$

B. $(RT)^{-1}$

C. $\left(P + a/V^2\right)$

D. RT

Answer: C

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16. As the temperature is raised from $20^\circ C$ to $40^\circ C$ the averge kinetic energy of neon atoms changes by a factor .

A. $\frac{313}{293}$

B. $\sqrt{(313/293)}$

C. $1/2$

D. 2

Answer: A

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Watch Video Solution

17. In van der Waals' equation of state of the gas law the constnat 'b' is a measure of .

A. volume occupied by the molecules

B. intermolecular attraction

C. intermolecular replusions

D. intermolecular collisions per unit volume.

Answer: A

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18. The volume of a certain mass of gas at $N.T.P.$ is $27.5cm^3$. What pressure will be necessary to keep the volume same at $27^\circ C$?

A. 11.13 bar

B. 1.113 bar

C. 2.15 bar

D. 1.56 bar

Answer: B

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19. At $27^\circ C$ under one atmosphere pressure, a gas occupies a volume of V L. In case the temperature is increased to

$177^{\circ}C$ and pressure to 1.5 bar, the corresponding volume will be :

A. VmL

B. $2VmL$

C. $V/2mL$

D. $V/3mL$

Answer: A

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20. Hydrogen gas occupies a volume of 18 litres at $27^{\circ}C$ and under a pressure of 0.92 bar. The number of moles present in the gas is :

A. 0.56 mol

B. 0.67 mol

C. 0.35 mol

D. 0.87 mol

Answer: B

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21. what volume of hydrogen gas , at 273 K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass=10.8) from the reduction of boron trichloride by hydrogen ?

A. $67.2L$

B. $44.8L$

C. $22.4L$

D. $89.6L$

Answer: A

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22. 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 velocity increases

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

C. The distribution becomes broader

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

Answer: B

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23. 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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24. The density of a gas a is twice that of gas B. Molecular mass of A is half of the molecular of B. The ratio of the partial pressures of A and B is :

A. $1/4$

B. $1/2$

C. $4/1$

D. $2/1$

Answer: C

Watch Video Solution

25. At what temperature, the r.m.s. velocity of a gas measured at $50^\circ C$ will become double ?

A. $626K$

B. $1019K$

C. $200^\circ C$

D. $1019^\circ C$

Answer: D

Watch Video Solution

26. The compressibility factor for a real gas at high pressure is .

A. 1

B. $1 + Pb/RT$

C. $1 - Pb/RT$

D. $1 + RT/Pb.$

Answer: B

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27. Mass of $112cm^3$ of NH_3 gas at S.T.P. is

A. $0.085g$

B. $0.850g$

C. $8.5g$

D. $80.5g$

Answer: A

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28. 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. $C^* : \overline{C} : C = 1 : 1.225 : 1.128$

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

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

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

Answer: D

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

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

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

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

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

Answer: B

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30. The statement that is NOT correct is :

A. compressibility factor measures the deviatio of real gas from ideal behaviour

B. van der Waals' constant 'a' measures extent of intermolecular attractive forces for real gases

C. critical temperature is the lowest temperature at which liquefaction of a gas first occurs

D. Boyle point depends on the natuer of the real gas.

Answer: C

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

A. London force

B. Hydrogen bond

C. lon-ion interaction

D. lon-dipole interaction.

Answer: B

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32. The compressibility factor (Z) for one mole of a gas is more than one under S.T.P. conditions. Therefore

A. $V > 11.2L$

B. $V < 22.38L$

C. $V > 22.38L$

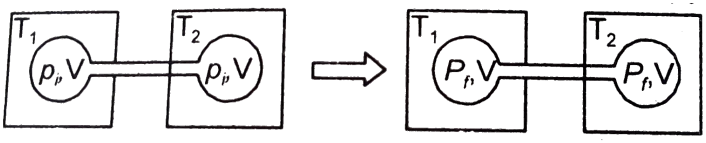
D. $V = 22.38L$

Answer: C

View Text Solution

33. Two closed bulb of euqal 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 released to T_2. The final pressure p_t is :



(a) $2p_i\left(\frac{T_1}{T_1+T_2}\right)$ (b) $2p_i\left(\frac{T_2}{T_1+T_2}\right)$

(c) $p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$ (d) $2p_i\left(\frac{T_1T_2}{T_1+T_2}\right)$

