

TIME: 3 HOURS

FULL MARKS: 70

1. The rate of a reaction is equal to rate constant of the reaction. Mention the order of the reaction. 1

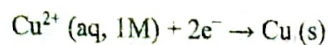
2. Define molality of a solution. 1

3. Write the IUPAC name of $[\text{CoCl}_2(\text{en})_2]^+$. 14. What is the primary and secondary valency of Ni in $[\text{Ni}(\text{CO})_4]$. 1

5. Can we store Copper sulphate solution in zinc vessel? 1

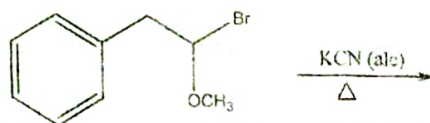
6. The measured emf of the cell is -

$\text{Pt(s)} | \text{H}_2(\text{g}, 1 \text{ bar}) | \text{H}^+(\text{aq}, 1 \text{ M}) || \text{Cu}^{2+}(\text{aq}, 1 \text{ M}) | \text{Cu(s)}$ is 0.34V. What is the standard electrode potential of the half-cell corresponding to the reaction?



1

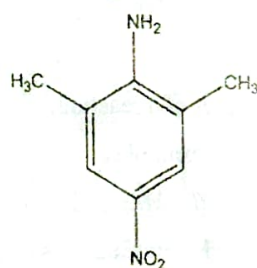
7. Complete the following reaction:



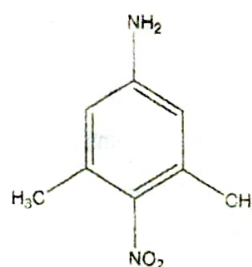
$$E_{\text{cell}}^{\circ} = E_{\text{c}}^{\circ} - E_{\text{a}}^{\circ}$$

$$\Rightarrow 0.34 =$$

8. Which one is a stronger base and why? 1



(A)



(B)

$$\ln \frac{[R]_0}{[R]} = -kt$$

$$\frac{[R]_0}{[R]} = e^{-kt}$$

$$\frac{16}{9} = \frac{16}{144} \cdot 5$$

$$16 \sqrt{150}$$

$$87.5 = \frac{x}{100}$$

9. For first order reaction prove that $[R] = [R]_0 e^{-kt}$. 210. A first order reaction takes 40 minutes for 87.5% completion. How much time will it take to complete $15/16^{\text{th}}$ of the reaction? 2

$$\frac{[R]_0}{[R]} = k dt$$

$$\ln[R] = kt + I$$

$$\log 2^4$$

$$\frac{5.2}{129}$$

$$P_A = K P_A$$

$$P_A = \frac{1}{K} X_A$$

$$P_A = K_H X_A$$

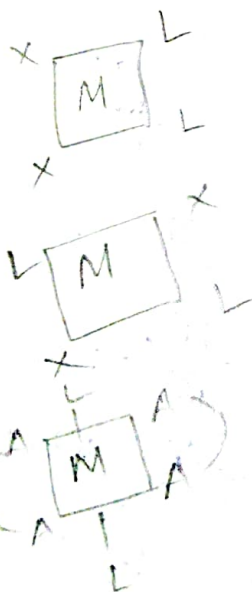
$$P_A = K_H X_A$$

⇒

2/3

$$\frac{59}{236} \times 3$$

$$ML_2 \times 2$$



11. A 5.2 molal aqueous solution of methyl alcohol is supplied. What is the mole fraction of methyl alcohol in the solution? 2

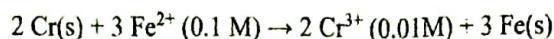
12. State Henry's Law. Mention its one application. 1+1=2

13. Write two differences each between a double salt and complex salt. 2

14. Explain linkage isomerism. Illustrate with an example. 2

15. A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH=10 and by passing H₂ gas around the platinum wire at 1 atm pressure. What will be the oxidation potential of the electrode? 2

16. Calculate emf of the following cell at 298K: 2



(Given: $E^0_{\text{Cr}^{3+}/\text{Cr}} = -0.74 \text{ V}$ and $E^0_{\text{Fe}^{2+}/\text{Fe}} = -0.44 \text{ V}$)

17. Aniline undergoes bromination even in the absence of FeBr₃. Explain. 2

18. Explain why acetophenone does not undergo Friedel Crafts reaction. 2

19. At 80°C the vapour pressure of pure liquid 'A' is 520 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at 80°C and 1 atm pressure, then what will be the amount of 'A' in the mixture? 3

20. Henry's Law constant for CO₂ in water is $1.67 \times 10^8 \text{ Pa}$ at 298 K. Calculate the quantity of CO₂ (in grams) in 500ml of soda water when packed under 2.5 atm pressure at 298 K. 3

21. For zero order reaction find out 1½ + 1½ = 3

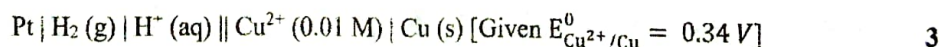
$$(i) \frac{t_{2/3}}{t_{1/4}} \quad (ii) \frac{t_{75\%}}{t_{87.5\%}}$$

