

**SANT NIRANKARI PUBIC SCHOOL**  
**NIRANKARI COLONY, DELHI**  
**HOLIDAYS HOMEWORK XII (SCIENCE STREAM 2018-19)**

**ENGLISH**

**WRITING SECTION**

- Q.1. Lack of job opportunities in the rural areas is forcing people to migrate to cities. Every big city thus has a number of slums in it. Life in these slums is miserable. Write a letter to the editor of a national newspaper on how we can improve the living conditions in these slums. You are Karan/Karuna, M 114, Mall Road Delhi.
- Q.2. Draft an application with bio data in about 120-150 words for the post of the Librarian in Vision Senior Secondary School, Calicut. You are Radhika/Rajeev from 21 Cherry Road, Madurai.
- Q.3. You are Isha/Ishan, the secretary of the Students' Forum of SahrudayaVidyalaya, Indranagar. You have planned an excursion to Jog Falls during the summer vacation. Write a letter to The Manager, Cox & Kings, for offering you a tour package. Give all necessary details about your trip.
- Q.4. You are Suresh/Sarika Jain of H no 20 Jawahar Nagar, Delhi. Two months ago you bought a desert cooler from M/S Cool Home Coolers, Delhi. Now you discover that it is not working properly. Write a letter to the Customer Care Manager complaining about the malfunctioning of the unit and asking them to repair and if required to replace it against warranty.
- Q.5. In the year to come you are going to celebrate your 18<sup>th</sup> birthday. Write an article in 150-200 words on joys and responsibilities of being eighteen. You are Navtej/Navita.
- Q.6. 'The policy of reservation of seats for admission to the professional courses is good for the deprived sections of society.' Write a debate in 150-200 words either for or against the motion.
- Q.7. Write a speech in 150-200 words on the topic : 'Discipline Shapes The Future Of A Student'. It is to be delivered in the morning assembly. You are Karen/Kashib.
- Q.8. Your school is organizing a Public Awareness Exhibition. In connection with it, prepare a poster to bring home the importance of Conservation of Electricity.
- Q.9. On the occasion of World Book Day, the school has decided to organize a Book Fair, Vishakha/Vishal, the secretary of the Book Club, wants to call a meeting of the office bearers of the club to discuss the arrangements for the fair. Write a notice in not more than 50 words.
- Q.10. You are manager, Infocom Network, C-3 Main Shopping Centre, VasantVihar, New Delhi. Draft an advertisement offering office furniture for sale, giving all necessary details.
- Q.11. Your company has launched a new pen READALL which in addition to working as a pen, can read the text in various languages. Draft an attractive advertisement in about 50 words, announcing the launch of the new pen, giving all relevant details.

**LITERATURE**

- Q.12. Dr. Sadao was a patriotic Japanese as well as a dedicated surgeon. How could he honour both the values?
- Q.13. How did the misadventure in YMCA swimming pool affect Douglas? What efforts did he make to conquer his old terror?
- Q.14. Do you think Jack shared an affinity with Roger Skunk? Explain.
- Q.15. How does M. Hamel prove to be an ideal teacher?

**MATHEMATICS**

MATRICES

1. Let  $A = \begin{bmatrix} 3 & 2 & 5 \\ 4 & 1 & 3 \\ 0 & 6 & 7 \end{bmatrix}$  then express  $A$  as a sum of two matrices such that one is Symmetric and the other are skew symmetric.
2. If  $A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix}$  verify that  $A^2 - 4A - 5I = 0$ .
3. Using elementary transformations find the inverse of the following matrix

$$\begin{bmatrix} 1 & 2 & 3 \\ 2 & 5 & 7 \\ -2 & -4 & -5 \end{bmatrix}$$

4. Using elementary transformations find the inverse of the following matrix

$$\begin{bmatrix} 2 & -1 & 4 \\ 4 & 0 & 2 \\ 3 & -2 & 7 \end{bmatrix}$$

5. Using elementary transformations find the inverse of the following matrix

$$\begin{bmatrix} 3 & 0 & -1 \\ 2 & 3 & 0 \\ 0 & 4 & 1 \end{bmatrix}$$

6. Using elementary transformations find the inverse of the following matrix

$$\begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$$

7. Express the following matrix as the sum of symmetric and skew symmetric matrix

And verify your result  $\begin{bmatrix} 3 & -2 & -4 \\ 3 & -2 & -5 \\ -1 & 1 & 2 \end{bmatrix}$