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

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

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

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

Answer: B

View Text Solution

34. Critical density of a gas having molecular mass $39 gmol^{-1}$ is $0.1 gcm^{-3}$. Its critical volume in $Lmol^{-1}$ is

A. 0.390

B. 3.90

C. 0.039

D. 39.0

Answer: A

View Text Solution

Comphension 1

1. Out of the three stes of matter, only the gases have most of the physical properties common. They neither have definite shapes nor volumes. Upon mixing they form hoogeneous mixture irespective of their nature and can also be compressed on applying pressure. In addition to these, the gases obey different gas laws such as Noyle's Law, Charles's Law, Dalton's Law of partial pressures, Graham's Law of diffusion etc. Based upon these laws, ideal gas equation $PV = nRT$ has been derived.

When the produce of pressure and volume is plotted against pressure for a given amount of a gas, the obtained is

A. parallel to X-axis

B. parallel to Y-axis

C. linear with positive slope

D. linear with negative slope

Answer: A

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2. Out of the three stes of matter, only the gases have most of the physical properties common. They neither have definite shapes nor volumes. Upon mixing they form hoogeneous mixture irespective of their nature and can also be compressed on applying pressure. In addition to these, the gases obey different gas laws such as Noyle's Law, Charles's Law, Dalton's Law of partial pressures, Graham's Law of diffusion etc. Based upon these laws, ideal gas

equation $PV = nRT$ has been derived.

4-4 g of a gas at STP occupies a volume of 2.224 L. The gas can be :

A. O_2

B. CO

C. NO_2

D. CO_2

Answer: D

View Text Solution

3. Out of the three stes of matter, only the gases have most of the physical properties common. They neither have definite shapes nor volumes. Upon mixing they form

hoogeneous mixture irespective of their nature and can also be compressed on applying pressure. In addition to these, the gases obey different gas laws such as Noyle's Law, Charles's Law, Dalton's Law of partial pressures, Graham's Law of diffusion etc. Based upon these laws, ideal gas equation $PV = nRT$ has been derived.

Which pair of gaseous species diffuse through a small jet with the same rate of diffusion at same P and T ?

A. NO, CO

B. NO, CO_2

C. NH_3, PH_3

D. NO, C_2H_6

Answer: D

View Text Solution

4. Out of the three stes of matter, only the gases have most of the physical properties common. They neither have definite shapes nor volumes. Upon mixing they form hoogeneous mixture irespective of their nature and can also be compressed on applying pressure. In addition to these, the gases obey different gas laws such as Noyle's Law, Charles's Law, Dalton's Law of partial pressures, Graham's Law of diffusion etc. Based upon these laws, ideal gas equation $PV = nRT$ has been derived.

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

A. PT / R

B. PRT

C. P / RT

D. RT / P

Answer: C

View Text Solution

5. Out of the three stes of matter, only the gases have most of the physical properties common. They neither have definite shapes nor volumes. Upon mixing they form hoogeneous mixture irespective of their nature and can also be compressed on applying pressure. In addition to these, the gases obey different gas laws such as Noyle's Law, Charles's Law, Dalton's Law of partial pressures, Graham's Law of diffusion etc. Based upon these laws, ideal gas

equation $PV = nRT$ has been derived.

Same mass of CH_4 and H_2 at taken in a container. The partial pressure caused by H_2 is

A. $\frac{8}{9}$

B. $\frac{1}{9}$

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

D. 1

Answer: A

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Comphension 2

1. The gases obey the different gas laws only theoretically. Practically all of them show some deviation from these laws. These are called real gases. The deviation are maximum under high pressure and at low temperature. These are comparatively small when the conditions are reversed. It has been found that the easily liquefiable gases show more deviations from the ideal gas behaviour as compared to the gases which are liquified with difficulty.

Gas deviates from ideal gas behaviour because molecules

A. are colourless

B. attract each other

C. contain covalent bond

D. show Brownian Movement

Answer: B

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2. The gases obey the different gas laws only theoretically. Practically all of them show some deviation from these laws. These are called real gases. The deviation are maximum under high pressyre and at low temperature. These are comparatively small when the conditions are reversed. It has been found that the easily liquefiable gases show more deviations from the ideal gas beheviour as compared to the gases which are liqufied with diffculty.