22. a) Write one difference between molecularity and order of a reaction? 1

b) Discuss the elementary and complex reactions with examples. 1+1=2

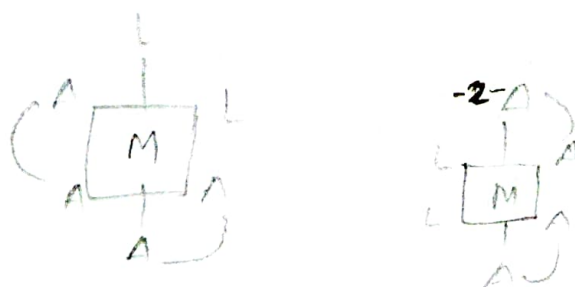
23. In the electrochemical cell; $\text{Zn} | \text{ZnSO}_4 (0.1 \text{ M}) || \text{CuSO}_4 (0.1 \text{ M}) | \text{Cu}$, the e.m.f. of the Daniel cell is E_1 . When the concentration of ZnSO₄ is changed to 1.0 M and CuSO₄ is changed to 0.01 M, the e.m.f. of the cell changes to E_2 . Establish the relation between E_1 and E_2 . 3

24. The cell potential for the following cell is 0.576 V at 298K. Calculate the pH of the solution:



25. a) How many geometrical isomers are possible for $[\text{Pt}(\text{NH}_3)(\text{H}_2\text{O})(\text{CO})(\text{Cl})]\text{NO}_3$. 1

b) Draw structures of geometrical isomers of $[\text{CoCl}_2(\text{en})_2]^+$ and $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$. 2



26. a) Define ambidentate ligand.

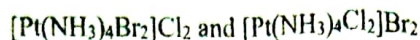
1

b) Why cis-trans isomers are not possible for four-coordinate tetrahedral complexes?

1

c) Name the isomerism exhibited by the following pair:

1



27. Explain why on nitration of aniline besides the ortho and para derivatives, significant amounts of meta derivative is also formed.

3

Or

An organic compound having molecular formula $\text{C}_4\text{H}_9\text{Cl}$ on treatment with aq. KOH gives B. B on heating with conc. H_2SO_4 gives C. C is treated with a particular reagent to give D. D is heated with dil. NaOH gives E. On heating of E gives F. Identify A to F and write the sequence of reactions.

3

28. a) How can you prepare p-nitroaniline from aniline?

2

b) How can you prepare p-bromoaniline from aniline?

2

c) Carbonic acid is slightly weaker than acetic acid. Explain.

1

29. An organic compound A having formula CH_5N on treatment with HNO_2 under ice cold condition gives B. B is treated with I_2 in the presence of red P gives C. C is treated with NaCN to give D. D is reduced with LiAlH_4 to give E. E is again treated with HNO_2 under ice cold condition gives F. F on oxidation with strong oxidising agent KMnO_4 acidified gives G. G is treated with SOCl_2 to give H. H is reduced with Lindlar's catalyst to give I. I is also obtained on oxidation of F with oxidising agent PCC. Identify A to I and write the sequence of reactions.

5

30. a) Explain why C-Cl bond length of chlorobenzene is shorter than ethylchloride.

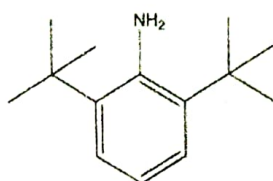
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b) Explain why C-N bond length of aniline is larger than ethanamide.

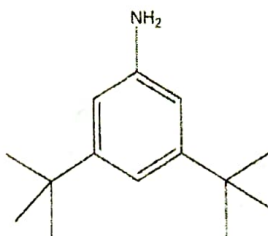
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c) Arrange the following in increasing order of basicity:

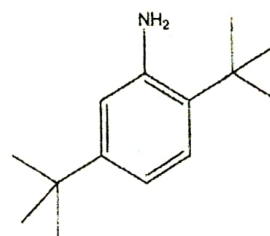
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(A)



(B)

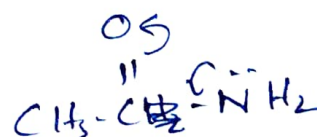


(C)



$$\begin{aligned} 50 &= 2 \\ 75 &= 3 \\ 875 &= 4 \end{aligned}$$

$$\frac{[R]_0}{[R]_2} = \frac{1}{16}$$



$$87.5 =$$

$$\frac{100}{87.5}$$

$$\begin{array}{r} 4 \overline{) 110} \\ 8 \\ \hline 20 \end{array}$$

$$K_t = [R]_0 - [R]_t/3$$

$$K_t = \frac{2}{3} K$$

$$87.5$$

$$25$$

$$\frac{2}{3} \times \frac{1}{8} = \frac{1}{12}$$

$$8 \overline{) 70}$$

-3-