Class-12 Diwali Break Assignment (Chemistry)

Date-26/10/2016 **Submission date-7/11/2016**

Chapter-1 (Solid State)

Q.1 Calculate the packing efficiency of a metal crystal for a simple cubic lattice.

Q.2 Define the following terms in relation to crystalline solids:
(i) Unit cell
(ii) Coordination number Give one example in each case.

Q.3 Silver crystallises with face-centred cubic unit cell. Each side of this unit cell has a length of 409 pm. What is the radius of silver atom? Assume the atoms just touch each other on the diagonal across the face of the unit cell.

Q.4 Zinc oxide is white but it turns yellow on heating. Explain.

Q.5 A crystalline solid has a cubic structure in which tungsten (W) atoms are located at cube corners of the unit cell, oxygen atoms at the cube edges and sodium atom at the centre. What is the molecular formula of the compound?

Q.6 In a cubic close packed structure of a mixed oxide one-eighth of tetrahedral voids are occupied by divalent ions X^{2+} while one half of the octahedral voids are occupied by trivalent ions Y^{3+}. What is the formula of the compound?

Chapter-2 (Solution)

Q.1 The solubility of $Ba(OH)_2.8H_2O$ in water at 288 K is 5.6 g per 100 g of water. What is the molality of hydroxide ion in saturated solution of $Ba(OH)_2.8H_2O$ at 288 K?

Q.2 Which of the following solutions will have the highest boiling point:
(a) 1 M glucose (b) 1 M NaCl (c) 1 M $CaCl_2$.

Q.3 What will happen to freezing point of a potassium iodide aqueous solution when mercuric iodide is added to solution?

Q.4 (a) Define the following terms:
(i) Mole fraction (ii) Ideal solution
(b) 15.0 g of an unknown molecular is dissolved in 450 g of water. The resulting solution freezes at -0.34°C. What is the molar mass of the material?
(Kf for water = 1.86 K kg mol^{-1})

Q.5 (a) State Raoult's low for a solution containing volatile components. How does Raoult's low become a special case of Henry's low?
(b) 1.00 g of a non-electrolyte solute dissolved in 50 g of benzene lowered the freezing point of benzene by 0.40 K. Find the molar mass of the solute. (Kf for benzene = 5.12 kg mol^{-1})

Chapter-3 (Electrochemistry)

Q.1 From the following molar conductivities at infinite dilution, calculate Λ^o_m for NH_4OH.

Λ^o_m for $Ba(OH)_2$ = 457.6 Ω^{-1} cm^2 mol^{-1}
Λ^o_m for $BaCl_2$ = 240.6 Ω^{-1} cm^2 mol^{-1}
Λ^o_m for NH_4Cl = 129.8 Ω^{-1} cm^2 mol^{-1}

Q.2 Estimate the minimum potential difference needed to reduce Al_2O_3 at 500°C. The free energy change for the decomposition reaction

$\frac{2}{3}Al_2O_3 \longrightarrow \frac{4}{3}Al + O_2$ is 960 kJ

(F = 96,500 C mol^{-1}).

Q.3 a) Define molar conductivity of a solution and explain how molar conductivity with change in concentration of solution for a weak and a strong electrolyte.
b) The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500 Ω What is the cell constant if the conductivity of 0.001 M KCl solution at 298 K Is 0.146 x 10^{-3} S cm^{-1}?

Q.4 (a) Corrosion is essentially an electrochemical phenomenon. Explain the reactions occurring during corrosion of iron kept in an open atmosphere.
(b) Calculate the equilibrium constant for the equilibrium reaction.

