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CHEMISTRY

BOOKS - VGS PUBLICATION-BRILLIANT

STATES OF MATTER : GASES AND LIQUIDS

Very Short Answer Questions

1. Name the different Intermolecular forces experienced by the molecules of a gas.

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2. State Boyle's law. Give its mathematical expression.

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3. State Charles' law . Give its mathematical expression.

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4. What are Isotherms?

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5. What is Absolute Temperature?

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6. What are Isobars?

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7. What is Absolute Zero?

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8. State Avogadro's law.

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9. What are Isochores?

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10. What are S.T.P conditions?

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11. What is Gram molar volume?

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12. What is an ideal gas?

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13. Why the gas constant 'R' is called universal gas constant?

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14. Why Ideal gas equation is called Equation of State?

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15. Give the values of gas constant is different units.

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16. How are the density and molar mass of a gas related?

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17. State Graham's law of diffusion.

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18. Which of the gases diffuses faster among N_2, O_2 and CH_4? Why?

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19. How many times methane diffuses faster than sulphur dioxide?

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20. Sate Dalton'law of partial pressures.

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21. Give the relation between the partial pressure of a gas and its mole fraction.

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22. What is aqueous tension?

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23. Give the two assumptions of Kinetic molecular theory of gases that do not hold good in explaining the deviation of real gases from ideal behaviour.

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24. Given the kinetic gas equation and write the terms in it.

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25. Give an equation to calculate the kinetic energy of gas molecules.

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26. What is Boltzman's constant? Give its value.

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27. What is R.M.S speed?

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28. What is average speed?

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29. What is most probable speed?

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30. What is the effect of temperature on the speeds of the gas molecules?

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31. What is the effect pf temperature on the kinetic energy of the gas molecules ?

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32. Given the ratio of RMS, average and most probable speeds of gas molecules.

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33. Why RMS speed is taken in the derivation of kinetic gas equation?

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34. What is compressiblity factor?

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35. What is Boyle's temperature?

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36. What is critical temperature? Give its value for CO_2.

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37. What is critical volume?

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38. What is critical pressure?

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39. What are critical constants?

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40. Define vapour pressure of a liquid.

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41. What are normal and standard boiling points? Give their values for H_2O.

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42. Why pressure cooker is used for cooking food on hills?

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43. What is surface tension?

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44. What is laminar flow of liquid?

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45. What is coefficient of viscosity? Give its units.

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Short Answer Questions

1. State and explain Boyle's law.

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2. State and explain Charle's law.

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3. Derive ideal gas equation.

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4. State and explain Graham's law of Diffusion.

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5. State and explain Dalton's law of partial pressures.

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6. Deduce Boyle's law from kinetic gas equation.

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7. Deduce Charle's kaw from kinetic gas equation.

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8. Deduce Graham's law from kinetic gas equation.

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9. Deduce Dalton's from kinetic gas equation.

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10. Derive an expression for kinetic energy of gas molecules.

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11. Define rms of gas molecule. Give their interrelationship.

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12. Define average of gas molecule. Give their interrelationship.

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13. Define most probable speeds of gas molecule. Give their interrelationship.

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14. Explain the physical significance of vander Waals parameter.

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15. What is surface tension of liquids? Explain the affect of temperature on the surface tension of liquids.

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16. What is vapour pressure of liquids? How the vapour pressure of a liquid is related to its boiling point?

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17. Define viscosity and coefficient of viscosity. How does the viscosity of liquids varies with temperature.

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Long Answer Questions

1. Write notes on Intermolecular forces

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2. State Boyle's law, Charles' law and Avogadro's law and derive ideal gas equation.

3. Write notes on diffusion of Gases.

4. State and explain Dalton's law of partial pressures.Derive the relation between partial pressure and total pressure.

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5. Write the postulates of kinetic molecular theory of gases .

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6. Derive an expression for kinetic energy of gas molecules.

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7. Explain Maxwell-Boltzmann distribution curves of molecular speeds and give the important conclusions. Discuss the effect of temperature on the distribution of molecular speeds.

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8. Write notes on the behaviour of real gases and their deviation from ideal behaviour.

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9. Derive the van der Waals equation of state. Explain the importance of van der Waals' gas equation.

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10. Explain the liquefication of gases.

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11. Write notes on the following properties of liquids

a) Vapour pressure (b) Surface tension (c) Viscosity.

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Problems

1. What will the minimum pressure required to compress $500 dm^3$ of air at 1bar 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 $35^\circ C$ and 1.2 bar pressure. 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 density of a gas is proportional to gas pressure p.

