Sub.Code : 3021'D'

NEB-GRADE XII
2082 (2025)
Chemistry

(For regular and partial general stream's students whose first two digits of registration number starts from 78, 79, 80 and 81)

Candidates are required to give their answers in their own words as far as practicable. The figures in the margin indicate full marks.

Multiple Choice Questions

Attempt all the questions.

Group 'A' [11×1=11]

Rewrite the correct option of each question in your answer sheet.

1. To estimate the chloride ion present in tap water, volumetric analysis has been commonly used in laboratory. Which of the following solutions can be used for the above mentioned titration ?

   A) $BaCl_2$ B) $NaOH$ C) $K_2Cr_2O_7$ D) $AgNO_3$

2. The half-life of a certain reaction is 50 seconds and it remains constant even if the initial concentration of the reactant is doubled. What is the order of the reaction ?

   A) Zero order reaction B) First order reaction

   C) Second order reaction D) Pseudo-first order reaction

3. Gibbs-Helmholtz equation is represented as : $\Delta G = \Delta H - T\Delta S$.

   For what value of ΔG will the reaction be spontaneous ?

   A) Positive B) Zero C) Negative D) Infinite

4. Standard reduction potential values for P, Q, R and S are +0.34V, -0.76V, +0.0V and -3.05V, respectively. What is the correct order of their reducing power ?

   A) P > R > Q > S B) S > R > Q > P

   C) Q > P > S > R D) S > Q > R > P

5. A deep blue complex is formed when conc. ammonium hydroxide is added to an aqueous solution of $CuSO_4$. Which of the following formulae represents the complex ?

   A) $[Cu(NH_3)_4]^{2+}$ B) $[Cu(NH_3)_4]^{+}$

   C) $[Cu(NH_3)_2]^{2+}$ D) $[Cu(NH_3)_6]^{2+}$

Contd...

6. Which of the following is the maximum possible oxidation state of the transition metals in 3d series ?

A) +3 B) +6 C) +7 D) +8

7. Which of the following are organometallic compounds ?

i) CH_3MgI ii) $Ni(CO)_4$ iii) C_4H_9Li

iv) C_2H_5ONa v) $(C_4H_9)_2SnCl_2$

A) i) and ii) only B) i), ii) and iii) only

C) i), ii), iii) and iv) only D) i), ii), iii) and v) only

8. The organic compound (X) boiled with water gives phenol. What is the compound (X) ?

A) Chlorobenzene B) Benzenediazonium chloride

C) Benzenesulphonic D) Aniline

9. Which of the following compounds gives positive carbylamine reaction ?

A) $(CH_3)_2NH$ B) $(CH_3)_3N$

C) $(CH_3)_4N^+$ D) CH_3NH_2

10. A compound 'Z' with molecular formula $C_3H_4O_4$ is heated to produce compound 'Y' and CO_2 gas. Heating of compound 'Y' with P_2O_5 forms compound 'X' and water molecule. Identify the compound 'X'.

A) Ethanoic acid B) Ethanoic anhydirde

C) Methanoic anhydride D) Ethanal

11. A sequence of reactions is represented as :

$$Benzene \xrightarrow[Anhy.AlCl_3]{CH_3Cl} (A) \xrightarrow[[O]]{CeO_2\ |H^+} (B) \xrightarrow[Reflux]{alc.KCN} (C)$$

Predict the name of reaction that converts (B) to (C).

A) Benzoin condensation B) Perkin's condensation

C) Aldol condensation D) Claisen condensation

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Time: 3 hrs. **Full Marks: 75**

Attempt all the questions.

Group 'A'

Question No. 1 to 11 (Multiple Choice Questions) will be provided after 30 minutes of starting examination. Rewrite its (MCQ) correct option (answer) in the same answer sheet.

Group 'B' [8×5=40]

12. Define instantaneous rate of reaction. Write down the rate expressions of the following reaction.

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

If 2.24 litres of O_2 at NTP is produced in 30 minutes, what is the rate of disappearance of $N_2O_5(g)$? [5]

13. Define standard heat of formation. Calculate the heat of formation of acetic acid from the following data : [5]

$C(s) + O_2(g) \rightarrow CO_2(g)$; $\Delta H = -99$ kcal/mol

$H_2(g) + \frac{1}{2} O_2(g) \rightarrow H_2O(l)$; $\Delta H = -68$ kcal/mol

$CH_3COOH + 2O_2(g) \rightarrow 2CO_2(g) + 2H_2O(l)$; $\Delta H = -208$ kcal/mol

Or

You are given the standard reduction potentials,

$E^0Zn^{2+}/Zn = -0.76V$, $E^0Mg^{2+}/Mg = -2.38V$

Answer the following questions :

a) What is standard electrode potential ? [1]

b) Construct the galvanic cell notation for the given electrodes indicating anode and cathode. [2]

c) Write the complete cell reaction for the given cell. [1]

d) Calculate the cell potential for the given cell at 25°C. [1]

Contd...