An ideal gas is one which obeys the gas laws under

A. a few selected experimental conditions

B. all experimental conditions

C. low pressure alone

D. high pressure alone.

Answer: B

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3. The gases obey the different gas laws only theoretically. Practically all of them show some deviation from these laws. These are called real gases. The deviation are maximum under high pressyre and at low temperature. These are comparatively small when the conditions are reversed. It has been found that the easily liquefiable gases show more deviations from the ideal gas beheviour as compared to the

gases which are liqufied with diffculty.

The temperature at which the real gases obey the ideal ga laws over a wide range of pressure is called

A. Critical temperature

B. Boyle's temperature

C. Inversion temperature

D. Reduced temperature.

Answer: B

4. The gases obey the different gas laws only theoretically. Practically all of them show some deviation from these laws. These are called real gases. The deviation are maximum

under high pressyre and at low temperature. These are comparatively small when the conditions are reversed. It has been found that the easily liquefiable gases show more deviations from the ideal gas beheviour as compared to the gases which are liqufied with diffculty.

The van der Waals equation reduces itself to ideal gas equation at

A. high pressure and low temperature

B. low pressure and low temperature

C. low pressure and high temperature

D. high pressure only.

Answer: C

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5. The gases obey the different gas laws only theoretically. Practically all of them show some deviation from these laws. These are called real gases. The deviation are maximum under high pressyre and at low temperature. These are comparatively small when the conditions are reversed. It has been found that the easily liquefiable gases show more deviations from the ideal gas beheviour as compared to the gases which are liqufied with diffculty.

The compressibility factor for an ideal gas is :

A. 1.5

B. 1.0

C. 2.0

D. Infinity.

Answer: B

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Comphension 3

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. $\mathrm{dyne}/\mathrm{cm}$

B. newton/m

C. J/m^2

D. $erg/cm.$

Answer: D

Watch Video Solution

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 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.

Surface tension of a liquid does not depend on :

A. temperature

B. intermolecular forces

C. surface area

D. solute dissolved in liquid.

Answer: C

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4. 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.

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

A. surface tension not hot water = surface tension of oil

B. surface tension not hot water $<$ surface tension of oil

C. surface tension not 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 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 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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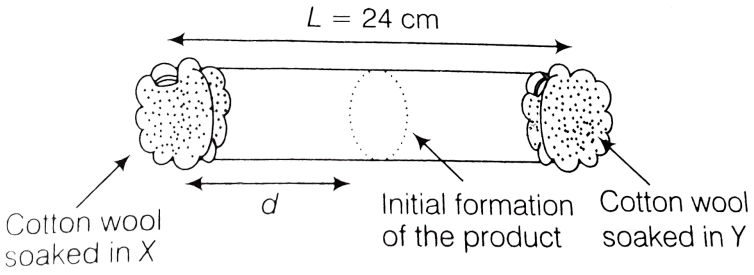
Comphension 4

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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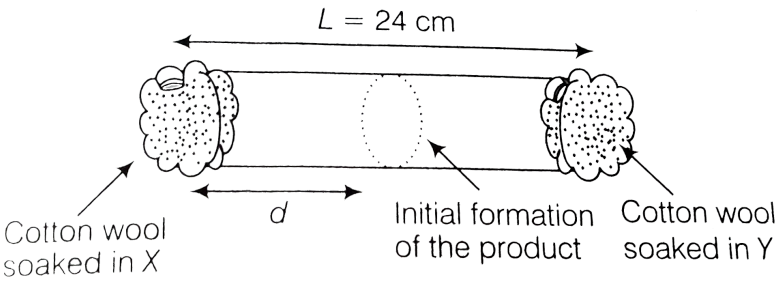
Watch Video Solution

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 for path for X as compared of that of Y

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

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

Answer: D

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Straight Objective Type Mcq

1. Equal weights 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. $\frac{1}{3}$

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

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

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

Answer: A

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2. Rate of diffustion of a gas is :

A. directly proportional to its density

B. directly proportional to its molecular mass

C. directly proportional to the square root of its molar mass

D. inversely propertional to the squaure root of its molar mass.

Answer: D

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3. A bottle contaning ammonia and a bottle containing hydrogen chloride are connected through along tube are opened simultaneously at both ends. The white ammonium chloride first formed will be :

A. at the centre of the tube

B. near the hydrogen chloride tube

C. near the ammonia tube

D. throughout the length of the tube.

Answer: B

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4. The value of van der Waals constant a for the gases O_2, N_2, NH_3, and CH_4 are 1.360, 1.390, 4.170, and $2.253 L^2 atm mol^{-2}$, respectively. The gas which can most easily be liquefied is

