CBSE EXAMINATION PAPER-2022

CHEMISTRY

(Solved)

Time allowed : 3 hours | Maximum Marks : 43

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **17 questions.** All questions are **compulsory.**

ii. This question paper is divided into **3 sections.**

iii. **Section A** – questions number **1 to 2** are case based questions

iv. **Section B** – questions number **3 to 4** are short answer

v. **Section C** – questions number **5 to 17** are long answer

vi. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.

vii. Use of calculator is NOT allowed.

Section A

Question 1. The rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the reactants. For a general reaction aA + bB → C with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by r = k[A]^x[B]^y, where [A] and [B] express the concentrations of A and B in moles per litre. Exponents x and y vary for each reaction and are determined experimentally. The value of k varies with conditions that affect reaction rate, such as temperature, pressure, surface area, etc. The sum of these exponents is known as overall reaction order. A zero order reaction has a constant rate that is independent of the concentration of the reactants. A first order reaction depends on the concentration of only one reactant. A reaction is said to be second order when the overall order is two. Once we have determined the order of the reaction, we can go back and plug in one set of our initial values and solve for k.

Question 2.

Read the passage given below and answer the questions that follow :

The rate law for a chemical reaction relates the reaction rate with the concentrations or partial pressures of the reactants. For a general reaction aA + bB→ C with no intermediate steps in its reaction mechanism, meaning that it is an elementary reaction, the rate law is given by r = k[A]X [B] y , where [A] and [B] express the concentrations of A and B in moles per litre. Exponents x and y vary for each reaction and are determined experimentally. The value of k varies with conditions that affect reaction rate, such as temperature, pressure, surface area, etc. The sum of these exponents is known as overall reaction order. A zero order reaction has a constant rate that is independent of the concentration of the reactants. A first order reaction depends on the concentration of only one reactant. A reaction is said to be second order when the overall order is two. Once we have determined the order of the reaction, we can go back and plug in one set of our initial values and solve for k.

(1)

Calculate the overall order of a reaction which has the following rate expression : Rate = $k[A]^{1/2}[B]^{3/2}$

[1 Marks]

(2)

What is the effect of temperature on rate of reaction ?

[1 Marks]

(3)

A first order reaction has a rate constant 1x 10^{-3} per sec. How long will 5 g of this reactant take to reduce to 3 g ? (log 3 = 0·4771; log 5 = 0·6990)

[1 Marks]

(4)

A first order reaction takes 77·78 minutes for 50% completion. Calculate the time required for 30% completion of this reaction. (log 10 = 1, log 7 = 0·8450)

[1 Marks]

(5)

What is meant by rate of a reaction ?

[1 Marks]

Section B

Question 3.

In a plot of ∧m against the square root of concentration (C1/2) for strong and weak electrolyte, the value of limiting molar conductivity of a weak electrolyte cannot be obtained graphically. Suggest a way to obtain this value. Also state the related law, if any.

[2 Marks]

Question 4.

Write reasons for the following statements :

(i) Benzoic acid does not undergo Friedel-Crafts reaction.(1)

(ii)Oxidation of aldehydes is easier than that of ketones. (1)

[2 Marks]

Section C

Question 5.

Write reasons for the following :

(i) Ethylamine is soluble in water whereas aniline is insoluble.(1)

(ii) Amino group is o- and p-directing in aromatic electrophilic substitution reactions, but aniline on nitration gives a substantial amount of m-nitroaniline. (1)

(iii) Amines behave as nucleophiles.(1)

[3 Marks]

Question 6.

How will you carry out the following conversions :

(i) Ethanenitrile to Ethanamine. (1)

(ii) Ethanamide to Methanamine. (1)

(iii) Nitrobenzene to Aniline. (1)

[3 Marks]

Question 7.

(i) Write the electronic configuration of d5 on the basis of crystal field splitting theory if $\Delta o < P$.(1)

(ii) $[Fe(CN)_6]^{3-}$ is weakly paramagnetic whereas $[Fe(CN)_6]^{4-}$ is diamagnetic. Give reason to support this statement. [Atomic no. : Fe = 26].(1)

(iii) Write the number of ions produced from the complex $[Co(NH_3)_6]Cl_2$ in solution.(1)

[3 Marks]

Question 8.

(b) (i) Calculate the spin only magnetic moment of the complex $[CoF_6]^{3-}$ (Atomic no. of Co = 27).(1)

(ii) Write the IUPAC name of the given complex : $[CrCl_2(H_2O)_4]Cl$. (1)

(iii) Which out of the two complexes is more stable and why ? $[Fe(H_2O)_6]3+$, $[Fe(C_2O_4)_3]^{3-}$. (1)

[3 Marks]

Question 9.

(i) Which ion amongst the following is colourless and why ? Ti^{4+}, Cr^{3+}, V^{3+} (Atomic number of Ti = 22, Cr = 24, V = 23). (1)

(ii) Why is Mn^{2+} much more resistant than Fe^{2+} towards oxidation ?(1)

(iii) Highest oxidation state of a metal is shown in its oxide or fluoride only. Justify the statement. (1)

[3 Marks]

Question 10.

