

4/CHE-250 Syllabus-2023

2026

(May-June)

FYUP : 4th Semester Examination

CHEMISTRY

(Inorganic Chemistry—I)

(CHE-250)

Marks : 75

Time : 3 hours

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

1. (a) Calculate the solubility product of PbCl_2 (solubility of PbCl_2 is $1.7 \times 10^{-3} \text{M}$). 2
- (b) Explain the impact of ionic product and solubility product on precipitation. 2
- (c) What is fractional precipitation? 2
- (d) What are the different types of EDTA titrations? Write a note on EDTA back titration. 1+3=4
- (e) What are titrations involving KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ known as? 1
- (f) What is an acid-base indicator? Why are these indicators usually weak acids or weak bases? 3

(g) Give one example each of an acidic and a basic buffer. What happens when acid is added to pure water? 2+2=4

(h) What is distribution equilibrium? 1

OR

2. (a) How would you prepare 500 ml of 0.1N $K_2Cr_2O_7$ (MW of $K_2Cr_2O_7$ is 294.18) in acidic medium? 2

(b) What happens when a solution containing Mg-EBT is titrated against standard EDTA solution? What will be the colour of the end point if the titration is carried out at pH ~ 12? 2+1=3

(c) Why is EDTA called a flexidentate ligand? What is the maximum denticity of EDTA? 1+1=2

(d) Differentiate between buffer action and buffer solution. 2

(e) With the help of suitable examples, explain common ion effect. 3

(f) Write notes on the following : 2+2=4

(i) Solubility equilibrium

(ii) Distribution coefficient

(g) With the help of a suitable example, explain acid-base equilibrium. 2

(h) What is activity coefficient? 1

3. (a) Calculate the effective atomic numbers of $\text{Mn}_2(\text{CO})_2$ and $[\text{FeCl}_6]^{3-}$. $1\frac{1}{2} \times 2 = 3$
- (b) Mention two points of difference between double salt and complex salt. 2
- (c) Discuss the classification of ligands on the basis of denticity. Give relevant examples. 4
- (d) Write down the IUPAC names of the following : 3
- (i) $(\text{NH}_4)_3[\text{Cr}(\text{NCS})_6]$
- (ii) $[\text{Co}(\text{en})_3]^{3+}$
- (iii) $[\text{Co}(\text{SCN})_6]^{3-}$
- (e) What kind of isomerism do the following complex pairs possess? 3
- (i) $[\text{CrCl}(\text{H}_2\text{O})_5]\text{Cl}_2 \cdot \text{H}_2\text{O}$ and $[\text{Cr}(\text{H}_2\text{O})_6] \cdot \text{Cl}_3$
- (ii) $[\text{Cr}(\text{NH}_3)_5(\text{CN})][\text{Co}(\text{NH}_3)(\text{CN})_5]$ and $[\text{Co}(\text{NH}_3)_5(\text{CN})][\text{Cr}(\text{NH}_3)(\text{CN})_5]$
- (iii) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^{2+}$ and $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$
- (f) What is coordination position isomerism? 1
- (g) Draw the geometrical isomers of PtCl_4^{2-} and $\text{Ni}(\text{CO})_4$. Give reasons for your observations. 3

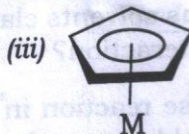
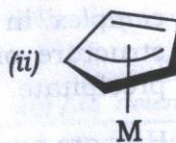
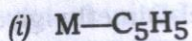
(4)

OR

4. (a) With the help of a suitable example, explain the EAN rule. 2
- (b) What are stereoisomers? Give one example of each type of stereoisomers. 1+3=4
- (c) How do the nature of the central metal ion and the nature of the ligands affect complex formation? 2+2=4
- (d) What are primary and secondary valencies in a complex? Which of these valencies determine the stereochemistry of the complex and why? 1+2=3
- (e) Explain the continuous variation method to determine the composition of complexes spectrophotometrically. 3
- (f) How many geometrical isomers does square planar complexes of the type $M(abcd)$ possess? 1
- (g) Write down the formulas of the following : 1+1=2
- (i) Triamminetrinitrito-N Cobalt(III)
- (ii) Ammonium hexathiocyanato-S-platinate(IV)
5. (a) Write the classification of organometallic compounds on the basis of nature of bonds. 5

(5)

(b) What is meant by hapticity? Identify the hapticity in the following compounds : 1+3=4



(c) Discuss the structure and mention one application each of the following compounds as precipitants : 2+2=4

(i) Oxine

(ii) Dithiozone

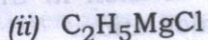
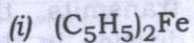
(d) What is solvent system concept? What happens when sodium is dissolved in liquid ammonia? 1+2=3

(e) Compare the rate of solvolysis in liquid SO_2 versus H_2O . 3

OR

6. (a) Write down one method of preparation, two chemical properties and one application of $RMgX$. 4

(b) Write down the IUPAC names of the following : 1+1=2



- (c) Explain with example, how dimethylglyoxime acts as a precipitant. Comment on the stability of the complex in acidic medium. Draw the structure of Nickel-Dimethylglyoximate precipitate. 2+1+1=4
- (d) How are non-aqueous solvents classified based on proton interaction? 3
- (e) Discuss the acid-base reaction in liquid ammonia with suitable examples. 3
- (f) Explain how alkali metals undergo redox reaction in liquid SO_2 . 3
7. (a) What types of errors are generally involved in analytical work? Give examples. 2
- (b) Distinguish between determinate and indeterminate errors. 2
- (c) What is meant by the term 'standard deviation'? An analyst performs 5 replicates to measure a mass (g). The values obtained are 1.0001, 1.0003, 1.0000, 1.0002 and 1.0004. Calculate the mean and the standard deviation. 1+1+2=4
- (d) Discuss the propagation of determinate errors when it transmits through multiplication and division in the final results through calculation. 3

- (e) The amount of oxalic acid present in a given solution was determined by two methods—standard and the other new method, when the following results were obtained :

Sample No.	Amount of oxalic $\hat{a}$ (g / L) determined by	
	Standard method	New method
1	8.65	9.35
2	11.60	11.06
3	7.30	8.90
4	13.95	12.58
5	17.26	18.89
6	12.80	11.62

Show that there is no significant difference between the two methods.

(The critical value of t for 5 degrees of freedom at appropriate level of confidence is reported to be 0.48). 4

- (f) Explain the fitting of a straight line by least square method. 3

OR

8. (a) Two sets of results, in mg/litre, one set obtained by a standard method and the other set by a new method are given below :

Standard method	31	27	26	35	23	31	33	32
New method	26	22	23	30	24	28	30	25

Determine whether the precision of

the new method differs significantly from that of the standard method. The critical values for 7 degrees of freedom is 2.13. 4

(b) Briefly explain how and why Q-test is performed. 2+1=3

(c) What is error distribution curve? Write down two useful qualitative features of such a curve. 1+2=3

(d) What is meant by normal distribution of indeterminate error? 2

(e) Write notes on the following : 1+1=2

(i) Personal error

(ii) Constant error

(f) Calculate the absolute error and the relative error (percent) for the following electronic charge values if the accepted value for electronic charge is 4.8×10^{-10} esu : 1½

1st determination = 4.79×10^{-10} esu

2nd determination = 4.81×10^{-10} esu

3rd determination = 4.79×10^{-10} esu

(g) Write down the rules for rounding off a numerical expression. 2½
