

St. Joseph's College of Arts & Science (Autonomous)
Cuddalore – 607001

QUESTION BANK

CLASS: I - B.Sc., CHEMISTRY, SEMESTER-I
SUBJECT: KINETIC THEORY OF GAS AND CHEMICAL KINETICS
SUBJECT CODE: CH102Q

UNIT – I ONE MARK QUESTIONS

1. Define mole fraction.
2. Give formula for Boyle's law-----
3. ----- is the mathematical representation of Charles's law.
4. What is the formula for Avogadro's law.
5. What is Boyle temperature? Give its significance.
6. The compressibility factor Z ----- for ideal gas.
7. $1\text{J} = \text{-----}(\text{Nm})$
8. $1\text{nm} = \text{-----}\text{\AA}$.
9. $1\text{\AA} = \text{-----}\text{cm}$.
10. $1\text{cal} = \text{-----}\text{J}$.
11. $1\text{atm} = \text{-----}\text{mmHg}$.
12. ----- is the conversion factor between K and $^{\circ}\text{C}$.
13. An ideal gas is one which obeys the gas laws or the gas equation----- at all pressures and temperatures. ($PV = RT$)
14. At,----- and ----- real gases show nearly ideal behaviour and the ideal-gas equation is obeyed. (low pressures and fairly high temperatures)
15. For n moles of the gas, the corrected volume is ----- ($V - nb$)
16. The pressure P in the ideal gas equation is corrected as ----- for n moles of gas.
17. The----- of a gas may be defined as that temperature above which it cannot be liquefied no matter how great the pressure applied. (critical temperature, T_c)
18. According to Boyle's law the volume of a fixed mass of a gas, at constant temperature, is (a) directly proportional to its pressure (b) inversely proportional to its pressure (c) the square root of its pressure (d) none of these. Answer. (b)
19. Mathematically, Boyle's law can be represented as (a) $V \propto 1/P$ (b) $V = k/P$ (c) $V P = k$ (d) all of these Answer. (d)
20. At constant temperature, the pressure of the gas is reduced to one third, the volume (a) reduces to one third (b) increases by three times (c) remains the same (d) cannot be predicted Answer. (b)
21. At constant pressure, the volume of a fixed mass of a gas is (a) directly proportional to its temperature (b) directly proportional to its absolute temperature (c) inversely proportional to its temperature (d) inversely proportional to its absolute temperature Answer. (b)
22. "Equal volume of all gases at the same temperature and pressure contain equal number of molecules" is the statement of (a) combined gas law (b) Charles's law (c) Avogadro's law (d) Boyle's law Answer. (c)

23. For one mole of a gas, the ideal gas equation is (a) $PV = RT$ (b) $PV = 1/2 RT$ (c) $PV = 3/2 RT$ (d) $PV = 5/2 RT$ Answer. (a)
24. The units of R, the gas constant are (a) erg $K^{-1} mol^{-1}$ (b) cal $K^{-1} mol^{-1}$ (c) joule $K^{-1} mol^{-1}$ (d) all of these Answer. (d)
25. In lit atm $K^{-1} mol^{-1}$ the numerical value of R, the gas constant, is (a) 0.821 (b) 0.0821 (c) 0.00821 (d) 0.000821 Answer. (b)
26. The real gases show nearly ideal behaviour at (a) low pressures and low temperatures (b) high pressures and low temperatures (c) high pressures and high temperatures (d) low pressures and high temperatures Answer. (d)
27. Excluded volume is _____ times the actual volume of molecules. (a) $1/2$ (b) two (c) three (d) four Answer. (d)
28. The units of 'a' the van der Waal's constant are (a) atm lit mol^{-1} (b) atm lit $^{-1}$ mol^{-1} (c) atm lit $^{-2}$ mol^{-2} (d) atm lit $^{-1}$ mol^{-2} Answer. (c)