14. A chemical reaction occurs as follows :

$CH_3CH_2CH_2Br$ + aq. KOH → B + KBr

(A)

a) Identify the compound 'B' in the above reaction. [1]

b) Which substitution reaction mechanism occurs in the above reaction and why ? [2]

c) What is the product formed when alc. KOH solution is used instead of aq. KOH in the above reaction ? [1]

d) How can you obtain nitropropane from compound 'A' ? [1]

15. A list of compounds is given as follows :

P-aminoazobenze, Benzenediazonium chloride, Aniline, Nitrobenzene, Phenol and Benzene

From the above list of compounds, prepare a sequence of reaction chain with suitable conditions and reagents. [5]

OR

An aliphatic compound (A) reacts with $SOCl_2$ to give (B). The compound (B) is heated with ammonia to produce (C). The compound (C) is further heated with Br_2/KOH to yield (D). The compound (D) gives (E) when treated with $NaNO_2$/HCl at low temperature. The compound (E) is a primary alcohol which gives positive iodoform test. *Identify* compound (A) to (E) with the reactions involved. [5]

16. Write the chemical equations to illustrate the following reactions : [5×1=5]

a) 2,4-DNP test

b) Reimer-Tiemann reaction

c) Williamson's reaction

d) Perkin's condensation reaction

e) Wurtz-Fittig's reaction

17. You are given the mixture of two compounds A and B.

A = $CH_3CH_2CH_2$-NH_2 and B = $CH_3CH_2NHCH_3$

How would you separate their mixture by applying Hoffmann's method ? Give the nitrous acid test to distinguish between compounds A and B. [3+2]

18. The metal 'M' with electronic configuration [Ar] $3d^{10}4s^2$ belongs to group IIB in the periodic table and is commonly called 'Jasta'.

a) Identify metal 'M' and write its main ore. [1]

b) Why is metal 'M' not considered as transition element ? [1]

c) Draw the vertical retort. Write its reduction reaction. [2]

d) What happens when metal 'M' is exposed to air for a long time ? [1]

Contd...

19. What is rusting ? Describe the electrochemical theory of rusting of iron. List any two methods for the prevention of rusting. [5]

Group 'C' [3×8=24]

20. Deduce the normality equation, $N_1V_1 = N_2V_2$. Experimental data obtained by titrating decinormal solution of oxalic acid with potassium permanganate solution are given below. [2]

Expt. No.	Volume of oxalic acid (ml)	Volume of $KMnO_4$ burrete reading (ml)	
		initial	final
1	10	0.0	11.5
2	10	0.0	11.0
3	10	0.0	11.0

a) Name the above titration. [1]

b) Calculate the equivalent weight of $KMnO_4$. [1]

c) Calculate the normality of $KMnO_4$ from the above data. [2]

d) Why is dil. H_2SO_4 added to the conical flask containing standard oxalic acid before titrating with $KMnO_4$ solution ? [1]

e) Identify the titrant and titrand in this titration. [1]

OR

a) Write the applications of solubility product principle and common ion effect in qualitative salt analysis. [4]

b) Differentiate between Bronsted-Lowry and Lewis concept of bases. [2]

c) Calculate the degree of ionization of HCN having concentration 0.01M (K_a of HCN = 4.8×10^{-10}). Also calculate H^+ concentration and pH of the solution. [2]

21. An organic compound (X) reacts with Grignard's reagent to give (Y), which on oxidation gives (Z). All of the compounds (X), (Y) and (Z) give positive iodoform test.

a) Identify the compounds (X), (Y) and (Z) with reactions and conditions involved. [3]

b) Why do these compounds give positive iodoform test ? [1]

c) How would you convert compound (Y) into pseudonitrol ? [2]

d) Write any two methods for the preparation of compound (Z). [2]

Contd...

Or

How will you carry out the following conversions ?

a) Ethanol into chloroform [2]

b) Phenol into DDT [2]

c) Ethoxyethane into methoxymethane [2]

d) Aniline into chlorobenzene [2]

22. Answer the following questions :

a) What are the raw materials for the production of paper ? [2]

b) Draw the flowsheet diagram for the manufacture of Portland cement. [3]

c) Nuclear fusion reaction is also called thermonuclear reaction. Why ?[1]

d) How are addition and condensation polymers formed ? Write an example of each. [2]