A. O_2

B. N_2

C. NH_3

D. CH_4.

Answer: C

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5. If the ration of the masses of SO_3 and O_2 gases confined in a vessel is $1:1$, then the ratio of their partial pressure would be

A. $1:2$

B. $2:5$

C. $2:1$

D. $1:2$

Answer: B

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6. The ratio between the root mean square speed of H_2 at $50K$ and that of O_2 at $800K$ is

A. 4

B. 2

C. 1

D. $1/4$

Answer: C

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7. Real gases behave ideally at:

A. low temperature and low pressure

B. low temperature, high pressure

C. high temperature, low pressure

D. high temperature, high pressure

Answer: C

Watch Video Solution

8. The compressibility factor for an ideal gas is

A. 1.5

B. 1.0

C. 2.0

D. ∞

Answer: B

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9. The critical temperature of water is higher than that of CO_2 because the H_2O molecular has

A. fewer electrons than O_2

B. two covalent bonds

C. V-shape

D. diople moment.

Answer: D

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10. The compressibility of a gas is less than unity at N.T.P. 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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11. The r.m.s. velocity of hydrogen is $\sqrt{7}$ times the r.m.s. velocity $1.0gcm^{-3}$ and that of wate vapours is $0.0006gcm^{-3}$, then the volume of water molecules in 1 L` of steam at this temperature is

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

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

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

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

Answer: C

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12. At $100^\circ C$ and $1atm$, if the density of the liquid water is $1.0gcm^{-3}$ and that of water vapour is $0.0006gcm^{-3}$, then the volume occupied by water molecules in $1L$ of steam at this temperature is

A. $6cm^3$

B. $60cm^3$

C. $0.6cm^3$

D. $0.06cm^3$

Answer: C

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13. 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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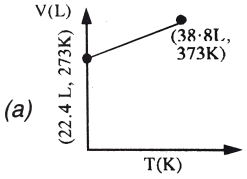
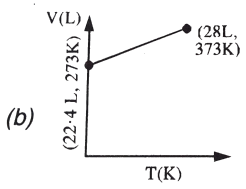
14. Which of the following volume-temperature $(V - I)$ plots represents the behaviour of 1mole of an ideal gas at the atmospheric pressure?

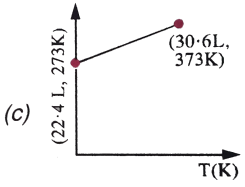
A.



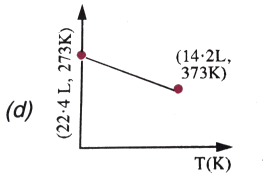
B.



C.



D.



Answer: C

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15. When the temperature is increased surface tension of water .

A. increases

B. decreases

C. remain constant

D. shows irregular behaviour.

Answer: B

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16. Positive deviation from ideal behaviour takes place because of

A. molecular interaction between atoms and $\frac{PV}{nRT} > 1$

B. molecular interaction between atoms and $\frac{PV}{nRT} < 1$

C. finite size of the atoms and $\frac{PV}{nRT} > 1$

D. finite size of the atoms and $\frac{PV}{nRT} < 1$

Answer: A

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17. 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: C

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

A. 2

B. 0.5

C. 1

D. 4

Answer: A

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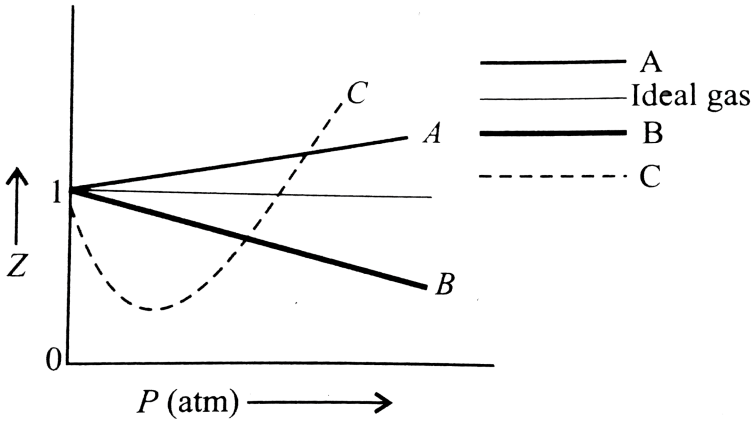
19. The given graph represents the variations of compressibility factor $Z = PV/nRT$ vs P for three real

gases A, B, and C.



