



Roll No.

Answer Sheet No. \_\_\_\_\_

Sig. of Candidate. \_\_\_\_\_

Sig. of Invigilator. \_\_\_\_\_

## CHEMISTRY HSSC-I

### SECTION - A (Marks 17)

Time allowed: 25 Minutes

NOTE:- Section-A is compulsory and comprises pages 1-2. All parts of this section are to be answered on the question paper itself. It should be completed in the first 25 minutes and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q. 1 Circle the correct option i.e. A / B / C / D. Each part carries one mark.

- (i) What is the formula of Sodium oxide if 0.69 g of Sodium combines with 0.24 g of Oxygen?
- |                     |                                   |
|---------------------|-----------------------------------|
| A. NaO              | B. Na <sub>2</sub> O              |
| C. NaO <sub>2</sub> | D. Na <sub>2</sub> O <sub>2</sub> |
- (ii) Which of the following pairs of mixture can be separated by sublimation?
- |   |  |
|---|--|
| A. Na <sub>2</sub> SO <sub>4</sub> and NaCl | B. Benzoic acid and H <sub>2</sub> O     |
| C. Sand and Naphthlene                      | D. Pb <sup>++</sup> and Cd <sup>++</sup> |
- (iii) The critical temperature of a gas \_\_\_\_\_
- |  |   |
|--|---|
| A. Depends on the critical pressure    | B. Does not depend on nature of gas     |
| C. Is lower than inversion temperature | D. Is higher than inversion temperature |
- (iv) HF is among the weakest halogen acid due to \_\_\_\_\_
- |  |                                  |
|--|----------------------------------|
| A. Strong polar bond between H <sub>2</sub> and F <sub>2</sub> | B. Electronegativity of Fluorine |
| C. Smaller size of Fluorine                                    | D. Hydrogen bonding              |
- (v) Which of the following are Isomorphs?
- |  |  |
|--|--|
| A. NaNO <sub>3</sub> and CaCO <sub>3</sub> | B. ZnSO <sub>4</sub> and NiSO <sub>4</sub> |
| C. NaF and MgO                             | D. All of these                            |
- (vi) The blue colour of water in sea is due to \_\_\_\_\_
- |   |  |
|---|--|
| A. Reflection of blue sky by sea water                    | B. Reflection of blue light by impurities in sea water                   |
| C. Scattering of blue light by H <sub>2</sub> O molecules | D. Absorption of other colours except blue by H <sub>2</sub> O molecules |
- (vii) An ionic compound will dissolve in water only if \_\_\_\_\_
- |   |   |
|---|---|
| A. Hydration energy low and lattice energy high       | B. Hydration energy high and lattice energy low |
| C. Hydration energy high and lattice energy very high | D. Hydration energy and lattice energy low      |
- (viii) For any system the difference between enthalpy and internal energy can be expressed as \_\_\_\_\_
- |       |       |
|-------|-------|
| A. CP | B. CV |
| C. RT | D. PV |
- (ix) The specific rate constant for the forward and reverse reactions are  $25 \times 10^{-2}$  and  $5 \times 10^3$ , respectively. The equilibrium constant for the reaction  $A + B \rightleftharpoons C + D$  \_\_\_\_\_
- |                         |                       |
|-------------------------|-----------------------|
| A. $2.5 \times 10^{-6}$ | B. $5 \times 10^{-5}$ |
| C. $2 \times 10^{-4}$   | D. $4 \times 10^2$    |