$Fe(s) + Cd^{2+}(aq) \rightleftharpoons Fe^{2+}(aq) + Cd(s)$

Given: $E^o_{Cd^{2+}/Cd}$ = - 0.40V , $E^o_{Fe^{2+}/Fe}$ = - 0.44V)

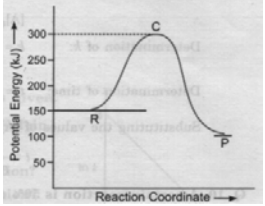
Q.5 (a) State Kohlrausch's law of independent migration of ions. Mention one application of kohlrausch's law.
(b) The resistance of a conductivity cell containing 10^{-3} M KCl solution at 20°C is 1500 Ω. What is the cell constant if conductivity of 10-3 M KCl solution at 25° C is 1.5 × 10^{-4} S cm^{-1}?

Chapter-4 (Chemical Kinetics)

Q.1 A plot of rate of reaction (γ-axis) versus concentration of reactant (x-axis) gives a line parallel to x-axis. What is the order of reaction?

Q.2 Can a reaction have zero activation energy?

Q.3 Answer the following questions on the basis of the given plot of potential energy vs reaction coordinate:
(i) What is the threshold energy for the reaction?
(ii) What is the activation energy for forward reaction?
(iii) What is the activation energy for backward reaction?
(iv) What is enthalpy change for the forward reaction?



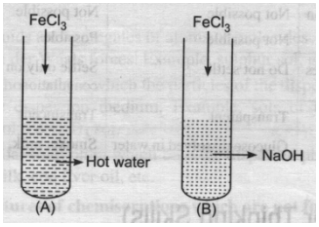
Q.4 (a) A reaction is second order in A and first order in B.
(i) Write the differential rate equation.
(ii) How is the rate affected on increasing the concentration of A three times?
(iii) How is the rate affected when the concentrations of both A and B are doubled?
(b) A first order reaction takes 40 minutes for 30% decomposition. Calculate $t_{1/2}$ for this reaction. (Given log 1.428 = 0.1548)

Chapter-5 (Surface Chemistry)

Q.1 (a) What are micelles? How do they differ from ordinary colloidal particles? Give two examples of micelle forming substances.
(b) State Hardy—Schulze rule.

Q.2 Explain how the phenomenon of adsorption finds application in each of the following processes:
(i) Production of vacuum (ii)Heterogeneous catalysis
(iii) Froth Floatation process

Q. 3 A colloidal solution of ferric oxide is prepared by two different methods as shown below.

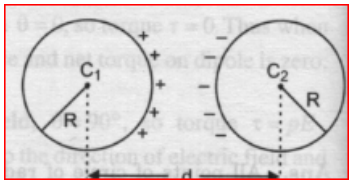


(i) What is the charge on colloidal particles in two test tubes (A) and (B)?
(ii) Give reasons for the origin of charge.

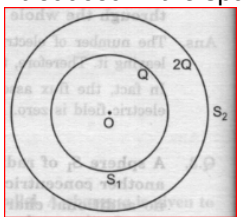
Class-12 Diwali Break Assignment (Physics)

Chapter-1 (Electrostatics)

Q.1. Two charged spherical conductors, each of radius R, are distance d apart such that d is slightly greater than 2R. They carry charges + q and - q. Will the force of attraction between them be exactly $\frac{q^2}{4\pi\varepsilon_0 d^2}$?



Q.2. S_1 and S_2 are two hollow concentric spheres enclosing charges Q and 2Q respectively as shown in the fig.
(i) What is the ratio of electric flux through S_1 and S_2?
(ii) How will the electric flux through the sphere S_1 change if a medium of dielectric constant 5 is introduced in the space inside S_1 in place of air?



Q.3 (i) Using Gauss Theorem show mathematically that for any point outside the shell, the field due to a uniformly charged spherical shell is same as the entire charged shell is concentrated at the centre.
(ii) Why do you expect the electric field inside the shell to be zero according to this theorem.

Q.4. State Gauss theorem in electrostatics. Apply this theorem to obtain the expression for the electric field at a point due to an infinitely long, thin, uniformly charged straight wire of linear charge density λ Cm^{-1}.