Identify the incorrect statements.

A. for the gas A, a = 0 and its dependent on P is linear at all pressures

B. for the gas B, B = 0 and its dependence on P, is linear at all pressures

C. for the gas C, which is typical real gas for which neither a nor b = 0. By knowing the minima and the

point of intersection, with $Z = 1$, a and b can be calculated

D. at high pressure, the slope is positive for all real gases.

Answer: B

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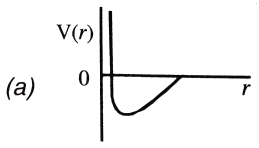
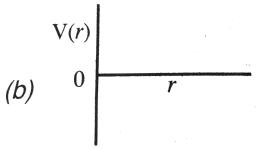
20. One mole of a monoatomic real gas satisfies the equation $p(V - b) = RT$ where b is a constant. The relationship of interatomic potential $V(r)$ and interatomic distance r for gas is given by

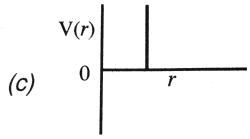
A.



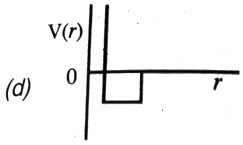
B.



C.



D.



Answer: C

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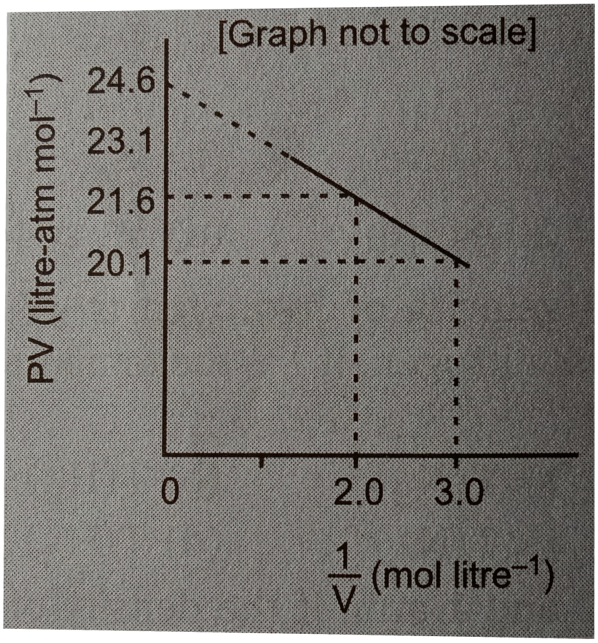
21. For one mole of a van der Waals gas when $b = 0$ and $T = 30K$ the $PVvs1/V$ plot is shown below The value of

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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22. Which of the following gives straight line plot, keeping the third parameter correct ?

A. P versus V

B. P versus $1/V$

C. V ersus T

D. P versus T.

Answer: B::C::D

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23. Which of the following are incorrect?

A. At altitude, the pressure of air is low

B. At altitude, the density of air is low

C. At altitude, cooking takes place slower

D. At altitude, water will boil at temperature greater than

$100^\circ C$.

Answer: C::D

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24. Units of pressure are :

A. Newton

B. Pascal

C. Bar

D. Torr.

Answer: B::C::D

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25. Which of the following are not the units of gas constant (R) ?

A. dynes $K^{-1}mol^{-1}$

B. ergs $\text{degree}^{-1}mol^{-1}$

C. $\text{cm}^3K^{-1}mol^{-1}$

D. $Padm^3K^{-1}mol^{-1}$

Answer: A::C

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26. If a gas is allowe to expand at constant temperature,

A. the pressure decreases

B. the kinetic energy of the molecules remains the same

C. kinetic energy decreases

D. no. of molecules of the gas incresaes.

Answer: A::B

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27. A gas described by van der Waals equation .