8. For the following matrices A and B verify that  $(AB)' = B'A'$

$$A = \begin{bmatrix} 1 \\ -4 \\ 3 \end{bmatrix}; B = \begin{bmatrix} -1 & 2 & 1 \end{bmatrix}$$

9. Using elementary transformations find the inverse of the following matrix

$$\begin{bmatrix} 6 & 5 \\ 5 & 4 \end{bmatrix}$$

10. Using elementary transformations find the inverse of the following matrix

$$\begin{bmatrix} 1 & 3 & -2 \\ -3 & 0 & -1 \\ 2 & 1 & 0 \end{bmatrix}$$

### DETERMINANT

Using properties of determinant prove the following:

$$\begin{vmatrix} 1 + a^2 - b^2 & 2ab & -2b \\ 2ab & 1 - a^2 + b^2 & 2a \\ 2b & -2a & 1 - a^2 - b^2 \end{vmatrix} = (1 + a^2 + b^2)^3.$$

2. Using properties of determinant prove the following:

$$\begin{vmatrix} 1 + a^2 & ab & ac \\ ab & 1 + b^2 & bc \\ ca & cb & 1 + c^2 \end{vmatrix} = 1 + a^2 + b^2 + c^2$$

3. Using properties of determinant show that:

$$\begin{vmatrix} 1 & a^2 + bc & a^3 \\ 1 & b^2 + ca & b^3 \\ 1 & c^2 + ab & c^3 \end{vmatrix} = -(a - b)(b - c)(c - a)(a^2 + b^2 + c^2)$$

4. Solve for x:  $\begin{vmatrix} 3x - 8 & 3 & 3 \\ 3 & 3x - 8 & 3 \\ 3 & 3 & 3x - 8 \end{vmatrix} = 0.$

5. Using properties of determinant prove that:

$$\begin{vmatrix} a & a + b & a + 2b \\ a + 2b & a & a + b \\ a + b & a + 2b & a \end{vmatrix} = ab^2(a + b)$$

6. Solve the system of equation by inverse matrix method:

$$2X - 3Y + 5Z = 11, 3X + 2Y - 4Z = -5, X + Y - 2Z = -3$$

7. Using properties of determinant(Q7 TO Q12) prove that:

$$\begin{vmatrix} 1 & 1 + p & 1 + p + q \\ 2 & 3 + 2p & 4 + 3p + 2q \\ 3 & 6 + 3p & 10 + 6p + 3q \end{vmatrix} = 1$$

8.  $\begin{vmatrix} x+y & x & x \\ 5x+4y & 4x & 2x \\ 10x+8y & 8x & 3x \end{vmatrix} = x^3$
9.  $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1-x^3)^2$
10.  $\begin{vmatrix} a+bx & c+dx & p+qx \\ ax+b & cx+d & px+q \\ u & v & w \end{vmatrix} = (1-x^2) \begin{vmatrix} a & c & p \\ b & d & q \\ u & v & w \end{vmatrix}$
11.  $\begin{vmatrix} (b+c)^2 & ab & ac \\ ab & (a+c)^2 & bc \\ ca & cb & (a+b)^2 \end{vmatrix} = 2ab(a+b+c)^3$
12.  $\begin{vmatrix} x & x^2 & 1+px^3 \\ y & y^2 & 1+py^3 \\ z & z^2 & 1+pz^3 \end{vmatrix} = (1+pxyz)(x-y)(y-z)(z-x)$  where p is any scalar.

### Continuity and Differentiability

- If  $y = \tan^{-1} \left[ \frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}} \right]$  find  $\frac{dy}{dx}$ .
- For what values of k the following function is continuous:  

$$F(x) = \begin{cases} 2x+1, & x < 2 \\ k, & x = 2 \\ 3x-1, & x > 2 \end{cases}$$
- If  $y = \tan^{-1} \left[ \frac{\sqrt{1+\sin x} + \sqrt{1-\sin x}}{\sqrt{1+\sin x} - \sqrt{1-\sin x}} \right]$ , find  $\frac{dy}{dx}$
- If  $y = \sin^{-1} \left[ \frac{5x+12\sqrt{1-x^2}}{13} \right]$  find  $\frac{dy}{dx}$
- If  $x = a(\cos \theta + \log \tan \frac{\theta}{2})$  and  $y = a \sin \theta$  find the value of  $\frac{dy}{dx}$  at  $\theta$
- Find the value of a, b, c if f(x) defined as following is continuous at  $x = 0$

$$F(x) = \begin{cases} \frac{\sin(a+1)x + \sin x}{x}, & x < 0 \\ c, & x = 0 \\ \frac{\sqrt{x+bx^2} - \sqrt{x}}{bx^{3/2}}, & \text{if } x > 0 \end{cases}$$