Q.5. (a) Define electric flux. Write its S.I. units.
(b) Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.
(c) How is the field directed if (i) the sheet is positively charged, (ii) negatively charge

Q.6. What is the area of the plates of a 2F parallel plate capacitor, given that the separation between the plates is 0.5 cm?

Q.7. (a) Obtain the equivalent capacitance of the following network of capacitors.
(b) For a 300 V supply, determine the charge and voltage across each capacitor.

Q.8. The plates of a parallel plates capacitor have an area of 90 cm^2 each and are separated by 2.5 mm. The capacitor is charged by connecting it to a 400 V supply?
(a) How much electrostatic energy is stored by the capacitor?
(b) View this energy as stored in the electrostatic field between the plates and obtain the energy per unit volume u. Hence arrive at a relation between u and the magnitude of electric field between the plates.

Q.9. A 4 μF capacitor is charged by a 200 V supply. It is then disconnected from the supply and is connected to another 2μF capacitor. How much electrostatic energy of the first capacitor is lost in the form of heat and electromagnetic radiation?

Q.10. Two identical metallic spheres, having unequal opposite charges are placed at a distance of 0.50 m apart in air. After bringing them in contact with each other, they are again placed at the same distance apart. Now the force of repulsion between them is 0.108N. Calculate the final charge on each of them.

Q.11. A charge q is placed at the centre of the line joining two equal charges Q. Show that the system of three charges will be in equilibrium of q = - $\frac{Q}{4}$

Chapter-2 (Current and Electricity)

Q.1 Derive expression for drift velocity of free electrons in a conductor in terms of relaxation time of electrons.

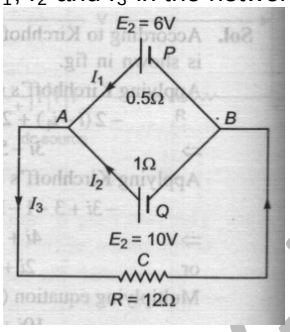
Q.2 Establish a relation between electric current and drift velocity.

Q.3 Two wires *X Y* have the same resistivity but their cross-sectional areas are in the ratio 2 : 3 and lengths in the ratio 1 : 2. They are first connected in series and then in parallel to a dc source. Find out the ratio of the drift speeds of the electrons in the two wires for the two cases.

Q.4 You are given *n* resistors each of resistance *r.* They are first connected to get the minimum possible resistance. In the second case, these are again connected differently to get the maximum possible resistance. Calculate the ratio between minimum and maximum values of resistance so obtained.

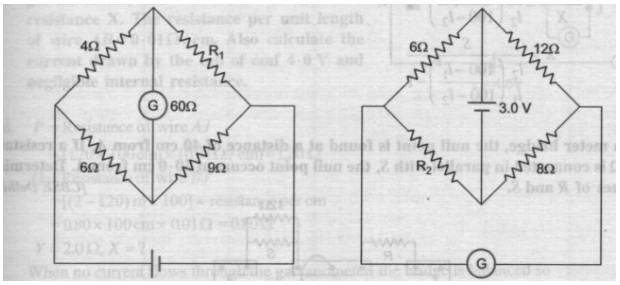
Q.5 Deduce Ohm's law using the concept of drift velocity.

Q.6. State Kirchhoff's rules. Apply Kirchhoff's rules to the loops ACAPA and ACAQA to write the expressions for the currents I_1, I_2 and I_3 in the network.

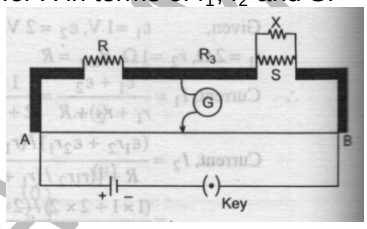


Q.7. Two cells of emf 1 *V,* 2 *V* and internal resistances 2Ω and 1Ω respectively are connected in *(1)* series. *(ii)* parallel. What should be the external resistance in the circuit so that the current through the resistance be the same in the two cases? In which case is more heat generated in the cells?

