BVM SCHOOL
Assignment (Electrochemistry)

1. Mention the differences between electrolytic cell and electrochemical cell.

2. what will happen when **a)** E_{ext} = 1.10 V, **b)** E_{ext} < 1.10 V and **c)** E_{ext}>1.10 V is applied on the cell Zn / Zn^{2+} || Cu^{2+}/ Cu ?

3.What is SHE ? How will you determine the potential of **a)** Zn electrode **b)** Cu electrode using SHE ?

4. E^0 Zn^{2+} / Zn = - 0.76 V and . E^0 Cu^{2+} / Cu = + 0.34 V. What does positive and negative sign convey ?

5. Account for the following:

a) Zn displaces hydrogen from dilute HCl while Cu can not.
b) Li is the strongest reducing agent while Fluorine is strongest oxidising agent.
c) copper sulphate solution can not be stored in zinc vessel.
E^0 Cu^{2+} / Cu = + 0.34 V E^0 Zn^{2+} / Zn = - 0.76 VE^0 Li+ / Li = - 3.05 V E^0 F_2 /2 F- = + 2.87 V)

6. Write Nernst equation for the following cells at 298 K

a) Cr/ Cr^{3+} || Fe^{2+} / Fe
(0.1M) (0.1M)
b) Zn + Sn^{4+} (1.5M) $\longrightarrow$ Zn^{2+}(0.5M) + Sn^{2+} (2M)

7. What is the effect of temperature on **a)** electrolytic conductivity **b)** metallic conductivity?

8. How does conductivity of an electrolyte solution varies with the dilution?

9. How does molar conductivity of an electrolyte solution varies with the dilution ?

10. Write the Kohlrausch equation and draw a graph to show the variation of molar conductivity with Öc for **a)** KCl **b)** CH_3COOH.

11. State Kohlrausch law of independent migration of ions.. Mention two applications of the law.

12. Give the products of electrolysis of

a) NaCl (molten) **b)** NaCl (aq) **c)** H_2SO_4(aq) **d)** $CuSO_4$(aq) using inert electrode like Pt **e)** $CuSO_4$(aq) using Cu electrodes **f)** $AgNO_3$(aq) using Ag electrode **g)** $AgNO_3$(aq) using Pt electrode.

13. Write the reactions involved at each electrode in mercury cell. Why does the cell potential of this cell remains constant?

14. What are fuel cells? Write the reactions involved at each electrode in H_2-O_2 fuel cell.

15. Give one similarity and one difference between fuel cell and other primary cells.

16. What are secondary cells? Write the reactions involved at each electrode in lead storage cell when

a) battery is in use **b)** battery is not in use.

17. Explain corrosion of iron as a electrochemical process. Mention the methods to prevent corrosion.

18. Iron bar A is coated with Zn and another bar B is coated with Sn. Which will rust faster when the coating is broken ?.

19. State Faraday's laws of electrolysis. What is Faraday constant?

20. Resistance of a conductivity cell filled with 0.1M KCl is 100 ohm. If the resistance of the same cell filled with 0.02 M KCl is 520 ohm, calculate the conductivity and molar conductivity of 0.02 M KCl. Conductivity of the 0.1M KCl is 1.29 s/m.

21. Resistance of a column of 0.05 M NaOH solution of diameter 1 cm and length 50 cm is 5.55 x 10^3 ohm. Calculate the resistivity and molar conductivity of the solution.

22. Resistance of 0.01M CH_3COOH solution is 2220 ohm. Cell constant is 0.366 cm^{-1}. Calculate the degree of dissociation and dissociation of CH_3COOH at this concentration. Given □^{0} HCl, NaCl, CH_3COONa are 425,128 and 96 scm^2 $mole^{-1}$ respectively.

23. Λ^0 $Al_2(SO4)_3$ is 858 scm^2 $mole^{-1}$. Find Λ^0 of Al^{3+} if Λ^0 of SO_4^{2-} is 160 scm^2 $mole^{-1}$.

24. Calculate the potential of hydrogen electrode in contact with a solution of $p^H = 10$.

25. At what p^H of HCl solution will the standard hydrogen electrode will have a potential of - 0.118V ?

26. Calculate the cell potential of $Cr/Cr^{3+}|| Fe^2$ / Fe.(0.1M) (0.1M) Given E^0Cr^{3+}/Cr = - 0.74V E^0 Fe^{2+}/Fe = - 0.44V.

