Sc-103/Chem-I/1st Sem/Comm/2017/M

CHEMISTRY – I

Full Marks – 70

Pass Marks – 21

Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No.1 and any *six* from the rest.

1. (a) Fill in the blanks : 1×5=5

(i) The mass of 1 mol of CCl_4 is ———.

(ii) Chemical equilibrium is ——— in nature.

(iii) The particle of a light is called ———.

(iv) Element having highest electron affinity is ——— .

(v) An electrovalent compound does not exhibit space isomerism because of ——— of the electrovalent bond.

(b) Give correct answers of the following : $1 \times 5 = 5$

(i) The oxidation number of Cr in $K_2Cr_2O_7$ is + 4/ + 6/ +7/ +2.

(ii) The compound which contains both ionic and covalent bond is CH_4 / H_2 /KCN /KCl.

(iii) Which of the following pair of ions is isoelectronic ? F^- and Cl^- / F^- and O^{2-} / Na^+ + and K^+ / Na^+ and Ca^{2+}.

(iv) What is the maximum number of electrons which can be accommodated in the sub-shell for which n = 3 and l = 2 ? 2/6/10/14.

(v) Which one of the following will not conduct electricity ?

$CuSO_4$ solution / graphite / crystalline Nacl / Nacl having defects.

2. (a) State Avogrado's hypothesis and prove that M = 2D. 3

(b) Calculate the volume occupied by 64g of oxygen. 2

(c) Derive an ideal gas equation or equation of state. 2

(d) 500 ml of oxygen at 27°C and 760mm pressure of mercury where subjected to a pressure of 20 atmospheres and the temperature increased to 43°C. Calculate the new volume. 3

3. (a) State Pauling Exclusion Principle. 3

(b) How many electrons, protons and neutrons are contained in

(i) Ca atom

(ii) Ca^{2+} ion if atomic number of Ca is 20 and its mass number is 40 ? 2

(c) Separate the isotopes and isobars from the following species : 2

$$^{14}_{6}C, \quad ^{14}_{7}N, \quad ^{13}_{6}C, \quad ^{15}_{8}O, \quad ^{15}_{7}N$$

(d) What are the postulates of Bohr's Theory of H-atom ? 3

4. (a) Define atomic radius. What is its periodicity ? 3

(b) The first ionisation energy of Mg is higher than that of Na. On the otherhand, the second ionisation energy of Na is very much higher than that of Mg. Explain why ? 3

(c) What is modern periodic law ? Describe two merits of long form periodic table over the Mendeleev's periodic table. 3

(d) Arrange the following species in order of increasing size : 1

C_a^{2+} , Cl^-, S^{2-}, K^+.

5. (a) What is covalent bond ? How does it differ from an electrovalent bond ? Select the covalent and electrovalent compounds from the following : 1+2+2=5

AlF_3, CO_2, NH_3, C_2H_6.

(b) Draw Lewe's electron dot structures for each of the following : 3

HCl, NH_3 H_3O^+.

(c) Explain why ionic compounds usually do not conduct electricity in solid state but conduct electricity when dissolved in polar solvent or when melted. 2

6. (a) What is E.C.E of an element ? What is the E.C.E. value of hydrogen ? What is the relation between E.C.E. and C.E. of an element ? 2+1+2=5

(b) What current is needed to deposit 0.5g chromium metal from a solution of Cr^{3+} in a period of 1 hour ? (Atomic mass of Cr = 52). 5

7. (a) Balance the following ionic equation : 3

$MnO_4^- + Fe^{2+} + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$.

(b) Arrange the following in order of increasing oxidation number of Mn. 2

$KMnO_4$, $MnCl_2$, MnO_2.

(c) State law of mass action. Define an expression for the equilibrium constant in terms of concentration for the following reaction : 2+3=5

$aA + bB \rightleftharpoons cC + dD$.

8. (a) Describe the Bronsted - Lowry concept of acids and bases. What is a conjugate acid-base pair ? 3

(b) What are strong and weak acids ? Give one example of each. 2

(c) 25 ml of a 0.1(N) solution completely neutralise 20 ml of a HCl solution. Calculate the normality of the acid. How much water is to be added to 100 ml of the acid solution to make it 0.125(N) HCl ? 3+2=5

9. (a) What is sterilized water ? Mention two methods of sterilization of water. 3

(b) How is the hardness of water removed by ion-exchange method ? 3

(c) What is catalyst ? Write the industrial application of catalyst in manufacture of ammonia by Haber's process and sulphuric acid by contact process. 1+3=4