Reg. No. | | | | | | | | | |

CAH 501

Third Semester M.Sc. Degree Examination, December 2018
ANALYTICAL CHEMISTRY
(CBCS : 2016-17 Syllabus)
Principles of Analytical Chemistry

Time : 3 Hours Max. Marks : 70

Instructions : *Answer Part – **A** and **any four** from Part – **B**. Figures to the **right** indicate marks.*

PART – A

1. Answer **all** the following sub-divisions : **(9×2=18)**

   a) Explain the indicator action of a redox indicator, diphenylamine in the titration of Fe^{2+} versus $K_2Cr_2O_7$ solution.

   b) Suggest a suitable indicator for the titration of 0.1 M acetic acid with 0.1 M NaOH and 0.01 M HNO_3 with 0.01 M NaOH. Give the reason for your choice.

   c) Why NaOH and EDTA solutions are not primary standards ?

   d) Write the indicator action of fluorescein in the titration of Cl^- solution with Ag^+ solution.

   e) The standard potential for the half-reaction, $M^{4+} + 2e \rightarrow M^{2+}$. Is M^{2+} a good or poor reducing agent ? Justify.

   f) If 100 mL of water sample is titrated with 26.58 mL of 0.01 M EDTA to Eriochrome Black-T indicator end point, calculate the hardness of water interms of $CaCO_3$ (Molecular weight of $CaCO_3$ = 100).

   g) Why EDTA is commercially available in the form of disodium salt of EDTA ? Write the structure of EDTA.

   h) What is precipitation from homogeneous solution ? Mention one of its advantages.

   i) Calculate the potential at the equivalence point in the titration of Sn(II) with Ce(IV) (Given : E^0Ce^{4+}/Ce^{3+} = 1.44 V and E^0 Sn^{4+}/Sn^{2+} = 0.15 V).

PART – B

Answer **any four full** questions. **(4×13=52)**

2. a) Explain with chemistry, the determination of nitrogen and sulphur, by acid-base titration.

   b) How are phenols determined ? Discuss with suitable examples.

   c) Sketch the titration curve involving the titration of a strong acid with a strong base. **(5+5+3=13)**

3. a) Discuss the steps involved in the determination of carbonates and carboxylic acid functional group.

   b) List out the solvents used as non-aqueous solvents. Discuss the typical applications of non-aqueous titrations with suitable examples. What are the limitations of non-aqueous titrations ? **(6+7=13)**

4. a) Propose a scheme for the determination of any 3 metal ions in a mixture by complexometric titration using the principle of masking and demasking.

   b) A 0.5g bronze sample containing Zn is dissolved in 100 mL of acid. If an aliquot of 20 mL need 10.1 mL of 0.011 M EDTA, calculate the percent of Zn in the bronze sample. (Atomic weight of Zn = 65.38 amu)

   c) Why EDTA titrations are called complexometric titrations ? Explain the indicator action of metallochromic indicator. **(5+4+4=13)**

5. a) Explain any three types of performing EDTA titrations. Give one example for each type.

   b) The chloride in a 0.6025 g sample of chloride salt is precipitated as AgCl by adding excess $AgNO_3$ solution. The precipitate is filtered, washed, dried and found to weigh 0.7134 g. Calculate the % chloride in the sample (Atomic masses of Ag and Cl are 107.9 and 35.45, respectively).

   c) Describe with chemistry the Volhard's method of determination of chloride in a water sample using Ag^+ solution. **(5+4+4=13)**

6. a) What is Karl Fischer (KF) reagent ? Illustrate its application in the determination of traces of water in an organic solvent.

   b) What is co-precipitation ? List the causes for co-precipitation.

   c) A 2.55 g coal sample was taken in a crucible weighing 19.35 g. After heating in an electrical oven at 105-110°C for 1 hour, the crucible weighed 21.8 g. The residue was then ignited at 700-750°C to a constant weight when the crucible weighed 19.6g. Calculate the % ash and moisture contents of the coal sample. **(5+4+4=13)**

7. a) A 0.20 g of haematite ore was brought to solution (100 mL) upon acid treatment. A 25 mL was reduced to Fe(II) and consumed 15.0 mL of 0.1N $K_2Cr_2O_7$ for diphenylamine end point. Calculate the amount of iron present in the given iron sample (Given : Equivalent weight of Fe = 55.85 amu).

   b) Discuss the conditions for precipitation.

   c) From the following reactions, give the relation between Normality (N) and Molarity (M) of the titrant. Indicate which type of titrations are these ?

   i) $2\ S_2O_3^{2-} + I_2 \rightarrow S_4O_6^{2-} + 2\ I^-$ and

   ii) $2\ MnO_4^- + 5\ C_2O_4^{2-} + 16H^+ \rightarrow 2\ Mn^{2+} + 10CO_2 + 8H_2O$. **(4+5+4=13)**
