

HALF YEARLY EXAMINATION 2016

CHEMISTRY-S-4

Time: 3 hours

SET-1

Max. Marks: 70

General Instruction:

- (i) All questions are compulsory.
- (ii) Question no. 1 to 5 are very short answer questions and carry 1 mark each.
- (iii) Question no. 6 to 10 are short answer questions and carry 2 marks each.
- (iv) Question no. 11 to 22 are also short answer questions and carry 3 marks each.
- (v) Question no. 23 is a value based question and carry 4 marks.
- (vi) Question no. 24 to 26 are long answer questions and carry 5 marks each.
- (vii) Use log tables if necessary, use of calculators is not allowed.

1. Which transition element does not show variable oxidation state?
2. Why is blood coagulate in the presence of potassium chloride?
3. What is the difference between galvanization and cathodic protection?
4. State the role of the following in the food industry:
 - (i) Sodium benzoate
 - (ii) Butylated hydroxy toluene.
5. In a cubic solid, atoms A are at the corners and atoms B at the centre of the two opposite faces. What is the simple formula of the solid?
6. Determine the osmotic pressure of a solution prepared by dissolving 25 mg of K_2SO_4 (molar mass = 174 g/mol) in 2 L of solution at 25°C, assuming that it is completely dissociated

$$(R = 0.082 \text{ L atm mol}^{-1} \text{ K}^{-1}).$$

OR

What type of non-idealities are exhibited by the following miscible liquid pairs?

- (i) Chloroform + Dimethyl ether
- (ii) Ethanol + Acetone

Also, predict the sign of ΔH and ΔV for these liquid pairs.

7. (i) Write the IUPAC name of $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$
 (ii) State the application of coordination compounds in qualitative salt analysis.
8. A first order reaction has a rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$.
 - (i) Calculate the half-life of a reaction.
 - (ii) How long will 5g of the reactant take to reduce to 3 g?
9. For the reaction $2\text{H}_2\text{O}_2 \xrightarrow{\text{I}^-} 2\text{H}_2\text{O} + \text{O}_2$, the rate expression is $\text{rate} = k[\text{H}_2\text{O}_2][\text{I}^-]$. Write the mechanism of this reaction. Also, predict the molecularity of each elementary step.

10. (i) Why is there a steep rise in molar conductivity when the concentration approaches zero for weak electrolyte?
 (ii) State Kohlrausch's law of independent migration of ions.
11. Gold (atomic radius = 0.1414 nm) crystallises in a face-centred unit cell)
 (i) What is the length of a side of unit cell?
 (ii) Find the density of gold.
 (Given: $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, Atomic mass of gold = 197 g/mol)
12. Explain the following terms with example
 (i) F-centres
 (ii) Anti ferromagnetism
 (iii) 12-16 compounds
13. $\text{CoCl}_2 \cdot 5\text{NH}_3 \cdot \text{H}_2\text{O}$ is a pink solid, the solution of this salt is also pink and formed 3 mol of AgCl with AgNO_3 solution.
 (i) Write the formula and IUPAC name of this pink solid which exist as a coordination compound.
 (ii) What is the geometry of this coordination compound?
14. (i) Why is $[\text{Ni}(\text{CN})_4]^{2-}$ diamagnetic while $[\text{NiCl}_4]^{2-}$ is paramagnetic? (at. no. of Ni = 28)
 (ii) Using crystal field splitting explain that $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital complex with magnetic moment equals to zero.
15. (i) Name the process when a pressure greater than osmotic pressure applied on solution. What is its practical application?
 (ii) Calculate the vapour pressure of pure water if an aqueous solution of solute of concentration 1 molal has vapour pressure of 12.3 k Pa.
16. Show graphically the depression in freezing point when a non-volatile solute is added to pure water. The graph should be well labelled. Using depression in freezing point, derive the expression to calculate the molar mass of solute.
17. Account for the following:
 (i) Transition metals are used in the formation of interstitial compounds.
 (ii) Lu^{3+} and La^{3+} ions are both colourless and diamagnetic.
 (iii) Actinoids show more number of oxidation states than lanthanoids.
18. (i) Arrange the following in order of increasing magnetic moment
 VO^{2+} , VO_2^+ , VO^+ (at no. of V = 23)
 (ii) What is the misch metal? Give its one use.
 (iii) Explain why 5d series elements have a higher ionization enthalpy than 3d or 4d series.