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4. At $0^\circ C$ the density of a certain oxide of a gas at 2bar is same as that of dinitrogen 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 the relationship between their molecular masses.

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6. The drain cleaner , Drainex contains small bits of aluminium which react with caustic soda to produce dihydrogen. What volume of

dihydrogen at $20^{\circ}C$ and one bar will be released when 0.15 g of aluminium reacts?

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

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8. What will be the pressure of the gaseous mixture when 0.5 L of H_2 at 0.8 bar and 2.0 L of dioxygen at 0.7 bar are introduced in a 1 L vessel at $27^\circ C$?

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9. Density of a gas is found to be $5.46 \frac{g}{d} m^3$ at $27^\circ C$ at 2 bar pressure. What will be its density of STP?

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10. 34.5 mL of phosphorus vapour weights 0.0625g at $546^{\circ}C$ and 0.1 bar pressure . What is the molar mass of phosphorus?

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11. A student forgot to add the reaction mixture to the round bottomed flask at $27^{\circ}C$ but instead he/she placed the flask on the flame . After a lapse of time, he realized his mistake, and using a pyrometer the 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 $5dm^3$ at 3.32 bar.

$\left(R = 0.083 bar dm^3 K^{-1} mol^{-1}\right)$.

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13. Calculate the total number of electrons present in 1.4 g of dinitrogen 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. Ammonia gas diffuses through a fine hole at the rate $0.5lit\ \min^{-1}$. Under the same conditions find the rate of diffusion of chlorine gas.

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16. Find the relative rates of diffusion of CO_2 and Cl_2 gases.

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17. IF 150 mL carbon dioxide effused in 25 seconds, what volume of methane would effuse in same time.

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18. Hydrogen chrolide gas is sent into a 100 metre tube from one end 'A and ammonia gas from the other end 'B', under similar conditions. At what distant from 'A' will be the two gases meet.

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19. Calculate the total pressure in a mixture of 8 g of dioxygen and 4 g of dihydrogen confined in a vessel of 1 dm^3 at $27^\circ C$. R=0.083 bar $dm^3 K^{-1} mol^{-1}$.

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20. Calculate the total pressure in a mixture of 3.5 g of dinitrogen 3.0 g of dihydrogen and 8.0

g dioxygen confined in vessel of 5 dm^3 at $27^\circ C$ (R=0.083 bar $dm^3 K^{-1} mol^{-1}$)

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

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

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23. 2.9 g of a gas at 95° occupied the same volume as 0.184 g of dihydrogen at $17^\circ C$,at the same pressure, what is the molar mass of the gas?

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24. A mixture of dihydrogen and dioxygen at one bar pressure contains 20% by weight of dihydrogen. Calculate the partial pressure of dihydrogen.

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

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

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27. Critical temperature for carbon dioxide and methane are $31.1^{\circ} C$ and $-81.9^{\circ} C$ respectively. Which of these has stronger intermolecular forces and why?

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28. Air is cooled from $25^\circ C$ to $0^\circ C$. Calculate the decrease in rms speed of the molecules.

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29. Find the rms, most probable and average speeds of SO_2 at $27^\circ C$.

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30. Find the RMS, average and most probable speeds of O_2 at $27^\circ C$.

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Additional Question Answers

1. A balloon is filled with hydrogen at room temperature. It will burst if pressure exceeds 0.2 bar, If at 1 bar pressure the gas occupies

2.27 L volume, upto what volume can the balloon be expanded?

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2. On a ship sailing in pacific ocean where temperature is $23.4^{\circ} C$, a balloon is filled with 2 L air. What will be the volume of the balloon when the ship reaches indian ocean, where temperature is $26.1^{\circ} C$?

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3. 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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4. $360cm^3$ of CH_4 gas diffused through a porous membrane in 15 minutes. Under similar conditions, $120cm^3$ of another gas diffused in 10 minutes. Find the molar mass of the gas.

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5. Carbon dioxide and another gas 'X' have their rates of diffusion as 0.299 cc s^{-1} and 0.271 cc s^{-1} respectively. Find the vapour density of the gas 'X' if the vapour density of carbon dioxide is 22.

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6. A neon dioxide 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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7. Find RMS speed , average speed and most probable speed of CO_2 gas at $27^\circ C$.

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8. Calculate kinetic energy of 5 moles of Nitrogen at $27^\circ C$.

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9. Calculate kinetic energy (in SI units) of 4g. Of methane at $-73^\circ C$.

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10. Calculate the ratio of kinetic energies of 3g of hydrogen and 4g of oxygen at an given temperature.

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