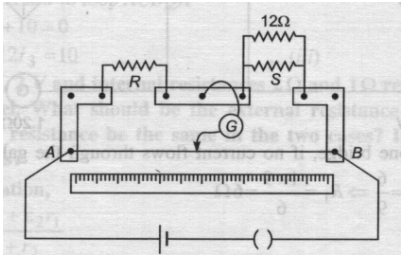
Q.8. Figure shows two circuits each having a galvanometer and a battery of 3 V. When the galvanometers In each arrangement do not show any deflection, obtain the ratio R_1/R_2



Q.9. When two known resistances *R* and S are connected in the left and right gaps of a meter bridge, the balance point is found at a distance from the zero end of the meter bridge wire. An unknown resistance X is now connected in parallel to the resistance S and the balance point is now found at a distance l_2 from the zero end of the meter bridge wire. Obtain a formula for X in terms of l_1, l_2 and S.



Q.10. In a meter bridge, the null point is found at a distance of 40 cm from *A.* If a resistance of 12Ω is connected in parallel with S, the null point occurs at 50.0cm from *A.* Determine the values of *R* and S.



Class-12 Diwali BreakAssignment (Mathematics)

Date-26/10/2016 **Submission date-7/11/2016**

Chapter-1 (Relation and Function)

1. Consider the binary operation * on the set {1, 2, 3, 4, 5} defined by a * b = min. {a, b}.Write the operation table of the operation *.

2. Consider the binary operation * on the set {1, 2, 3, 4, 5} defined by a * b = H.C.F. of a and b. write the operation table of the operation *. Is * commutative? Justify. Also, compute
(i) (2 * 3) * 5(ii) (2 * 3) * (4 * 5)

3. Let X be a non-empty set and * be a binary operation on P (X) (the power set of set X) defined by A * B = A ∪ B for all A,B∈ P(X)
Prove that '*' his both commutative and associative on P (X). Find the identity element with respect to '*' on P (X). Also, show that ϕ ∈P (X) is the only invertible element of P (X).

Chapter-2 (ITF)

6. Solve for x: $2\tan^{-1}(\sin x) = \tan^{-1}(2\sec x)$, $x \neq \frac{\pi}{2}$

7. Prove that: $\cos^{-1}\left(\frac{12}{13}\right) + \sin^{-1}\left(\frac{3}{5}\right) = \sin^{-1}\left(\frac{56}{65}\right)$

8. Solve the equation
$\tan^{-1}\sqrt{x^2+x} + sin^{-1}\sqrt{x^2+x+1} = \frac{\pi}{2}$

Chapter-3 (Matrices)

9. Prove that every square matrix can be uniquely expressed as the sum of a symmetric matrix and skew-symmetric matrix.

10. If A = $\begin{bmatrix}1 & 1 & 1\\ 1 & 1 & 1\\ 1 & 1 & 1\end{bmatrix}$, prove that

A" = $\begin{bmatrix}3^{n-1} & 3^{n-1} & 3^{n-1}\\ 3^{n-1} & 3^{n-1} & 3^{n-1}\\ 3^{n-1} & 3^{n-1} & 3^{n-1}\end{bmatrix}$, n ∈ N

11. Prove that following by the principle of mathematical induction:

If A = $\begin{bmatrix}3 & -4\\ 1 & -1\end{bmatrix}$, then A^n = $\begin{bmatrix}1+2n & -4n\\ n & 1-2n\end{bmatrix}$ for every positive integer n.

Chapter-4 (Determinants)

12. Find the equation of the line joining A (1, 3) and B (0, 0) using determinants and find *k* if D (*k*, 0) is a point such that the area of Δ*ABD* is 3 sq. units.

13. In a triangle *ABC*, if

$\begin{vmatrix}1 & 1 & 1\\ 1+\sin A & 1+\sin B & 1+\sin C\\ \sin A+\sin^2 A & \sin B+\sin^2 B & \sin C+\sin^2 C\end{vmatrix}$ = 0

then prove that ΔABC is an isosceles triangle.