### INVERSE TRIGONOMETRIC FUNCTION

- Prove that:  $\tan\left(\frac{\pi}{4} + \frac{1}{2} \cos^{-1} \frac{a}{b}\right) + \tan\left(\frac{\pi}{4} - \frac{1}{2} \cos^{-1} \frac{a}{b}\right) = \frac{2b}{a}$ .
- Solve for x:  $\tan^{-1}(x+1) + \tan^{-1}(x-1) = \tan^{-1} \frac{8}{31}$ .
- Prove that  $2 \tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{8} = \tan^{-1} \frac{8}{31}$ .
- Prove that  $\sin^{-1} \frac{12}{13} + \cos^{-1} \frac{4}{5} + \tan^{-1} \frac{63}{16} = \pi$
- Prove that:  $\tan^{-1} \frac{1}{3} + \tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{7} + \tan^{-1} \frac{1}{8} = \frac{\pi}{4}$
- Solve for X:  $\tan^{-1} 2x + \tan^{-1} 3x = \frac{\pi}{4}$
- Solve for X:  $\tan^{-1} \frac{x-1}{x-2} + \tan^{-1} \frac{x+1}{x+2} = \frac{\pi}{4}$
- Prove that:  $2 \tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{7} = \tan^{-1} \frac{31}{17}$
- Prove that  $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{5} + \tan^{-1} \frac{1}{8} = \frac{\pi}{4}$

## **BIOLOGY**

### **ASSIGNMENT**

- Q1. Distinguish between asexual and sexual reproduction.
- Q2. Why vegetative propagation is called asexual reproduction?
- Q3. Name vegetative propagules in agave and Bryophyllum.
- Q4. Why banana is considered good example of parthenocarpy.
- Q5. Differentiate between Gametogenesis and Embryogenesis.
- Q6. What do you mean by Staminate and Pistillate?
- Q7. State the function of filiform apparatus found in mature embryo sac of an angiosperm.

- Q8. What is Geitonogamy? Give its one similarity to Autogamy and Xenogamy
- Q9. List post fertilization events in angiosperms.
- Q10. Mention the function of corn tassels of corn cob and tapetum in the microsporangium
- Q11. State what is apomixis. Comment on its significance? How can it be commercially used?
- Q12. Draw diagram of anatropous ovule.
- Q13. Define spermiogenesis. Where does it occur?
- Q14. Describe the process of parturition in humans.
- Q15. Explain the events in the ovary of human female during follicular and luteal phase of menstrual cycle.
- Q16. Describe stages of oogenesis in human females.
- Q17. Trace the development of zygote up to its implantation in the uterus.
- Q18. Placenta acts as endocrine tissue. Justify.
- Q19. What is amniocentesis? Why has the government imposed a statutory ban in spite of its importance in the medical field?
- Q20. Explain ZIFT. How is it different from IUT ?
- Q21. Describe various methods of birth control.
- Q22. Name an oral pill used as a contraceptive by human females. Explain how does it prevent pregnancy.
- Q23. Suggest and explain any three ART to an infertile couple.
- Q24. Why is test tube baby a misnomer?
- Q25. Define and design a test cross.
- Q26. Explain phenomenon of dominance, multiple allelism and co dominance taking ABO blood group as an example.
- Q27. Explain mechanism of sex determination in birds.
- Q28. Explain how trisomy of 21st chromosome occurs in humans. List any three symptoms of this disorder.
- Q29. In a family, four children have different blood group. Their mother has blood group A and their father has blood group B. Work out a cross to explain.
- Q30. A true breeding pea plant homozygous is crossed with another pea plant with constricted yellow pods what would be the phenotype and genotype of  $F_1$  and  $F_2$  generation? Give the phenotype ratio of generation. State the generalization proposed by Mendel on the basis of the above mentioned cross.
- Q31. Describe the experiment that demonstrated the semi conservative mode of DNA replication.
- Q32. Draw a labelled diagram of transcription unit.
- Q33. Explain the dual role of AUG codon. Give the sequence of bases it is transcribed from and its anticodon.
- Q34. What is DNA fingerprinting? Mention its application.
- Q35. Explain the process of protein synthesis from processed m RNA.
- Q36. Describe how the lac operon operates, both in the presence and absence of an inducer in E coli.