2 & 3 MARK QUESTIONS

1. Define or explain the following terms : (a) Boyle's law (b) Charle's law (c) Avogadro's law (d) Combined gas laws (e) Ideal gas equation (f) Gas constant (g) Mean free path (h) Collision frequency (i) Real gases (j) van der Waals equation (k) Critical temperature.
2. Derive ideal gas equation.
3. State joule Thomson effect?
4. Explain the Linde's refrigerator?
5. Explain Compression/Compressibility factor?
6. State Viral equation of state.
7. Derive Vanderwalls state of equation?
8. Derive gas constant R in SI units.
9. Give gas constant R values in various units.
10. Explain the compressibility factor for different gases with graph.
11. Explain the deviation behavior of nitrogen gas.
12. What pressure is exerted by a mixture of 2.00 g of H_2 and 8.00 g of N_2 at 273 K in a 10 litre vessel ?
13. One mole of water vapour is confined to a 20 litre flask at $27^\circ C$. Calculate its pressure using (a) van der Waal's equation (b) Ideal gas equation Given that a = 5.464 litre 2 atm mol^{-1} b = 0.0305 litre mol^{-1} R = 0.0821 litre atm. deg $^{-1}$ mol^{-1}
14. Two moles of NH_3 are enclosed in a five litre flask at $27^\circ C$. Calculate the pressure exerted by the gas assuming that (i) the gas behaves like an ideal gas. (ii) the gas behaves like a real gas.
15. Van der Waals' constants for hydrogen chloride gas are a = 3.67 atm lit $^{-2}$ and b = 40.8 ml mol^{-1} . Find the critical temperature.
16. Give the conversion factors between $^\circ C$, $^\circ F$ and K.
17. Convert the following into Kelvin unit. A) 23,4.56,0.55,-45 Faremheit, B) 0,100,234,-45.5 degree Celcius.

UNIT –II ONE MARK QUESTIONS

1. The product PV for a gas has the same unit as-----
2. The density of helium gas will be highest at-----
3. A gas would show maximum deviations from ideal gas behavior at-----
4. The compressibility factor of a perfect gas is-----
5. The compressibility factor of a vanderwaals gas at the critical point is-----
6. Average Velocity = $0.9213 \times$ ----- Velocity.
7. The closest distance between the centres of the two molecules taking part in a collision is called the -----.
8. The smaller the collision or molecular diameter, the larger is the-----.(mean free path).
9. The----- of a gas is defined as the number of molecular collisions taking place per second per unit volume (c.c.) of the gas. (collision frequency).
10. "The total pressure of a mixture of gases (non-reacting) is equal to the sum of the partial pressures of all the gases present" is the statement of (a) Graham's law of diffusion (b) Dalton's law of partial pressures (c) Avogadro's law of partial pressures (d) none of these Answer. (b)
11. Under same conditions of temperature and pressure, the rates of diffusion of different gases are (a) directly proportional to the square roots of the molecular masses (b) directly proportional to the square roots of their vapour densities (c) inversely proportional to the square roots of their molecular masses (d) inversely proportional to the square roots of their molar volumes Answer. (c)
12. The average kinetic energy of the gas molecules is (a) inversely proportional to its absolute temperature (b) directly proportional to its absolute temperature (c) equal to the square of its absolute temperature (d) directly proportional to the square root of its absolute temperature Answer. (b)
13. For one mole of a gas the kinetic energy is given by (a) $E = 1/2 RT$ (b) $E = 3/2 RT$ (c) $E = 5/2 RT$ (d) $E = 7/2 RT$ Answer. (b)
14. The kinetic gas equation is given by the relation (a) $PV = 1/3 m N \mu^2$ (b) $PV = 1/2 m N \mu^2$ (c) $PV = 3/2 m N \mu^2$ (d) $PV = 2/3 m N \mu^2$ Answer. (a)
15. The average velocity of a gas is given by-----
16. The root mean square velocity of gas molecules is given by the relation-----
17. The free path is the distance travelled by the molecule (a) before collision (b) in one second (c) after collision (d) in one minute Answer. (a)
18. The mean free path is (a) directly proportional to the pressure of the gas (b) directly proportional to the root mean square velocity of gas (c) directly proportional to the temperature of the gas (d) directly proportional to the absolute temperature of the gas Answer. (d)
19. The collision frequency of a gas is (a) directly proportional to the square root of absolute temperature (b) directly proportional to the absolute temperature (c) inversely proportional to the pressure of the gas (d) inversely proportional to the absolute temperature Answer. (b)

2 &3 MARK QUESTIONS

1. Derive combined gas equation?
2. Derive kinetic gas equation?
3. Define Dalton's law?
4. What is partial pressure?
5. Determination of Maxwell distribution?
6. Calculate the pressure exerted by 2mol of oxygen gas in 2.54dm^3 vessel at 53.2°C using ideal gas and vanderwaals equation?
7. What is STP and SATP?
8. What is the difference between diffusion and effusion?
9. Define average, most probable and rms velocity.
10. Calculate the Average, Most probable and Root mean square velocity of CO_2 molecule at 1000°C .
11. Calculate the RMS velocity of chlorine molecules at 12°C and 78 cm pressure.
12. Calculate the average velocity of nitrogen molecule at STP.
13. Oxygen at 1 atmosphere pressure and 0°C has a density of 1.4290 grams per litre. Find the RMS velocity of oxygen molecules.
14. Calculate the most probable velocity of nitrogen molecules, N_2 , at 15°C .
15. The root mean square velocity of hydrogen at STP is $1.83 \times 10^5 \text{ cm sec}^{-1}$ and its mean free path is $1.78 \times 10^{-5} \text{ cm}$. Calculate the collision number at STP.