DO NOT WRITE ANYTHING HERE

- (x) Which of the following statements about the order of reaction is **TRUE**?
- A. The order of reaction can only be determined by experiment  
B. A second order reaction is always bimolecular  
C. The order of reaction must be a positive integer  
D. The order of reaction increases with increase in temperature
- (xi) One mg of solute per kilogram of solution is \_\_\_\_\_
- A. 1 M  
B. 1 PPM  
C. 1 m  
D. 1% w/w
- (xii) If 5.85 g of NaCl are dissolved in 90 g of H<sub>2</sub>O, the mole fraction of NaCl is \_\_\_\_\_
- A. 0.1  
B. 0.2  
C. 0.0196  
D. 0.01
- (xiii) A compound decomposes with half life of 8 seconds and half life is independent of concentration. How much time is consumed to convert the concentration of  $\frac{1}{16}$ th (one sixteenth) of its initial concentration?
- A. 32 s  
B. 24 s  
C. 40 s  
D. 14 s
- (xiv) Standard reduction electrode potential of the three metals A, B and C are 0.5 v, -3.0 v and -1.2 v, respectively. The order of reducing power is \_\_\_\_\_
- A.  $B > C > A$   
B.  $A > B > C$   
C.  $C > B > A$   
D.  $A > C > B$
- (xv) Shape of  $ClO_3^-$  is \_\_\_\_\_
- A. Triangular pyramidal  
B. Tetrahedral  
C. Triangular bipyramidal  
D. Triangular planer
- (xvi) The properties which depend mainly on the arrangement of atoms in the molecule and to a lesser extent on their number are called \_\_\_\_\_ properties.
- A. Colligative  
B. Constitutive  
C. Additive  
D. Chemical
- (xvii) The temperature at which the solid and liquid phase of a substance coexists is called \_\_\_\_\_
- A. Consulate temperature  
B. Triple point  
C. Boiling point  
D. Freezing point

For Examiner's use only:

Total Marks:

17

Marks Obtained:

--- 1HA 1208 (L) ---



# CHEMISTRY HSSC-I

Time allowed: 2:35 Hours

Total Marks Sections B and C: 68

NOTE:- Sections B and C comprise pages 1-2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

## SECTION – B (Marks 42)

Q. 2 Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. ( 14 x3 = 42 )

- (i) What volume of 27% (W/v) HCl, with a density of  $1.14 \text{ g/cm}^3$  is required to produce 10.0 g of Hydrogen by the following equation: 03
- $$\text{Mg}_{(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{MgCl}_{2(aq)} + \text{H}_{2(g)}$$
- (ii) Why  $\text{H}_2$  and Helium are nearly ideal at room temperature and ordinary pressure but  $\text{SO}_2$  is non-ideal? 03
- (iii) 180 g of glucose and 342 g of sucrose have the same number of molecules but different number of atoms present in them. Justify the statement. 03
- (iv) Differentiate between Isomorphism and Polymorphism. 1.5+1.5=03
- (v) Why is the lattice energy of NaCl greater than KCl which in turn is greater than KBr? 03
- (vi)  $\text{BF}_3$ ,  $\text{BCl}_3$  and  $\text{AlCl}_3$  are triangular planer molecule but  $\text{NH}_3$ ,  $\text{NF}_3$  and  $\text{PCl}_3$  are triangular pyramids although in all these compounds the central atom is connected with three other atoms. 03
- (vii) Calculate the radius of third ( $n=3$ ) orbit of Hydrogen atom. What is the energy of an electron in this orbit? 03
- (viii) Explain Hybridization in  $\text{BF}_3$ . 03
- (ix) Calculate the heat of formation of  $\text{C}_3\text{H}_8$  Propane from the following data:  
Heat of combustion of C,  $\text{H}_2$  and  $\text{C}_3\text{H}_8$  is  $-393 \text{ kJm}^{-1}$ ,  $-286 \text{ kJm}^{-1}$  and  $-2213 \text{ kJm}^{-1}$ , respectively. 03
- (x) What are the optimum conditions of temperature, pressure and catalyst for obtaining maximum yield of products in the following industrial processes: 1.5+1.5=03
- a.  $\text{N}_{2(g)} + 3\text{H}_{2(g)} \rightleftharpoons 2\text{NH}_{3(g)}$
- b.  $2\text{SO}_{2(g)} + \text{O}_{2(g)} \rightleftharpoons 2\text{SO}_{3(g)}$
- (xi) Explain why aqueous solution of  $\text{CuSO}_4$ ,  $\text{CH}_3\text{COONa}$  and  $\text{NaCl}$  are acidic, basic and neutral respectively. 03

- (xii) Balance the following equations by ion-electron method in basic medium: 1.5+1.5=03
- $$\text{CN}^- + \text{MnO}_4^- \rightarrow \text{CNO}^- + \text{MnO}_2$$
- $$\text{IO}_3^- + \text{ASO}_3^{3-} \rightarrow \text{I}^- + \text{ASO}_4^{3-}$$
- (xiii) How is power generated by using the fuel cell? 03
- (xiv) Differentiate between Molecularity and Order of reaction. 1.5+1.5=03
- (xv) Why is it necessary to state the physical state of reactants and products in the thermochemical equations? 03
- (xvi) What is common ion-effect? Give its two applications. 03
- (xvii) a. Differentiate between stationary phase and mobile phase. 02  
 b. What is the role of stationary phase in chromatography? 01
- (xviii) Derive Graham's law of diffusion from Kinetic Molecular theory. 03
- (xix) Differentiate between Continuous and Line spectrum. 1.5+1.5=03