## **PHYSICS**

1. Think about a new idea/initiative/creation/innovation. The idea may help the problems of pollution, water conservation, energy conservation, global warming, traffic problem or any general nature. Write a presentation on it. You can also use multi-media to present your idea.
2. Complete your practical file. (5 experiments and 5 activities)
4. Do the following.
  - i) All/left in-text questions of chapters 1, 2, 3, 4 of NCERT
  - ii) All/left the back-exercises including additional questions of chapters 1, 2, 3, 4 of NCERT
  - iii) Two questions each related to every topic from chapter 1, 2, 3, 4.
 The questions must be from any CBSE board exam.

## CHEMISTRY

- PREPARE AN INVESTIGATORY PROJECT WHICH CONTAINS PRACTICAL KNOWLEDGE FROM YOUR COURSE WORK.

### SOLID STATE

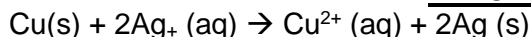
1. Sodium crystallises in a bcc unit cell. What is the approximate number of unit cells in 4.6 g of sodium? Given that the atomic mass of sodium is 23 g mol<sup>-1</sup>. [Ans. :  $6.022 \times 10^{22}$ ]
2. In a crystalline solid anions 'C' are arranged in cubic close packing, cations 'A' occupy 50% of tetrahedral voids and cations 'B' occupy 50% of octahedral voids. What is the formula of the solid? [Ans. : A<sub>2</sub>BC<sub>2</sub>]
3. Magnetite, a magnetic oxide of iron used on recording tapes, crystallises with iron atoms occupying 1/8th of the tetrahedral holes and 1/2th of the octahedral holes in a closed packed array of oxides ions. What is the formula of magnetite? [Ans. : Fe<sub>3</sub>O<sub>4</sub>]
4. A metal crystallises into two cubic lattices fcc and bcc, whose edge length are 3.5 Å and 3.0 Å respectively. Calculate the ratio of the densities of fcc and bcc lattices.
5. An element of atomic mass 98.5 g mol<sup>-1</sup> occurs in fcc structure. If its unit cell edge length is 500 pm and its density is 5.22 g cm<sup>-3</sup>. Calculate the value of Avogadro constant. [Ans. :  $6.03 \times 10^{23}$  mol<sup>-1</sup>]
6. An element crystallises in a cubic close packed structure having a fcc unit cell of an edge 200 pm. Calculate the density if 200 g of this element contain  $24 \times 10^{23}$  atoms. [Ans. : 41.6 g cm<sup>-3</sup>]
7. Analysis shows that a metal oxide has a empirical formula M<sub>0.96</sub>O. Calculate the percentage of M<sup>2+</sup> and M<sup>3+</sup> ions in this crystal. [Ans. : M<sup>2+</sup> = 91.7%, M<sup>3+</sup> = 8.3%]
8. A metallic element has a body centered cubic lattice. Edge length of unit cell is  $2.88 \times 10^{-8}$  cm. The density of the metal is 7.20 g cm<sup>-3</sup>. Calculate (a) The volume of unit cell. (b) Mass of unit cell. (c) Number of atoms in 100 g of metal. [Ans. : (a)  $2.39 \times 10^{-23}$  cm<sup>3</sup> (b)  $1.72 \times 10^{-22}$  g, (c)  $1.162 \times 10^{24}$  atoms]
9. Molybdenum has atomic mass 96 g mol<sup>-1</sup> with density 10.3 g/cm<sup>3</sup>. The edge length of unit cell is 314 pm. Determine lattice structure whether simple cubic, bcc or fcc. (Given N<sub>A</sub> =  $6.022 \times 10^{23}$  mol<sup>-1</sup>) [Ans. : Z = 2, bcc type]
10. The density of copper metal is 8.95 g cm<sup>-3</sup>. If the radius of copper atom is 127 pm, is the copper unit cell a simple cubic, a body-centred cubic or a face centred cubic structure? (Given at. mass of Cu = 63.54 g mol<sup>-1</sup> and N<sub>A</sub> =  $6.02 \times 10^{23}$  mol<sup>-1</sup>) [Ans. : Z = 4, fcc type]
11. Define F-centre. Mention its one consequence.
12. What is packing efficiency. Calculate the packing efficiency in body-centered cubic crystal.
13. Account for the following: (a) Glass objects from ancient civilizations are found to become milky in appearance. (b) Window glass panes of old buildings are thicker at the bottom than at the top.
14. Why is graphite soft lubricant and good conductor of electricity?
15. What makes the crystal of KCl sometimes appear violet?

