

CHEMISTRY

Time: 1 Hour

Max.Marks : 60

Instructions:

(1) *Answer must be written either in English or the medium of instruction of the candidate in high school.*

(2) *There will be no negative marking*

(3) *Use of calculators or graph papers is not permitted*

(4) *There are TWELVE questions. Answer all the questions.*

1. (a) What is ionic and solubility product, differentiate the two with suitable example.

(b) Derive a solubility product expression for the salt B_xA_y

(c) What is the significance of ionic and solubility product in chemistry.

(1+2+2=5)

2. (a) For all practical purposes, chemical reactions are classified into reversible and irreversible reactions. What is the criterion for reverse and irreversibility of the reaction?

(b) What is equilibrium constant and what is the significance of equilibrium constant in chemistry.

(c) At a particular temperature the number of moles of different constituents for the reactions $N_2 + 3H_2 \rightleftharpoons 2NH_3$ are $(1-\alpha)$ for N_2 ; $3(1-\alpha)$ for H_2 ; 2α for NH_3
Derive the expression for equilibrium constant K_p in terms of α and total pressure P . Assume that α is less than one. (1+2+2=5)

3. (a) $pH = -\log[H^+]$; $pOH = -\log[OH^-]$ and $pK_w = -\log K_w$ from this information derive the relation among the term pH, pOH and pK_w .

(b) Nature of the solution depends on $[H^+]$, but pH notation is used to express the nature of the solution why?

(c) At $100^\circ C$ pK_w of $H_2O = 13$ and $pH = 6.5$ but H_2O is neutral at this temperature, explain. (1+2+2=5)

4. (a) Give the preparatory procedure of white phosphorus through balanced chemical equation.
 (b) How white phosphorus is converted into red phosphorus.
 (c) Write one structural, one physical and one chemical difference between the white and red phosphorus.
 (d) Explain reactions of white phosphorus with Ba(OH)_2 with balanced equation.
 (1+1+1+2=5)

5. (a) Why absolute temperature is used in discussing the behavior of gases.
 (b) Draw the graph for volume of the gas versus absolute temperature $T(\text{K})$ for 5 moles of an ideal gas at one atmosphere pressure and
 (c) at what point on Y-axis it intercepts.
 (d) Show the volume of the gas in the graph at 473K. (2+1+1+1=5)

6. (a) What is oxidation and reduction according to modern theories?
 (b) Why should oxidation and reduction occur together in a reaction?
 (c) Give a displacement reaction, and identify the oxidant and reductant.
 (d) What are the advantages in introducing the oxidation - reduction concept in chemical reactions. (1+1+1+2=5)

7. (a) What is meant by term rate of reaction. Why does rate of reaction normally change with time?
 (b) When does rate of reaction equal to rate constant.
 (c) What are the factors that affect the magnitude of rate constant and why? And which factors do not affect the magnitude of the rate constant.
 (d) Alcohol is removed from blood stream by a series of metabolic reactions. The first reaction produces acetaldehyde and then other products are formed. The following data have been determined for the rate at which alcohol is removed from blood of an average male. Although individual rates can vary by 25% - 30% women metabolize alcohol little more slowly.

$[\text{C}_2\text{H}_5\text{OH}] \text{ M}$ 4.4×10^{-2} 3.3×10^{-2} 2.2×10^{-2}

Rate moles/lit. 2.0×10^{-2} 2.2×10^{-2} 2.2×10^{-2}

Determine the rate equation and overall order for this reaction. (1+1+1+2=5)

8. Potassium permanganate is most commonly used inorganic chemical in the industry. It is used as oxidizing agent in the most of the chemical reactions. Write the balanced chemical equations for its preparation and oxidizing properties given below.

- (a) Pyrolusite is fused with solid KOH in the presence of air.
 (b) Resulted mass is extracted with water and treated with Cl_2 gas.
 (c) Through the acidified solution of potassium permanganate H_2S gas is passed.
 (d) KMnO_4 is used as a disinfectant. (1+1+1+2=5)

9. (a) What is the basic difference between molarity and molality.
 (b) What is affect of the temperature?

(c) For a given aqueous solution, which is the higher, molarity (or) molality.

(d) The molarity and molality of a solution are M and m respectively. If the molecular weight of the solute is Y derive the relation for density in terms of M, m and Y. (1+1+1+2=5)

10. (a) What is organic chemistry what makes the organic chemistry a systematic subject.

(b) What are the factors that are responsible for formation of more number of organic compounds?

(c) Why does silicon form catenated compounds of very low stability?

(d) Why does carbon compounds are called as organic compounds? (1+1+2+1=5)

11. (a) Modern periodic table is based on electronic configuration but not on atomic number (Z) why?

(b) Why do we call s and p block elements excluding zero group, are called as representative elements.

(c) What is the group and maximum combining capacity of the element with atomic number 53?

(d) A monatomic ion has a charge of +3. The nucleus of the ion has a mass number of 45. The number of neutrons in the nucleus is 1.14 times that of the number of protons. How many electrons are there in the ion. What is the name of the element? (1+2+1+1=5)

12. (a) Why cation is called as basic radical and anion is called as basic radical.

(b) What is acid - base neutralization? What happens during the neutralization?

(c) Every reaction has its own heat of reaction, but same amount of heat is liberated when one mole of caesium hydroxide is separately treated with one mole of HI and HClO_4 .

(d) When acid solution is completely neutralized with base, the resulted solution is not always neutral, why? (1+1+1+2=5)