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**CHEMISTRY (HSSC-I)**

**SECTION –A (Marks: 17) Time Allowed: 25 Min**

 **Note:** Section – A is compulsory. All parts of this section are to be answered on this page and handed over to the Centre Superintendent. Deleting/overwriting is not allowed. Do not use lead pencil.

Q.1 Fill the relevant bubble for each part. Each part carries one mark.

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|  | **Questions**  | **A** | **B** | **C** | **D** | **A** | **B** | **C** | **D** |
| **1.** | What is the relative rate of effusion of CO and CO2? | CO is 1.25 times faster than CO2 | CO is 3.75 times faster than CO2 | CO is 1.25 times faster than CO | Both diffuse at the same rate |  |  |  |  |
| **2.** | Which one of the following electrons, identified only by their n and l quantum numbers, has the lowest energy?http://highered.mheducation.com/olcweb/styles/shared/spacer.gif n = 5, l = 2 n = 5, l = 1 n = 5, l = 0 n = 4, l = 1 | n = 5, l = 2 | n = 5, l = 1  | n = 5, l = 0  | n = 4, l = 1  |  |  |  |  |
| **3.** | What is the Principal Quantum number (n) of the first shell to have d orbitals? | 1 | 2 | 3 | 4 |  |  |  |  |
| **4.** | 500 ml of NH3 contains 6.00 x 1023 molecules at S.T.P. How many molecules are present in 100 ml of CO2 at S.T.P.? | 6 x 1023 | 1.5 x 1023 | 1.2 x 1023 | None of these |  |  |  |  |
| **5.** | Consider the binding of oxygen to haemoglobin: Hb + O2 http://global.oup.com/uk/orc/biosciences/chembio/crowe3e/student/mcqs/ch15/crowe_rlharpoon.gif HbO2 If we decrease the pressure of the system, what is the effect on this equilibrium reaction? | The equilibrium shifts to the left  | The equilibrium shifts to the right | There is no change in the system | None of above |  |  |  |  |
| **6.** | Consider the following redox reaction:C2H12O6 + 6O2 🡪 6CO2 + 6H2O The substance undergoing reduction is: | O2 | CO2 | H2O | C6H12O6 |  |  |  |  |
| **7.** | On the basis of molecular orbital theory, select the incorrect option: | he bond order of O2\_ is 2.5 and it is paramagnetic | The bond order of O2+ is 2.5 and it is paramagnetic | The bond order of O2 is 2 and it is diamagnetic | The bond order of O2 is 3 and it is paramagnetic |  |  |  |  |
| **8.** | The equation for the standard enthalpy of formation of N2O3 is: | N2O(g) + O2(g) →N2O3(g) | N2O5(g) →N2O3(g) + O2(g) | NO(g) + NO2(g) →N2O3(g) | N2(g) + 3/2 O2(g) →N2O3(g) |  |  |  |  |
| **9.** | Which one of the following is the weakest acid? | HF (Ka = 6.8 x10-4) | Acetic acid (Ka = 1.8x10-5) | HNO2 (Ka = 4.5x10-4) | HClO (Ka = 3.0x 10-8) |  |  |  |  |
| **10.** | Which of the following is a redox reaction?  | Mg(OH)2 + 2NH4Cl → MgCl2 + 2NH4OH  | CaC2O4 + 2HCl → CaCl2 + H2C2O4 | NaCl + KNO3 → NaNO3 + KCl | Zn + 2AgCN → 2Ag + Zn (CN)2 |  |  |  |  |
| **11.** | The standard reduction potential Eo for half reactions are: Zn = Zn2+ + 2e           Eo = +0.76 V Fe = Fe2+ + 2e            Eo = + 0.41 VThe EMF of the cell reaction Fe2+ + Zn = Zn2+ + Fe is:  | +0.35 V  | - 0.35 V  | +1.17 V  | – 1.17 V |  |  |  |  |
| **12.** | Molarity of pure water is: | 1 | 18 | 55.5 | 6 |  |  |  |  |
| **13.** | You are given four unknown solutions I, II, III, and IV. The pH values of these solutions are found to be 3, 7, 8, and 10 respectively. Among the given solutions, which solution has the highest hydrogen ion concentration? | I | II | III | IV |  |  |  |  |
| **14.** | In which of the following reaction oxidation No of Nitrogen does not change: | NO2 +H2O HNO3 +HNO2 | N2 + O2 2NO | 2NO2 N2O4 | NH4NO2 N2 +H2O |  |  |  |  |
| **15.** | Which one of the following conversions involve change in both hybridization and shape? | NH3 → NH4+ | CH4 → C2H6 | H2O → H3O+ | BF3 → BF4– |  |  |  |  |
| **16.** | Which of the following have same No. of molecules at STP: | 1000 cm3 of N2H4 and O2 | 200 cm3 of CO2 and N2O | 50 cm3 each of CO and N2 | All above |  |  |  |  |
| **17.** | The ground state electronic configuration of the zinc ion, Zn2+ (Z = 30) is:   | 1s2 2s2 2p6 3s2 3p6 3d10 | 1s2 2s2 2p6 3s2 3p6 4s2 3d8  | 1s2 2s2 2p6 3s2 3p6 4s2 3d10  | None of above |  |  |  |  |