### SOLUTIONS

1. Calculate the molarity of a solution prepared by mixing 500 mL of 2.5 M urea solution and 500 mL of 2M urea solution. [Ans. : 2.25 m]
2. The mole fraction of CH<sub>3</sub>OH in an aqueous solution is 0.02 and density of solution 0.994 g cm<sup>-3</sup>. Determine the molality and molarity. [Ans. : 1.13m, 1.08m]
3. 200 mL of calcium chloride solution contains  $3.011 \times 10^{22}$  Cl<sup>-</sup> ions. Calculate the molarity of the solution. Assume that calcium chloride is completely ionized. [Ans. : 0.125 M]
4.  $6 \times 10^{-3}$  g oxygen is dissolved per kg of sea water. Calculate the ppm of oxygen in sea water. [Ans. : 6 ppm]
5. Two liquids X and Y on mixing form an ideal solution. The vapour pressure of the solution containing 2 mol of X and 1 mol of Y is 550 mm Hg. But when 4 mol of X and 1 mole of Y are mixed, the vapour pressure of solution thus formed is 560 mm Hg. What will be the vapour pressure of pure X and pure Y at this temperature? [Ans. : X = 600 mm Hg; Y = 400 mm Hg]
6. An aqueous solution containing 3.12 g of barium chloride in 250 g of water is found to be boil at 100.0832°C. Calculate the degree of dissociation of barium chloride. [Given molar mass BaCl<sub>2</sub> = 208 g mol<sup>-1</sup>, K<sub>b</sub> for water = 0.52 K/m] [Ans. : 83.3%]

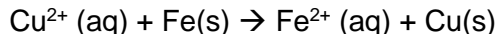
- The degree of dissociation of  $\text{Ca}(\text{NO}_3)_2$  in a dilute aqueous solution, containing 7.0 g of salt per 100 g of water at  $100^\circ\text{C}$  is 70%. If the vapour pressure of water at  $100^\circ\text{C}$  is 760 mm of Hg, calculate the vapour pressure of the solution. [Ans. : 745.3 mm of Hg]
- 2g of  $\text{C}_6\text{H}_5\text{COOH}$  dissolved in 25g of benzene shows depression in freezing point equal to 1.62K. Molar freezing point depression constant for benzene is  $4.9 \text{ K kg mol}^{-1}$ . What is the percentage association of acid if it forms a dimer in solution? [Ans. : 99.2%]
- Calculate the amount of NaCl which must added to one kg of water so that the freezing point is depressed by 3K. Given  $K_f = 1.86 \text{ K kg mol}^{-1}$ , Atomic mass : Na = 23, Cl = 35.5). [Ans. : 0.81 molNaCl]
- Three molecules of a solute (A) associate in benzene to form species  $\text{A}_3$ . Calculate the freezing point of 0.25 molal solution. The degree of association of solute A is found to be 0.8. The freezing point of benzene is  $5.5^\circ\text{C}$  and its  $K_f$  value is  $5.13 \text{ K/m}$ . [Ans. :  $4.9^\circ\text{C}$ ]
- A 5% solution of sucrose ( $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ) is isotonic with 0.877% solution of urea ( $\text{NH}_2\text{CONH}_2$ ) Calculate the molecular mass of urea. [Ans. :  $59.99 \text{ g mol}^{-1}$ ]
- Osmotic pressure of a 0.0103 molar solution of an electrolyte was found to be 0.75 atm at  $27^\circ\text{C}$ . Calculate Van't Hoff factor. [Ans. :  $i = 3$ ]
- The vapour pressure of pure liquids A and B are 450 and 750 mm Hg respectively, at 350K. Find out the composition of the liquid mixture if total vapour pressure is 600 mm Hg. Also find the composition of the vapour phase. [Ans. :  $X_A = 0.4$ ,  $X_B = 0.6$ ,  $Y_A = 0.3$ ,  $Y_B = 0.7$ ]
- For a dilute solution containing 2.5 g of a non-volatile non-electrolyte solute in 100 g of water, the elevation in boiling point at 1 atm pressure is  $2^\circ\text{C}$ . Assuming concentration of solute is much lower than the concentration of solvent, determine the vapour pressure (mm of Hg) of the solution. [Given :  $K_b$  for water =  $0.76 \text{ kg mol}^{-1}$ ] [Ans.: 724 mm of Hg]