**SECTION – C (Marks 26)**

**Note:- Attempt any TWO questions. All questions carry equal marks. (2 x 13 = 26)**

- Q. 3** a. Derive an expression for the calculations of energy, frequency and wave number of photon emitted when electron jumps from  $n=1$  to  $n=2$  orbit. 06
- b. What is Absolute Zero? 03
- c. Why is the Molecular orbital theory superior to valence bond and VSEPR theory? 04
- Q. 4** a. Derive Arrhenius equation. 04
- b. Draw a complete fully labelled "Born-Haber" cycle for the formation of NaCl. 05
- c. What is the pH of  $10^{-4}$  moles  $\text{dm}^{-3}$  of HCl and  $\text{Ba(OH)}_2$  04
- Q. 5** a. What is Planck's Quantum theory? 03
- b. 9.2 molar  $\text{HClO}_4$  is available from the market. The density of this solution is  $1.54 \text{ gcm}^{-3}$ .  
 What is the percentage by weight of  $\text{HClO}_4$ ? 05
- c. Describe the standard Hydrogen Electrode. How will you use "SHE" to measure the standard electrode potential of Zinc electrode? 05

---- 1HA 1208 (L) ----



DO NOT WRITE ANYTHING HERE

- (xi) Which of the following has the highest value of pH?
- A. 0.1 M NaOH  
B. Pure water  
C. Bread  
D. Rain water
- (xii) When a colourless, odourless gas was compressed, a whitish solid is formed. What is the gas?
- A.  $\text{NH}_3$   
B.  $\text{SO}_2$   
C.  $\text{SO}_3$   
D.  $\text{CO}_2$
- (xiii) Dipole moment is the measure of polarity. Which of the following molecules is polar?
- A.  $\text{CCl}_4$   
B.  $\text{BF}_3$   
C.  $\text{CF}_4$   
D.  $\text{NF}_3$
- (xiv) The reaction rate becomes four times by doubling the concentration of a reactant, then order with respect to that reactant is \_\_\_\_\_
- A. Zero order  
B. First order  
C. Second order  
D. Third order
- (xv) A certain ion has ground state configuration  $[\text{Ar}]3d^{10}$ . This ion is \_\_\_\_\_
- A.  $\text{Cu}^{2+}$   
B.  $\text{Cu}^+$   
C.  $\text{Zn}^+$   
D.  $\text{Cr}^{3+}$
- (xvi) In which crystal  $a \neq b \neq c, \alpha = \beta = \gamma = 90^\circ$  ?
- A. Cubic  
B. Triclinic  
C. Orthorhombic  
D. Hexagonal
- (xvii) Dipole-dipole interactions are present in the \_\_\_\_\_
- A. Atoms of the Helium gas  
B. Molecules of  $\text{CCl}_4$   
C. Molecules of solid  $\text{I}_2$   
D. Molecules of  $\text{NH}_3$

For Examiner's use only:

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17

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--- 1HA 1208 (ON) ---



# CHEMISTRY HSSC-I

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Total Marks Sections B and C: 68

NOTE:- Sections B and C comprise pages 1-2. Answer any fourteen parts from Section 'B' and any two questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet-B if required. Write your answers neatly and legibly.