27. Calculate the cell potential at 298K

$Zn + Sn^{4+} \longrightarrow Zn^{2+} + Sn^{2+}$
(1.5M) (0.5M) (2M)

Given E^0Zn^{2+}/Zn = - 0.76V E^0Sn^{4+}/Sn^{2+} = 0.13V

28. Calculate the equilibrium constant and work done by the cell $\longrightarrow Ni + Cu^{2+}$ Ni^{2+} +Cu Given $E0Ni^{2+}$ / Ni = - 0.25V E^0 Cu^{2+}/Cu = 0.34 V

29 . Find the emf of the cell Pb/Pb2+(0.001M)|| Pt, Cl^2 (1.5 atm) / 2Cl-(1M) E^0Pb^{2+}/ Pb = - 0.13V E^0 Cl2/ 2 Cl- = 1.36V

30. Find the potential of the electrode Mg^{2+}/ Mg

$Mg^{2+} + 2e- \longrightarrow Mg$ E^0 Mg^{2+}/ Mg = - 2.36 V

31. An electrochemical cell is set up by dipping Cu in 0.1M $CuSO_4$(aq) and Ag in 0.1M $AgNO_3$(aq) Write reaction taking place at each electrode and overall reaction. Determine the potential of the cell at 298K.

32. Calculate the amount of chlorine gas liberated when a current of 1.5 amperes for 90 minutes is passed through molten NaCl. (Atomic mass of Cl = 35.5)

33. Silver is electrodeposited by passing a current of 0.2 amperes for 3 hours on a vessel of surface area 800 cm^2 using silver nitrate as an electrolyte solution. Calculate the thickness of silver deposited..(Atomic mass of Ag=108) Density of Ag = 10.8 g/cm^2

34. Electrolysis of a metal salt solution resulted in the deposition of 1gram of metal by passing 1.5 amperes for 2 hours. Determine the charge carried by the metal ion. (Atomic mass of the metal = 27)

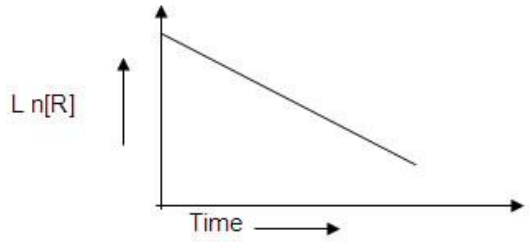
35. Three electrolytes A,B and C containing solutions of $ZnSO_4$, $CuSO_4$ and $AgNO_3$ were connected in series. 1.5 grams of Ag deposited by passing 1.5 amperes. How long did current flow? Find the mass of copper and zinc deposited. (Atomic mass of Cu = 63.5, Zn = 65.5)

36. How many coulomb of electricity is needed for the following reactions?

a) 2 moles of MnO^{4-} to Mn^{2+} **b)** 1 mole of H_2O to O_2 **c)** 9 grams of Al from molten $AlCl_3$ (atomic mass of Al=27)

BVM SCHOOL
Assignment (Chemical Kinetics)

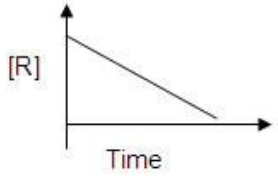
1. Explain the following terms: **a)** average rate of a reaction **b)** instantaneous rate of a reaction. **c)** rate constant of a reaction **d)** rate law of a reaction **e)** order of a reaction **f)** molecularity of a reaction.
2. What do you mean by pseudo first order reaction. Give one example.
3. Give one example each of **a)** zero order reaction **b)** first order reaction.
4. Derive integrated rate law for **a)** zero order reaction **b)** first order reaction. Show that t1/2 for **c)** zero order reaction is directly proportional to initial concentration of the reactant. **d)** first order reaction is independant initial concentration of the reactant.
5. Give differences between order and molecularity of a reaction.
6. What is activation energy? How is it related to rate constant K?
7. Give the unit of rate constant for **a)** zero order **b)** first order **c)** second order reaction.
8. What is pseudo first order reaction? Give one example.
9. Mention the conditions a reactant has to satisfy to become product.
10. $A+B \longrightarrow C+D$ Rate = $PZ_{AB}e^{-Ea/RT}$ What is the significance of P and $e^{-Ea/RT}$?
11. Draw the graph of reaction coordinate Vs potential energy for a reaction **a)** with out catalyst **b)** with catalyst.
12. Generally rate of a reaction doubles when the temperature is raised by 10K. Explain this statement with the help of the Maxwell Boltzmann distribution curve.
13. Explain collision theory of reaction rate with an example.
14. Draw the graphs
a) concentration Vs time for reactant. **b)** Concentration Vs time for product **c)** concentration Vs time for a zero order reaction **d)** ln[R] vs time for a first order reaction **e)** potential energy diagram of a catalysed reaction.
15. What is meant by order of reaction being zero?
16. Half life of a reaction is inversely proportional to initial concentration of the reactant.Determine the order of this reaction.
17. The decomposition ammonia on a platinum surface follows zero order kinetics.
$2NH_3(g) \longrightarrow N_2(g)+3H_2(g)$ K= $2.5x10^{-4}$ mole/l/sec. Determine the rate of **a)** disapperance of NH_3 **b)** rate of formation of N_2 **(c)** rate of formation of H_2.
18. A first order reaction is 20% complete in 10 minutes. Determine the time taken for 80% completion of the reaction.
19. $2A + B \longrightarrow A_2B$ K= $2.5 \times 10^{-4} M^{-2} sec^{-1}$ Find the rate when the initial concentrations of [A] = 0.1M [B] = 0.2 M. Also find the rate when 0.04 moles/litre of A has reacted. Rate=$K[A][B]^2$
20. For a certain chemical reaction variation in the concentration in [R] versus time(s) plot is given below