** HCCS EDUCATIONAL SYSTEM**

 **CHEMISTRY HSSC I**

 **(PRE BOARD EXAM, 2024)**

**(SUBJECTIVE)**

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| **Time allowed: 2:40 Hours Total Marks Section B and C:68** |
| **Note: The Questions of sections B and C are to be answered on the separately provided answer book. Use supplementary answer sheet i.e. sheet – B if required. Write your answers neatly and legibly.**  |

**SECTION – B (42 Marks)**

**Q.2 Attempt all parts. All parts carry equal marks. (14 x 3 = 42)**

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| **1. A compound EH4 contains 90% E. What is the atomic mass of E?.** |
| **OR** |
| What are amphoteric oxides give two examples and justify with equations  |
| **2. What is the difference between Galvanic cell and Electrolytic cell giving one example in each case**  |
| **OR** |
| A 10.0-liter vessel contains gas X at a pressure of 300. Torr and a 3.0-liter vessel contains gas Y at a pressure of 400. Torr. Gas X is forced into the second vessel. Calculate the resulting pressure in torr. Assume temperature remains constant |
| **3. Consider the reaction: 2 NO(g) + O2(g) → 2 NO2(g)****The following data were obtained from three experiments using the method of initial rates:**

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|  | Initial [NO]mol L-1 | Initial [O2]mol L-1 | Initial rate NOmol L-1s-1 |
| Experiment 1 | 0.010 | 0.010 | 2.5 x 10-5 |
| Experiment 2 | 0.020 | 0.010 | 1.0 x 10-4 |
| Experiment 3 | 0.010 | 0.020 | 5.0 x 10-5 |

Determine the order of the reaction for each reactant. |
| **OR** |
| The Acetylene (C2H2) is used in welding. If the heats of formation of acetylene, CO2 and H2O are +226KJ/mol,-393.5 KJ/mol and -285.7 KJ/mol respectively. Calculate the enthalpy of combustion of acetylene |
| **4. What are the factors affecting viscosity** |
| **OR** |
| Predict the geometries of BeCl2 and NH3 on the basis of V.S.E.P.R.theory |
| **5. Balance the following reactions by ion-electron method.** (a) IO3-1 + ClO3-1 I2 + ClO4- ( Acidic medium) (b) MnO4-1 + NO2-1 Mn+2 + NO3-1  (acidic medium) |
| **OR** |
| At 25°C, water dissolves 0.8108g of PbCl2 per liter, calculate the Ksp of PbCl2at 25°C |
| **6. The mechanism of a reaction is shown below.** HOOH + I¯ 🠆 HOI + OH¯ (slow) HOI + I¯ 🠆 I2 + OH¯ (fast) 2OH¯ + 2H3O+ 🠆 4 H2O (fast) a. What is the overall reaction? b) Which compounds are intermediates? c) Predict the rate law based on this mechanism |
| **OR** |
| Write the spontaneous reaction for the following set of half reactions.Au3+ + 3e Au E0 =1.5 VNO3- +4H+ +3e NO + H2O E0 =0.096V |