19. The decomposition of hydrocarbon follow the equation

$$k = (4.5 \times 10^4 \text{ s}^{-1}) e^{-20000 \text{ K} / T}$$

- (i) Calculate energy of activation ($R = 8.314 \text{ J mol}^{-1} \text{ K}^{-1}$)
 - (ii) What is effect of using catalyst on the energy of activation and rate constant?
20. (i) Prove that for a first order reaction, half-life is independent of the initial concentration of the reactant.

(ii) The decomposition of NH_3 is a zero order reaction with rate constant,

$$k = 1.23 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}. \text{ Find the rate of production of } \text{N}_2 \text{ and } \text{H}_2.$$

Explain the following terms:

- (i) Ultrafiltration
- (ii) Electrophoresis
- (iii) Bredig's arc method

OR

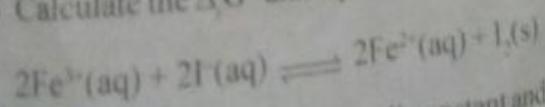
Explain what is observed

- (i) when a beam of light is passed through a colloidal sol.
 - (ii) an electrolyte, NaCl is added to hydrated ferric oxide sol.
 - (iii) electric current is passed through a colloidal sol.
22. (i) Give reason why a finely divided substance is more effective as an adsorbent.
- (ii) What are lyophilic and lyophobic sols? Give one example of each type.
23. Manoj's grandmother complained of irritation and pain in her stomach. He called the family doctor, but got an appointment only in the evening. Meanwhile, he gave her ranitidine tablet for immediate relief.
- (i) In your opinion, is Manoj's action justifiable?
 - (ii) What type of drug is ranitidine?
 - (iii) What are the values associated with Manoj's action?
24. (i) Define electrochemical series.

$$\text{Given: } E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.76 \text{ V}, E_{\text{Pb}^{2+}/\text{Pb}}^{\circ} = -0.13 \text{ V}, E_{\text{Ni}^{2+}/\text{Ni}}^{\circ} = -2.37 \text{ V}$$

Arrange the metals in order of increasing reactivity.

(ii) Calculate the ΔG° and equilibrium constant at 25°C .



$$E^{\circ} = +0.295 \text{ V}$$

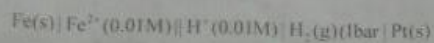
Calculating cell constant and conductivity.

OR

(i) Conductivity of 0.025 M weak acid is $8.0 \times 10^{-4} \text{ S cm}^{-1}$.

Calculate the molar conductivity. If Λ_m° for this weak acid is $280.5 \text{ S cm}^2 \text{ mol}^{-1}$, find the percentage dissociation of an acid.

(ii) Find E_{cell}° and E_{cell} at 25°C



Given: $E_{\text{Fe}^{2+}/\text{Fe}}^\circ = -0.44 \text{ V}$

(iii) How much electricity in terms of Faraday is required to produce 20.0 g Ca from molten CaCl_2 ? [at mass Ca = 40]

25. (i) What are the impurities present in the anode mud in the electrolytic refining of copper? Why are they so present?

(ii) Extraction of silver and gold by Mac-Arther process involves both oxidation and reduction. Justify by giving chemical equation.

(iii) Explain the term 'gangue'

OR

(i) How would you extract copper from low grade copper ores? Explain giving equation.

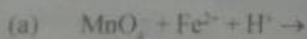
(ii) What is copper matte? Give its composition. Why is silica required in the extraction of copper?

(iii) How will you purify titanium by van Arkel's method?

26. (i) Which divalent cation in the 3d series has highest value of the magnetic moment?

(ii) What is lanthanoid contraction? What are the consequence of Lanthanoid contraction?

(iii) Complete the following equations:



OR

(i) Under what conditions the transition metal shows zero or negative oxidation states?

(ii) Vanadium ($Z = 23$) form an ion which has a magnetic moment of 1.73 BM. Write the symbol of the ion and electronic configuration of the ion.

(iii) (a) How would you account for the fact that Co^{2+} is stable in aqueous solution but in the presence of complexing agent it is easily oxidised to Co^{3+} ?

(b) A transition metal exhibits highest oxidation state in oxides and fluorides. Explain.