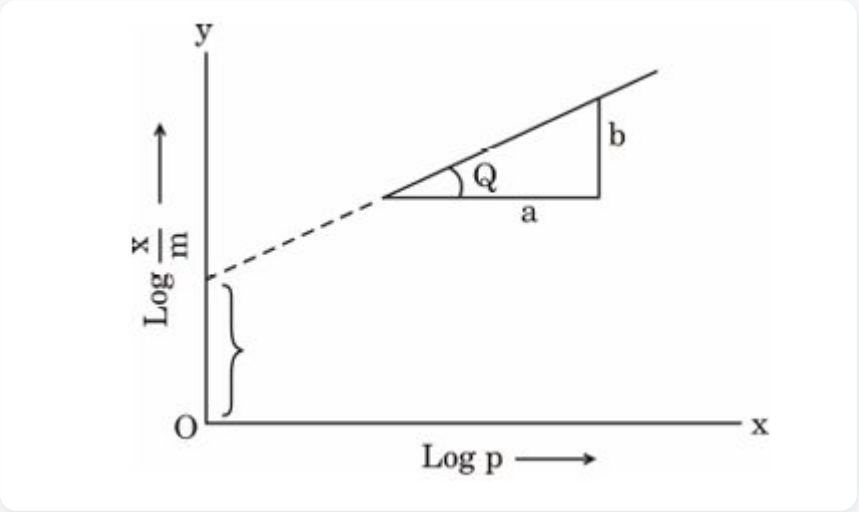
A compound 'A' (C_2H_4O) on oxidation gives 'B' ($C_2H_4O_2$). 'A' undergoes Iodoform reaction to give yellow precipitate and reacts with HCN to form the compound 'C'. 'C' on hydrolysis gives 2-hydroxypropanoic acid. Identify the compounds 'A', 'B' and 'C'. Write down equations for the reactions involved.

[3 Marks]

Question 11.

Observe the given figure and answer the following questions :(i) (a) Write the expression for adsorption of gases on solids in the form of an equation. (ii)What is the slope of the graph ? (iii)What does the intercept of the line represent ?

[3 Marks]



Question 12.

Write equations involved in the following reactions :

(i) Ethanamine reacts with acetyl chloride.(1)

(ii) Aniline reacts with bromine water at room temperature.(1)

(iii) Aniline reacts with chloroform and ethanolic potassium hydroxide.(1)

[3 Marks]

Question 13.

(i)Write the IUPAC name for the following organic compound :

$(CH_3CH_2)_2NCH_3$ (1)

(ii) Write the equations for the following : (1)

(I) Gabriel phthalimide synthesis (II) Hoffmann bromamide degradation. (1)

[3 Marks]

Question 14.

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

$Cr|Cr^{3+}$ (0·1 M)$||Fe^{2+}$ (0·01 M)$|Fe$

Given : E^{Θ} Cr^{3+} /Cr =- 0·75 V E^{Θ} Fe^{2+} / Fe =- 0·45 V (log 10 = 1)

[3 Marks]

Question 15.

(a) (i) Silver atom has completely filled d-orbitals in its ground state, it is still considered to be a transition element. Justify the statement. (1)

(ii) Why areE^{Θ} M^{2+}/ M values of Mn and Zn more negative than expected ? (1)

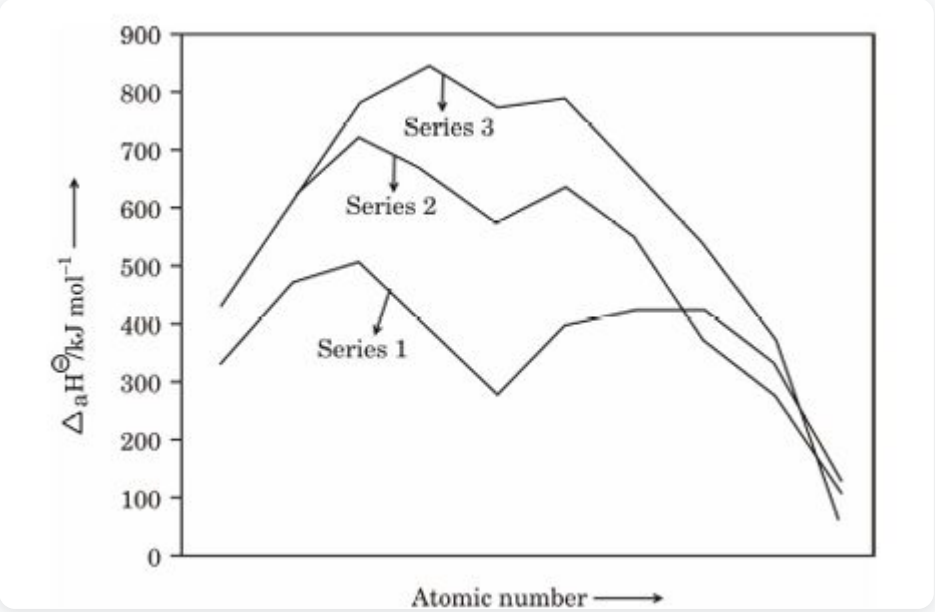
(iii) Why do transition metals form alloys ?

[3 Marks]

Question 16.

Answer the following questions on the basis of the figure given below :(i) Which element in 3d series has lowest enthalpy of atomisation ?(ii) Why do metals of the second and third series have greater enthalpies of atomisation ? (iii) Why are enthalpies of atomisation of transition metals quite high ?

[3 Marks]



Question 17.

Arrange the following compounds in the increasing order of their property indicated :

(i) Acetaldehyde, Benzaldehyde, Acetophenone, Acetone (Reactivity towards HCN).(1)

(ii) $(CH_3)_2CHCOOH$, $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$ (Acidic strength)

(iii) CH_3CH_2OH, CH_3CHO, CH_3COOH (Boiling point)

[3 Marks]