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| **7. Nitrosyl bromide decomposes according to the following equation. 2NOBr (g)⇄ 2NO (g) + Br2 (g)** **A sample of NOBr (0.64 mol) was placed in a 1.00-L flask containing no NO or Br2. At equilibrium the flask contained 0.46 mol of NOBr. How many moles of NO and Br2, respectively, are in the flask at equilibrium?**  |
| **OR** |
| Explain the low density and high heat of fusion of ice? |
| **8. 50cm3 of a gas effuses through a tiny aperture in146 sec. The same volume of CO2 effuses under the same condition in 115 sec. Determine molar mass of A.** |
| **OR** |
| State the trend in the boiling points of the halogens from fluorine to iodine and explain this trend. |
| **9. M.O Theory is superior to V.B Theory. Justify with one example** |
| **OR** |
| A 35.0 mL sample of a 37.0% (w/w)HCl solution has a density of 1.18 g/mL. The sample is diluted to a volume of 0.125 L. What is the molarity of the final solution?  |
| **10. Write the electronic configuration of 29 Cu, 16S--,30Zn++** |
| **OR** |
| Define theoretical yield.What are the factors which are mostly responsible for the low yield of the product In chemical reaction |
| **11. The observed dipole moment of HF is 1.9D.Finf the % of ionic character inHF bond The distance between charges is 0.917 x10-10 m.** |
| **OR** |
| Define the following:  (a) Pauli’s exclusion principle (b) Hund’s rule (c) Aufbau principle  |
| **12. Write three applications of Dalton”s Law of partial pressure** |
| **OR** |
| What is the energy of ONE MOLE of photons with a wavelength of 501 nm? |
| **13. Use your knowledge of kinetics to explain each of the following statements.** (a)An increase in the temperature at which a reaction takes place increases the reaction rate.(b)The addition of a catalyst increases the rate at which a reaction will take place. ©Increasing the concentration of reactants increases the rate of the reaction.  |
| **OR** |
| A solution of toluene (molecular weight 92.1) in benzene (molecular weight 78.1) is prepared. The mole fraction of toluene in the solution is 0.100. What is the molality of the solution? |
| **14. Define the following properties of crystalline solids**(a) Anisotropy (b) Polymorphism (c) Isomorphism |
| **OR** |
| A solution contains 0.500M HA (Ka = 1.0 x 10-8) and 0.250M NaA. What is the [H+] after 0.10 mole of HCl(g) is added to 1.00 L of this solution? |

**SECTION – C (26 Marks)**

 **NOTE: Attempt all questions. All questions carry equal marks.**

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| **Q.3** | Explain Quantum numbers (7) |
|  | **OR** |
|  | Kc for the following reaction is 1x 10-3 at 230 0C 2ICl  Cl2 + l2 1.6 mole of ICl . 0.05 mole of I2 and 0.05 mole of Cl2 is present in the equilibrium mixture in 2 dm3 container at 230 C0 . Determine the equilibrium concentration of I2,Cl2 and ICl when the equilibrium is restored after the removal of one mole of ICl (7) |
| **Q.4** | Derive Vander Waals equation for real gases (3+3) |
|  | **OR** |
|  | Define and explain the term vapour pressure .What factors affect the vapour pressure of a liquid (2+4) |
| **Q.5** | Al2O3 is reduced by electrolysis at low potentials and high currents. If 4.0 × 104 amperes of current is passed through molten Al2O3 for 6 hours, what mass of aluminium is produced? (6) |
|  | **OR** |
|  | Explain in detail the various factors which can affect the rate of reactions |
| **Q.6** | CuCl2 + 2 NaNO3🡪 Cu(NO3)2 + 2 NaCl (a) If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, how much sodium chloride can be formed? (b) How much of the non- limiting reagent is left over in this reaction?  (c) If 11.3 grams of sodium chloride are formed in the reaction described above, what is the percent yield of this reaction? (atomic mass Cu-64 , Cl -35.5 O-16, Na-23 , N-14) (7) |
|  | **OR** |
|  | CuCl2 + 2 NaNO3🡪 Cu(NO3)2 + 2 NaCl (a) If 15 grams of copper (II) chloride react with 20 grams of sodium nitrate, how muchsodium chloride can be formed? (b) How much of the non- limiting reagent is left over in this reaction?  (c) If 11.3 grams of sodium chloride are formed in the reaction described above, what is the percent yield of this reaction?(atomic mass Cu-64 , Cl -35.5 O-16, Na-23 , N-14)Explain Born Haber Cycle to calculate lattice energy and draw its cycle with one example. |