### ELECTROCHEMISTRY



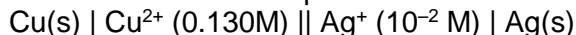
The standard cell potential for the reaction at  $25^\circ\text{C}$  is 0.46V. [Given  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ ]  
[Ans. :  $4.0 \times 10^{15}$ ]

- Calculate  $\Delta G^\circ$  for the reaction:



- $E^\circ(\text{Cu}^{2+}|\text{Cu}) = +0.34\text{V}$ ;  $E^\circ(\text{Fe}^{2+}|\text{Fe}) = -0.44\text{V}$  [Ans. :  $-150.540 \text{ kJ}$ ]

- Write the Nernst equation and calculate the emf of the following cell at 298K.



Given  $E^\circ(\text{Cu}^{2+}|\text{Cu}) = +0.34\text{V}$ ;  $E^\circ(\text{Ag}^+|\text{Ag}) = 0.80\text{V}$  [Ans. : 0.37V]

- A zinc rod is dipped in 0.1M solution of  $\text{ZnSO}_4$ . The salt is 95% dissociated at this dilution at 298K. Calculate the electrode potential. Given  $E^\circ(\text{Zn}^{2+}|\text{Zn}) = 0.76 \text{ V}$ . [Ans. :  $-0.7902\text{V}$ ]

- For the electrode  $\text{Pt, H}_2(1 \text{ atm}) | \text{H}^+(\text{aq})(x\text{M})$ , the reduction electrode potential at  $25^\circ\text{C}$  is  $-0.34\text{V}$ . Write the electrode reaction and calculate the value of x. and the pH of solution. [Ans. :  $x = 1.807 \times 10^{-6}$ ,  $\text{pH} = 5.743$ ]

- For what concentration of  $\text{Ag}^+(\text{aq})$  will the emf of the given cell be zero at  $25^\circ\text{C}$  if concentration of  $\text{Cu}^{2+}(\text{aq})$  is 0.1M?

Given  $E^\circ(\text{Ag}^+|\text{Ag}) = 0.80\text{V}$ ;  $E^\circ(\text{Cu}^{2+}|\text{Cu}) = +0.34\text{V}$  Cell :  $\text{Cu(s)} | \text{Cu}^{2+}(\text{aq}) || \text{Ag}^+(\text{aq}) | \text{Ag(s)}$  [Ans. :  $5.3 \times 10^{-9}$ ]

- Zinc granules are added in excess to 500 mL of 1.0M nickel nitrate solution at  $25^\circ\text{C}$  until the equilibrium is reached. If the standard reduction potential of  $\text{Zn}^{2+} | \text{Zn}$  and  $\text{Ni}^{2+} | \text{Ni}$  are  $-0.75 \text{ V}$  and  $-0.24 \text{ V}$  respectively, find out the concentration of  $\text{Ni}^{2+}$  in solution at equilibrium. [Ans. :  $5.88 \times 10^{-18}\text{M}$ ]

- The molar conductivity of 0.1M  $\text{CH}_3\text{COOH}$  solution is  $4.6 \text{ S cm}^2 \text{ mol}^{-1}$ . Calculate the conductivity and resistivity of the solution. [Ans. :  $.00046 \text{ S cm}^{-1}$ ,  $2174 \text{ }\Omega\text{cm}$ ]