## SECTION - B (Marks 42)

Q. 2 Answer any FOURTEEN parts. The answer to each part should not exceed 5 to 6 lines. (14 x 3 = 42)

- (i) Hydrazine ( $N_2H_4$ ) can be produced as follows:  $ClNH_2 + 2NH_3 \rightarrow N_2H_4 + NH_4Cl$   
If 2.00 kg of chloral-amine ( $Cl-NH_2$ ) produces 946.0 g of hydrazine, calculate the percentage yield of hydrazine. 03
- (ii) What are Isotopes? 1+2=3
- (iii) Derive Boyle's law and Charles' law from kinetic molecular theory. 1.5+1.5=3
- (iv) Why is Sodium softer than Copper, but both are very good electrical conductor? 03
- (v) What is Artificial radioactivity? Write chemical equation for the production of proton and neutron. 1+2=3
- (vi) Calculate energy, frequency and wavelength of radiation emitted when electron drops from  $n=4$  to  $n=2$  for Hydrogen atom. 03
- (vii) How does dipole-moment help us to predict the geometry of Triatomic molecule and Tetraatomic molecule? 03
- (viii) Differentiate between sigma and pi-bond by giving examples of HF and  $O_2$ . 1.5+1.5=3
- (ix) Calculate the Enthalpy change ( $\Delta H$ ) for the reaction: 03
- $$2Al_{(s)} + Fe_2O_{3(s)} \rightarrow 2Fe_{(s)} + Al_2O_{3(s)} \quad \Delta H = ?$$
- $$2Al_{(s)} + 1.5O_2(g) \rightarrow Al_2O_3(s) \quad \Delta H = -1675 \text{ kJ}$$
- $$2Fe_{(s)} + 1.5O_2(g) \rightarrow Fe_2O_3(s) \quad \Delta H = -824 \text{ kJ}$$
- (x) Write three definitions of Raoult's law. 03
- (xi) Balance the following equations by oxidation number method: 1.5+1.5=3
- a.  $MnO_4^- + C_2O_4^{2-} \rightarrow Mn^{2+} + CO_2$
- b.  $IO_3^- + ASO_3^{3-} \rightarrow ASO_4^{3-} + I^-$
- (xii) Zn can replace Cu from  $CuSO_4$  solution while Zn does not replace Mg from  $MgSO_4$  solution. Write cell reactions in support of your answer. Reduction potential of Zn =  $-0.76 \text{ v}$ . Reduction potential of Mg =  $-2.37 \text{ v}$ . 03
- (xiii) In the reaction of NO and  $H_2$  it was observed that equimolecular mixture of gases at 340.5 mm pressure was half changed in 102 seconds. In another experiment with an initial pressure 288 mm of Hg the reaction was half completed in 140 seconds. Calculate the order of reaction. 03
- (xiv) Differentiate between Hydration and Hydrolysis by giving examples. 03
- (xv) Consider the following system:  $N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO(g)$   
 $K_e$  for the reaction at  $2000^\circ \text{C}$  is 0.10. If initial concentration of  $N_2$ ,  $O_2$  and NO are 0.100M, 0.100M and 0.00M, respectively, what are the concentrations of these substances at equilibrium? 03

- (xvi) Define Chromatography. What is the main difference between Absorption Chromatography and Partition Chromatography? 1+2=3
- (xvii) Solubility is affected by temperature. Prove. 03
- (xviii) The sum of the mole fractions of all the components is always equal to unity for any solution. Explain with reasons. 03
- (xix) What is meant by Activation of a catalyst and Poisoning of a catalyst? Give one example in each case. 1.5+1.5=3

**SECTION – C (Marks 26)**

**Note:- Attempt any TWO questions. All questions carry equal marks. (2x13 = 26)**

- Q. 3**
- a. What is Dalton's law of Partial Pressure? How will you calculate partial pressure of a gas? 1+3=4
- b. There is a mixture of  $H_2$ , He and  $CH_4$  occupying a vessel of volume  $13 \text{ dm}^3$  at  $37^\circ C$  and pressure of 1 atm. The masses of  $H_2$  and He are 0.8 g and 0.12 g, respectively. Calculate the Partial Pressure of each gas in torr. 05
- c. Differentiate between Orbit and Orbital. 04
- Q. 4**
- a. These species  $NH_2^-$ ,  $NH_3$  and  $NH_4^+$  have bond angles of  $105^\circ$ ,  $107.5^\circ$  and  $109.5^\circ$ , respectively. Justify these values by drawing their structures according to VSEPR theory. 05
- b. What are the drawbacks of Bohr's Atomic model? 04
- c. Differentiate between Ideal and Non-ideal solutions. 04
- Q. 5**
- a. Derive Henderson's equation. 04
- b. What is Catalysis? Differentiate between Homogeneous and Heterogeneous catalysis. 04
- c. SHE acts as anode when connected with Cu electrode and as cathode when connected with Zn electrode. Explain by writing cell reactions. 05

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