i) what is the order of the reactions? **ii)** what are the units of rate constant k? **iii)** give the relationship between k and t1/2 **iv)** what does the slope of the above line indicate? **v)** draw the plot [R] 0 / [R] versus time(s)

21. $2NO_2+F_2 \longrightarrow 2NO_2F$ Write the rate of reaction in terms of
(a) rate of formation of NO_2F **(b)** rate of disappearance of NO_2 **(c)** rate of disappearance of F_2

22. Consider the reaction R → P. The change in the concentration of R with shown in the following plot.



i) Predict the order of the reaction. **ii)** Write the expression for half life of this reaction.

23. The decomposition of NH3 follows zero order. 2 NH_3 ⟶ N_2+3H_2 Find the rate of production of N_2 and H_2.K=2.5x$10^{-4}MS^{-1}$ −1

24. 2A+B+C_⟶ A_2B+C Rate=K(A)$(B)_2$ K=2x$10^{-6}M^{-2}S^{-1}$Calculate the initial rate when **(A)**=0.1M **(B)**=0.2M **(C)**=0.6M Find the rate when 0.04mole of (A) is consumed.

25. $2NO_2+F_2$ ⟶ $2NO_2F$

Experiment	(NO_2)M	(F_2) M	Rate(M/S)
1	0.2	0.05	0.006
2	0.4	0.05	0.012
3.	0.8	0.10	0.048

Find the order with respect to NO_2 and F_2.Also find the overall order of the reaction.

26. Show that(a) 2t½=t¾ (for first order) (b)Half life of a reaction is 10seconds.Find $t_{2/3}$

27. Rate of a reaction becomes 1.414 times when concentration of the reactant is doubled. Find the order of the reaction.

15. (a) show that for a first order reaction t½ is independent of the initial concentration of the reactant.

(b) show that for a zero order reaction t½ is directly proportional to initial concentration of the reactant and inversely proportional to rate constant.

28. Rate constant of a reaction is 2M $^{-1}$ S $^{-1}$ at 700K and 32 M $^{-1}$ S $^{-1}$ at 800K.Find Ea

29. Rate of a reaction becomes 4 times when temperature changes from 27 ^{0}C to 37 ^{0}C. Find Ea.

30. Show that for a first order reaction, time required for 99.9% reaction is 10 times the time needed for 50% completion of the reaction.

31. A piece of wood shows C_{14} activity which is 60% activity found today. Find the age of the sample.t½=5770years.

32. The following data were obtained during the first order decomposition of SO_2Cl_2 at constant volume . $SO_2Cl_2(g)$ ⟶ $SO_2(g)$ +$Cl_2(g)$

Experiment	Time(sec)	Total pressure(atm)
1	0	0.5
2	100	0.6

Calculate the rate when total pressure is 0.65 atmospheres.

33. $2N_2O_5(g)$ ⟶ 2 $N_2O_4(g)$ +$O_2(g)$ follows first order kinetics at constant volume.

Experiment	Time(sec)	Total pressure(atm)
1	0	0.5
2	100	0.512

Find the value of rate constant K.

34. The time required for 10% completion of a first order reaction at 298K is equal to that required for 25% completion at 308K. Find Ea. Calculate K at 318K.

35. 2HI(g) ⟶ $H_2(g)$ +I2(g) Ea at 581K is 209.5KJ/mole. Determine the fraction of molecules having energy equal to or greater than Ea.

36. Ea of a reaction is 75 KJ/mole in the absence of a catalyst and 50KJ/mole in the presence of a Catalyst at 300K. Determine the extent to which the rate of reaction is increased.

37. The rate constant for the first order decomposition of H_2O_2 is given as logK = 14.34 – 1.25x 104 K/T. Calculate Ea for this reaction. At what temperature will its half life be 256 minutes?

38. The decomposition of hydrocarbon follows the equation K = (4.5x 1011 sec-1) e-28000K/T Calculate Ea

39. 2NO(g) + $O_2(g)$ ⟶ $2NO_2(g)$ occurs in one step. What will happen to the rate when the Volume of the reaction vessel is reduced to 1/3 of the original volume?

40. Rate of a reaction becomes 1.414 times when concentration of the reactant is doubled. Determine the order of the reaction.