- The molar conductivities of  $\text{NH}_4^+$  ion and  $\text{Cl}^-$  ion are  $73.5 \text{ S cm}^2 \text{ mol}^{-1}$  and  $76.255 \text{ S cm}^2 \text{ mol}^{-1}$  respectively. The specific conductivity of 0.1 M  $\text{NH}_4\text{Cl}$  is  $1.288 \times 10^{-2} \text{ S cm}^{-1}$ . Calculate the dissociation constant of  $\text{NH}_4\text{Cl}$ . [Ans. :  $7.396 \times 10^{-2}$ ]

- Molar conductivity at infinite dilution for  $\text{NH}_4\text{Cl}$ ,  $\text{NaOH}$  and  $\text{NaCl}$  solution at 298K are respectively 129.8, 218.4 and  $108.9 \text{ S cm}^2 \text{ mol}^{-1}$  and m for  $10^{-2} \text{ M}$  solution of  $\text{NH}_4\text{OH}$  is  $9.33 \text{ S cm}^2 \text{ mol}^{-1}$ . Calculate the degree of dissociation of  $\text{NH}_4\text{OH}$ . [Ans. : 0.039]

- Write the Nernst equation and emf of the following cell at 298 K; Pt(s)/ Br<sub>2</sub>(l) | Br<sup>-</sup> (0.010M) || H<sup>+</sup>(0.030M) | H<sub>2</sub>(g) (0.9 bar) | Pt(s). E°(Br<sub>2</sub>/Br<sup>-</sup>/Pt) = 1.09V. [Ans. : -1.297V]
- In the button cells widely used in watches and other devices, the following reaction takes place : Zn(s) + Ag<sub>2</sub>O (s) + H<sub>2</sub>O (l) → Zn<sup>2+</sup> (aq) + 2Ag(s) + 2OH<sup>-</sup>(aq) Determine Δ<sub>r</sub>G° and E° for the reaction. Given E°(Zn<sup>2+</sup>/Zn) = - 0.76V; E°(Ag<sup>+</sup>/Ag) = 0.8V [Ans.: -301.08 kJ / mol; 1.56V]
- (a) Explain Kohlrausch law of independent migration of ions. Mention two applications of this law.  
(b) The conductivity of 0.001M CH<sub>3</sub>COOH is 4.95 × 10<sup>-5</sup> Scm<sup>-1</sup>. Calculate its dissociation constant. Given for acetic acid λ<sup>o</sup><sub>m</sub> is 390.5 S cm<sup>2</sup> mol<sup>-1</sup>. [Ans. : = 0.126]
- Give reasons for : (a) For a weak electrolyte, its molar conductivity of dilute solution increases as the concentration of solution is decreased. (b) Molar conductivity of a strong electrolyte like KCl decreases almost linearly while increasing concentration? (c) It is not easy to determine λ<sup>o</sup><sub>m</sub> of a weak electrolyte by extrapolation of V<sup>c</sup> vs λ<sub>m</sub> curves?

### CHEMICAL KINETICS

- A certain reaction is 50% complete in 20 min at 300K and the same reaction is again 50% complete in 5 min at 350K. Calculate the activation energy if it is a first order reaction. (R = 8.314J K<sup>-1</sup> mol<sup>-1</sup>, log 4 = 0.602) [Ans. : 24.206 kJ/mol]
- A first order reaction has a rate constant 1.15 × 10<sup>-3</sup> s<sup>-1</sup>. How long will 5g of this reactant take to reduce to 3g? [Ans. : t = 444 s]
- The rate of reaction triples when the temperature changes from 20°C to 50°C. Calculate the energy of activation. [R = 8.314 J K<sup>-1</sup> mol<sup>-1</sup>, log 3 = 0.48] [Ans. : 12.59 kJ]
- A hydrogenation reaction is carried out at 550 K. If the same reaction is carried out in the presence of a catalyst at the same rate, the temperature required is 400 K. Calculate the activation energy of the reaction if the catalyst lowers the activation barrier by 20 kJ mol<sup>-1</sup>. [Ans. : E<sub>a</sub> = 100 kJ mol<sup>-1</sup>]
- The rate constant for the first order decomposition of H<sub>2</sub>O<sub>2</sub> is given by the following equation log k = 14.34 - 1.25 × 10<sup>4</sup> / K/T. Calculate E<sub>a</sub> for this reaction and at what temperature will its half-life be 256 minutes. [Ans. : E<sub>a</sub> = 239.34 kJ; T = 670K]
- Show that for a first order reaction, time required for 99% completion is twice for the time required for the 90% completion of reaction.
- A reaction is 20% complete in 20 minutes. Calculate the time required for 80% completion of reaction, if reaction follows the first order kinetics. [Ans. : 144 min]
- The decomposition of phosphine 4PH<sub>3</sub>(g) → P<sub>4</sub>(g) + 6H<sub>2</sub>(g) has rate law; Rate = k [PH<sub>3</sub>]. The rate constant is 6.0 × 10<sup>-4</sup> s<sup>-1</sup> at 300K and E<sub>a</sub> = 3.05 × 10<sup>5</sup> J mol<sup>-1</sup>. Calculate the value of the rate constant at 310K. (R = 8.314 J K<sup>-1</sup> mol<sup>-1</sup>). [Ans. : 30.97 × 10<sup>-3</sup> s<sup>-1</sup>]
- For the decomposition of azoisopropane to hexane and nitrogen at 543K, the following data is obtained.