UNIT –III ONE MARK QUESTIONS

1. What is law of mass action?
2. -----is not applicable at high pressures.(Freundlich isotherm).
3. -----occurs rapidly at low temperature and decreases with increasing temperature.(Physical adsorption)
4. -----like most chemical changes, generally increase with temperature.(Chemisorption)
5. increase of -----leads to increase of adsorption and decrease of pressure causes desorption.(pressure)
6. The phenomenon of concentrations of molecules of a gas or liquid at a solid surface is called (a) absorption (b) adsorption (c) catalysis (d) none of these Answer. (b)
7. Adsorbate is that substance (a) which concentrates on the surface (b) where adsorption takes place (c) which evaporates from the surface of metals (d) none of these Answer. (a)
8. The adsorption of gases on metal surfaces is called (a) catalysis (b) occlusion (c) adsorption (d) absorption Answer. (b)
9. Increase in _____ of the adsorbent increases the total amount of the gas adsorbed (a) density (b) volume (c) surface area (d) surface tension Answer. (c)
10. _____ the critical temperature of the gas, the more readily will it be adsorbed (a) lower (b) higher (c) intermediate (d) none of these Answer. (b)
11. The process of adsorption is (a) exothermic (b) endothermic (c) sometimes exothermic, sometimes endothermic (d) none of the above Answer. (a)

12. Physical adsorption is a _____ process (a) reversible (b) irreversible (c) exothermic (d) none of these Answer. (a)
13. Physical adsorption occurs rapidly at _____ temperature (a) low (b) high (c) absolute zero (d) none of these Answer. (a)
14. Physical adsorption generally _____ with increasing temperature (a) decreases (b) increases (c) sometimes decreases, sometime increases (d) none of these Answer. (a)
15. Chemisorption generally _____ with temperature (a) increases (b) decreases (c) remains the same (d) none of these Answer. (a)
16. Multi-molecular layers are formed in (a) absorption (b) physical adsorption (c) chemisorption (d) reversible adsorption Answer. (c)
17. The relationship between equilibrium pressure of a gas and its amount adsorbed on the solid adsorbent at constant temperature is called (a) chemisorption (b) adsorption isobars (c) adsorption isotherms (d) none of these Answer. (c)
18. Freundlich isotherms is not applicable at (a) high pressure (b) low pressure (c) 273 K (d) room temperature Answer. (a)
19. At low pressures, the amount of the gas adsorbed is _____ proportional to the pressure (a) directly (b) inversely (c) sometimes directly, sometimes inversely (d) none of these Answer. (a)
20. In gas masks the poisonous gases are removed by the adsorbent by the process of (a) absorption (b) adsorption (c) catalysis (d) none of these Answer. (b)
21. Froth flotation process for the concentration of sulphide ore makes use of the process of (a) adsorption (b) heterogeneous catalysis (c) absorption (d) equilibrium Answer. (a)

2 & 3 MARK QUESTIONS

1. Explain law of mass action.
2. Derive relationship between K_p & K_c ?
3. Explain Le chatlier's principle ?
4. What is adsorption explain and its terminologies ?
5. Derive Gibbs adsorption isotherm ?
6. Derive Freundlich-Langmuir adsorption isotherm ?
7. Derive BET isotherm ?
8. Explain various applications in adsorption isotherm?
9. What is adsorption? Define the terms 'adsorbent' and adsorbate' giving suitable examples.
10. Distinguish between physical adsorption and chemical adsorption.
11. What is an adsorption isotherm? Deduce Langmuir's adsorption isotherm.
12. Explain the applications of Adsorption.