14. Without expanding evaluate the determinant

$\begin{vmatrix}(a^x+a^{-x})^2 & (a^x-a^{-x})^2 & 1\\ (a^y+a^{-y})^2 & (a^y-a^{-y})^2 & 1\\ (a^z+a^{-z})^2 & (a^z-a^{-z})^2 & 1\end{vmatrix}$, where a > 0 and x, y, z ∈ R.

Chapter-5 (Ad-joint and Inverse of a matrix)

15. 11. A mixture is to be made of three foods A, B, C. The three foods A, B,C contain nutrients P, Q, R as shown below:

Food	Grams per kg of nutrient		
	P	Q	R
A	1	2	5
B	3	1	1
C	4	2	1

How to form a mixture which will have 8 grams of *P,* 5 grams of Q and 7 grams of *R?*

16. 11. If *A*= $\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$, verify that $A^3 - 6A^2 + 9A - 4I = 0$ and hence find A^{-1}.

Chapter-6 (Continuity and Differentiability)

17. If $y = \log \tan\left(\frac{\pi}{4}+\frac{x}{2}\right)$, show that $\frac{dy}{dx} - \sec x = 0$.

18. If $x \in R - [-1, 1]$, prove that the derivative of $\sec^{-1}x$ w.r.t. *x* is $\frac{1}{|x|\sqrt{x^2-1}}$

19 If y = $\begin{vmatrix}f(x) & g(x) & h(x)\\ l & m & n\\ a & b & c\end{vmatrix}$, prove that $\frac{dy}{dx}$ = $\begin{vmatrix}f'(x) & g'(x) & h'(x)\\ l & m & n\\ a & b & c\end{vmatrix}$.

20. Verify Rolle's theorem for the function:
$f(x) = x^2 + 2x - 8, \in [-4, 2]$

Chapter-7(Application of derivative)

21. Show that the right circular cylinder, open at the top, and of given surface area and maximum volume is such that its height is equal to the radius of the base.

22. If length of three sides of a trapezium other than base are equal to 10 cm, then find the area of the trapezium when it is maximum.

23. Show that the volume of the greatest cylinder that can be inscribed in a cone of height *'h'* and semi-vertical angle '*a*' is $\frac{4}{27}\pi h^3 \tan^2 a$.

24. An Apache helicopter of enemy is flying along the curve given by $y = x^2 + 7$. A soldier, placed at (3, 7), wants to shoot down the helicopter when it is nearest to him. Find the nearest distance.

Chapter-8 (Integrals)

25. Evaluate $\int_{\pi/6}^{\pi/3} \frac{\sin x + \cos x}{\sqrt{\sin 2x}}\,dx$

26. Evaluate: $\int_0^{\pi/4} \frac{\sin x + \cos x}{9+16\sin 2x}\,dx$

27. Evaluate: $\int_0^{\pi/2} \frac{\sin^2 x}{\sin x + \cos x}\,dx$

28. Evaluate: $\int_0^{\pi/2} \frac{x \sin x \cos x}{\sin^4 x + \cos^4 x}\,dx$

Chapter-9 (Application of integrals)

30. Using integration find the area of the region bounded by the parabola $y^2 = 4x$ and the circle $4x^2 + 4y^2 = 9$.

31. Find the area of that part of the circle $x^2 + y^2 = 16$ which is exterior to the parabola $y^2 = 6x$.

32. Using integration, find the area bounded by the lines x + 2y = 2, y - x = 1 and 2x + y =7.

33. Find the area of the region {(x, y) : $y^2 \le 6ax$ and $x^2 + y^2 \le 16a^2$} using method of integration.

34. Prove that the curves $y^2 = 4x$ and $x^2 = 4y$ divide the area of the square bounded by x = 0, x = 4, y = 4 and y = 0 into three equal parts.

35. Find the area of the region {(x, y): $x^2 \le y \le x$)