t (sec.) 0 360 720

Pressure (atm.) 35.0 54.0 63.0

Calculate the rate constant. [Ans. : k<sub>360</sub> = 2.17 × 10<sup>-3</sup> s<sup>-1</sup> ; k<sub>720</sub> = 2.24 × 10<sup>-3</sup> s<sup>-1</sup>]

- The decomposition of hydrocarbon follows the equation k = (4.5 × 10<sup>11</sup> s<sup>-1</sup>) e<sup>-28000 / K/T</sup>, Calculate activation energy (E<sub>a</sub>). [Ans. : 232.79 kJmol<sup>-1</sup>]

- A reaction is 50% complete in 2 hours and 75% complete in 4 hours. What is the order of reaction? [Ans : First order]
- A chemical reaction is of second order w.r.t. a reactant. How will the rate of reaction be affected if the concentration of this reactant is : (a) doubled; (b) reduced to 1/8th. [Ans. : (a) Four times (b) 1/64]

### SURFACE CHEMISTRY

- Define the term peptization and mention its cause.
- Write the factors upon which the catalytic reaction of shape-selective catalyst depends?
- How can physisorption be distinguished from chemisorption?
- In what way these are different : (a) a sol and a gel (b) a gel and an emulsion.

5. Account for the following : (a) Artificial rain can be caused by spraying electrified sand on the clouds. (b) Electrical precipitation of smoke.
6. “Adsorbents in finely divided form are more effective.” Why?
7. Why gas masks are used by miners in coal mines while working?
8. What is the composition of colloidal solution?
9. What happens when hydrated ferric oxide and arsenious sulphide sols are mixed in almost equal proportions?
10. Gelatin is generally added to ice-cream. Why?
11. State the purpose of impregnating the filter paper with colloidal solution.

## **COMPUTER SCIENCE**

**Note: all the questions should be done in the class notebook**

12.

- 1 What do you mean by data member and member functions of a class?
- 2 List the various access-specifiers of a class. Explain each w.r.t. their visibility.
- 3 How destructor is different from constructor?
- 4 Declare and define class Student having the following members:  
**Private members :**  
 Student Roll No. - integer  
 Student Name - 20 characters  
 Student Age - integer  
 Student Marks – Float array for eng, maths, science  
 Ctotal() - Function to calculate eng+maths+science  
**Public members:**  
 Takedata() - To read all data members and invoke the function Ctotal()  
 Showdata() - To display all data members
- 5 What are inline functions? Explain the concept of inline for member and non-member functions.
- 6 What is wrong with this – Class C {public: int x=0;};
- 7 Declare and define class Applicant having the following members:  
**Private members :**  
 Admission No. - long  
 Name - 20 characters  
 Aggregate marks - Float  
 Grade – Char  
 GradeMe() - Function to find Grade as per Aggregate marks as follows:  
 Aggregate Marks Grade  
 >=80 A  
 Less than 80 and >=65 B  
 Less than 65 and >=50 C  
 Less than 50 D  
**Public members:**  
 ENTER() - To read all data members and invoke the function GradeMe()  
 RESULT() - To display all data members

## **PHYSICAL EDUCATION**

Maintain Record File :-

- 1.) Any one game of your choice with labelled diagram of field. Along with rules, terminologies and skills required, with player’s photograph in playing position.
- 2.) Same as above for an Athletic Event, a Jumping Event and a Throwing Event.
- 3.) Yoga Asanas (Any 10) with diagrams, benefits and rules.