A. behaves similar to an ideal gas in the limit of large molar volumes

B. behaves similar to an ideal gas in the limit of large pressures.

C. is characterised by van der Waals co-efficients dependent the identity of the gas but independent of the temperature

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

Answer: A::C

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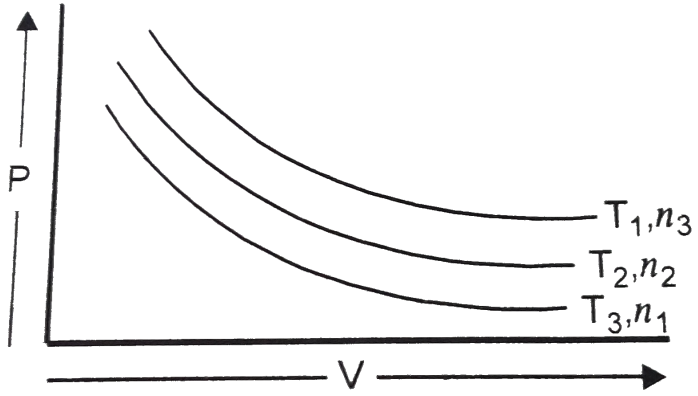
28. The graph of P vs V is given at temperature and number of moles :



The correct relationship is/are

A. $T_1 > T_2 > T_3$

B. $T_1 < T_2 < T_3$

C. $n_1 > n_2 > n_3$

D. $n_3 > n_2 > n_1$

Answer: A::D

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29. Which of the following statements are correct ?

A. Z (compressibility factor)for ideal gas is independent of temperature and pressure.

B. Z for ideal gas is greater than one.

C. Z for non-ideal gas is either greater tha one or less than one as well as dependent on temperature and pressure.

D. When $Z > 1$, then force of attraction dominates over force of replusion.

Answer: A::C

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Assertion And Reason

1. Assertion : At zero degree kelvin, the volume occupied by a gas is negligible.

Reason : All molecular motion ceases at $0K$.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: C

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

Reason : Intermolecular forces of attraction in real gases are greater than in ideal gas.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorrect

Answer: A

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3. Assertion : For a certain amount of an ideal gas, PV is always constant at constant temperature.

Reason : This is the statement of Boyle's Law.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: A

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4. Assertion : Compressibility factor for ideal gas is one.

Reason : For an ideal gas $PV = nRT$ equation is obeyed.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: A

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

Reason: Helium is an inert gas.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: C

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6. 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 assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: A

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7. 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 assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: A

8. Assertion : Pressure of a dry gas at any temperature can be calculated by substracting aqueous tension at that temperature from the pressure of the moist gas.

Reason : The pressure of water vapours is called aqueous tension.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: B

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9. Assertion : CO_2 gas stronger intermolecular forces than CH_4

Reason : Critical temperature of CO_2 is more.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: A

View Text Solution

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

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

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: B

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11. Assertion : Lower the cirtical temperature for a gas, more easily can it is liquefied.

Reason : Critical temperature is the temperature above which above which a gas cannot liquefied depending upon the pressure.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: D

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Statement Type Question

1. Statement-1. Considering van der Waals' equation of state of NH_3 and N_2

$$\left[P + \frac{a}{V^2}\right][V - b] = RT$$

The value of van der Waals' constant for NH_3 is more than tht for N_2

Statement-2. Ammonia has lower molecular mass than N_2.

A. If both assertion and reason are correct and reason is correct explanation for assertion

B. If both assertion and reason are correct and reason is not correct explanation for assertion

C. If assertion is correct but reason is incorrect

D. If assertion and reason are both incorreect.

Answer: B

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2. Statement-1. Ammonia has lower molecular mass than N_2. Statement-2. At a given temperature te rate of diffusion is inversely proportional to the square root of its density.

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

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

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

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

Answer: A

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3. Statement-1. The pressure inside the LPG cylinder remains constant even what it is in use at room temperature.

Statement-2. Pressure on the liquid is independent of its mass.

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

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

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

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

Answer: A

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4. Statement-1. Vapour pressure of liquid ammonia is more than that iof water.

Statement-2. Molar mass of ammonia is less than that of water.

A. Statement-1 is true, statement-2 is also true, statement-2 is correct explanation of statement-3

B. Statement-1 is true, statement-2 is also true, statement-2 is not correct explanation of statement-3

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

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

Answer: A

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5. Statement-1. Most probable velocity is the velocity possesed by the maximum fraction of the molecules at a given temperature.

Statement-2. On collision, more and more molecules acquire higher speed at the same temperature.

A. Statement-1 is true, statement-2 is also true, statement-2 is correct explanation of statement-4

B. Statement-1 is true, statement-2 is also true, statement-2 is not correct explanation of statement-4

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

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

Answer: C

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