UNIT –IV ONE MARK QUESTIONS

1. What is first order reaction?
2. Write a equation of first order kinetics/
3. What is order?
4. What is molecularity ?
5. The rate constant for a second order reaction is $0.001 \text{ mol}^{-1} \text{ s}^{-1}$. Its value expressed in units of $\text{ml molecule}^{-1} \text{ min}^{-1}$ is-----.
6. The rate of a reaction is directly proportional to the-----, each concentration being raised to some power.(reactant concentrations)
7. An expression which shows how the reaction rate is related to concentrations is called the-----.(rate law or rate equation)
8. A -----is one whose rate is independent of concentration.(zero order reaction)
9. The -----of an elementary reaction is defined as the number of reactant molecules involved in a reaction.(molecularity)
10. The experimental order which is not the actual one is referred to as the ----- (pseudo order)

2 &3 MARK QUESTIONS

1. What is average rate of reaction ?
2. What are the types in expressing the concentration of solutions ?
3. Give explanation of order and molecularity?
4. Explain half life period of a raction ?
5. Derive first order reaction kinetics ?
6. Derive pseudo and second order kinetics?
7. Explain temperature dependence of the rate of a reaction?
8. Write a note on effect of catalyst ?
9. Derive micheals-menton equation for catalysis ?
10. Calculate the units of the rate constant for first and second order reaction ?
11. Explain the effect of catalyst on the rate of a reaction with graph ?
12. From the following data for the decomposition of N_2O_5 in CCl_4 solution at 48°C , show that the reaction is of the first order

T(mins)	10	15	20	∞
Vol of O_2 evolved	6.30	8.95	11.40	34.75

13. The half-life of a substance in a first order reaction is 15 minutes. Calculate the rate constant.
14. The rate law for the decomposition of N_2O_5 (l) is : rate = $k [\text{N}_2\text{O}_5]$ where $k = 6.22 \times 10^{-4} \text{ sec}^{-1}$. Calculate half-life of N_2O_5 (l) and the number of seconds it will take for an initial concentration of N_2O_5 (l) of 0.100 M to drop to 0.0100 M.
15. The first order rate constant for the decomposition of N_2O_2 of 0°C is $5.2 \times 10^{-6} \text{ min}^{-1}$. If the energy of activation is 6200 joules per mole, calculate the rate constant at 25°C . Answer. 7.385×10^{-6}

UNIT –V ONE MARK QUESTIONS

1. Emulsifiers consists of ----- as well as ionogenic surfactants.
2. The miscelles of a surfactants is known as-----
3. CMC is called -----
4. The particle can move but not the medium is known as-----
5. Gouy-chapman layer is used to study-----
6. Some organic solids having long rod-like molecules do not melt to give the liquid substance directly. They, instead, pass through an intermediate state called the liquid crystal state, often referred to as the -----(liquid crystal)
7. The -----have a structure between that of a liquid and that of a crystalline solid.(liquid crystals)
8. -----have molecules parallel to each other like soda straws but they are free to slide or roll individually.(Nematic liquid crystals)
9. -----molecules in this type of crystal are also parallel but these are arranged in layers. The layers can slide past each other.(Smectic liquid crystals.)
10. The liquid crystals have (a) properties of super cooled liquid (b) properties of amorphous solids (c) the fluidity of a liquid and optical properties of a solid (d) none of these Answer. (c)
11. p-Ozoxyanisole is an example of (a) semi conductor (b) super conductor (c) liquid crystal (d) none of these Answer. (c)
12. In a solution of oxygen in water, oxygen is
a) Solute b) solvent c) Colloid d) Solution
13. Protein in water is an example for
a) Lyophobic b) Lyophilic c) Solution d) Colloids
14. The concentration of the solution can be expressed by
a) Molality b) Molality c) Normality d) All these
15. When a liquid is dispersed in a solid, the colloid is known as
a) A solution b) An emulsion c) A gel d) A foam

2 &3 MARK QUESTIONS

1. What is size range of colloidal particle ?
2. Explain the use of (a)dialysis (b)electro-dialysis (c)ultrafiltration ?
3. Discuss the origin of charge on colloidal solutions and explain the action ?
4. Discuss in detail the importance and applications of colloids ?
5. What is meant by electrical double layer ?
6. What are emulsion how are they prepared ?
7. What are gels and explain and its terms ?
8. What are emulsifiers ?

9. Define and Explain the liquid crystals?
10. Explain different types of solutions.
11. Give the different units of concentrations.
12. Differentiate ideal and non ideal solutions.
13. a). What is Meant by ideal solution Give example?
b). What are liquid crystals? How they are classified. Give example for each.
14. a). What weight of HCl is present in 155ml of a 0.540M solution?
b). Compare Lyophilic and Lyophobic solutions?
15. A). Discuss the Importance and applications of colloids?
16. a). Write Kinetic equation for gases.
b). What are Liquid crystals? How they are classified? Give example for each.