First Preliminary Exam - 2022 Time : 3.00 Hrs.

Std. : XII (Sci.) Sub. : Chemistry Marks : 70

Note :

(1) All questions are compulsory.
(2) Draw neat labelled diagrams and balanced chemical equations wherever necessary.
(3) Question paper consists of 31 questions divided into FOUR sections, namely A, B, C and D.
(4) Start each section on new page.
(5) Figures to the right indicate full marks.
(6) Use log table, if necessary. Use of calculator is not allowed.

Given : $R = 8.314\ JK^{-1}mol^{-1}$

Atomic weights : H = 1, C = 12, N = 14, O = 16, Cl = 35

Section - A

Q.1 Select and write the correct answer. **(10)**

(i) n-type semiconductor is formed when trace amount of impurity is added to silicon. The number of electrons in the impurity atom must be ..... .

(a) 1 (b) 2 (c) 3 (d) 5

(ii) The boiling point of solution containing 2.62 g of substance A in 100 g of water is higher by 0.0512°C than the boiling point of pure water. The molar mass of substance is ..... .

(a) 131 g mol^{-1} (b) 262 g mol^{-1}
(c) 26.2 g mol^{-1} (d) 2620 g mol^{-1}

(iii) Which of the following solution will have pH value equal to 1.0 ?

(a) 50 ml of 0.1 M HCl + 50 ml of 0.1 M NaOH
(b) 60 ml of 0.1 M HCl + 40 ml of 0.1 M NaOH
(c) 20 ml of 0.1 M HCl + 80 ml of 0.1 M NaOH
(d) 75 ml of 0.2 M HCl + 25 ml of 0.1 M NaOH

(iv) The SI unit of molar conductivity is ..... .

(a) S cm^2 mol^{-1} (b) S dm^2 mol^{-1}
(c) S m^2 (d) S m^2 mol^{-1}

(v) The elementary reaction $O_3 + O_2 \rightarrow 2O_2$ is .....
(a) unimolecular and second order
(b) bimolecular and second order
(c) bimolecular and first order
(d) unimolecular and first order

(vi) The hybridization of sulphur in SO_2 is ..... .
(a) sp (b) sp^2 (c) sp^3 (d) dsp^2

(vii) When an excess of $AgNO_3$ is added to the complex, one of AgCl is precipitated. The formula of the complex is ..... .
(a) $[CoCl_2(NH_3)]Cl$ (b) $[CoCl(NH_3)_4]Cl_2$
(c) $[CoCl_3(NH_3)_4]$ (d) $[Co(NH_3)_4]Cl_3$

(viii) The flux added during extraction of iron from haemetite ore is ..... .
(a) silica (b) calcium carbonate
(c) sodium carbonate (d) Alumina

(ix) Select the major product formed from the reaction 2-Bromobutane and alcoholic KOH.
(a) tran $CH_3 - CH = CH - CH_3$
(b) cis $CH_3 - CH = CH - CH_3$
(c) $CH_2 = CH - CH_2 - CH_3$
(d) $CH_2 = CH - CH_3$

(x) The number of carbon atoms present in the ring of caprolactum is ..... .
(a) five (b) two (c) seven (d) six

Q.2 Answer the following. **(8)**

(i) Write the relationship between rate constant and half-life of first order and zeroth order reactions.

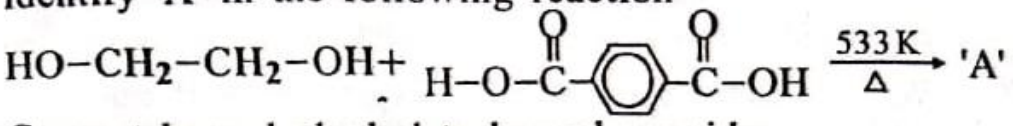
(ii) Under what conditions the cell potential is called standard cell potential ?

(iii) Complete the following :
$I_2 + 2KClO_3 \rightarrow$ ..... $+ 2KIO_3$

(iv) Why nobelium is the only actinoid with +2 oxidation state ?

(v) Is the complex $[CoF_6]$ cationic or anionic if the oxidation state of cobalt ion is +3 ?

(vi) Identify 'A' in the following reaction



(vii) Convert benzyl alcohol to benzyl cyanide.

(viii) Define electrochemical series.

Section - B

Attempt any EIGHT. (16)

Q. 3. Define freezing point. How is molar mass of a non-volatile solute related to the depression in freezing point ?

Q. 4 On the basis of Arrhenius theory, define acids and bases.

Q. 5 A free expansion of gas results into no work. Explain.

Q. 6. Why is anode in galvanic cell considered to be negative and cathode positive electrode ?

Q. 7. A conductivity cell filled with 0.02 M H_2SO_4 gives at 25°C a resistance of 122 Ohms. If the molar conductivity of 0.02 M H_2SO_4 is 618 Ω^{-1} cm^2 mol^{-1}, what is cell constant ?

Q. 8 Define order of reaction. What is molecularity of an elementary reaction ?

Q. 9. Write the reaction of SO_2 with H_2S and $FeCl_2$.

Q.10. Explain: The compounds of copper(II) are coloured but those of Zn are colourless.

Q.11. What is IUPAC name of $[Cu(H_2O)_2(NH_3)_2]Cl_2$? Write the formula of potassium trioxalatoaluminate.

Q.12 Write the postulates of Werner's theory.

Q.13. Write the names and formulae of the monomers used in the preparation of terylene.

Q.14. A carbonyl compound 'A' having molecular formula $C_9H_{10}O$ forms crystalline precipitate with sodium bisulphite and give positive iodoform test but doesn't reduce Fehling's solution. Write the structure of carbonyl compound.

Section - C

Attempt any EIGHT. (24)

Q. 15 How many tetrahedral and octahedral voids are present in a closed packed structure ? Find the coordination number in body centered cubic structure.

Q. 16 What causes depression in freezing point ? Write the units of K_f.

Q. 17 Bring about following conversions :
(a) Acetic acid into ethyl alcohol (b) Acetone into tert. butyl alcohol

Q. 18 What is dehydrogenation ? Explain it with suitable example.

Q. 19 Write oxidation state, coordination number and electronic configuration of metal atom in $[CrCl_3(Py)_3]$ complex.

Q. 20 Calculate the mass in grams of an impurity of molar mass 100 g mol^{-1} which would be required to raise the B.P. of 50 g of chloroform by 0.3 K (K_b for chloroform = 3.6 kg mol^{-1}).

Q. 21 Sodium crystallises in bcc unit cell. Calculate the approximate number of unit cell in 9.2 g of sodium (Z of Na = 23)

Q. 22 Label the conjugate acid-base pair.
$CO_3^{2\ominus} + H_2O \rightleftharpoons OH^{\ominus} + HCO_3^{\ominus}$
Derive the relation of pH + pOH = 14.

Q. 23 Calculate the maximum work when 24 g of O_2 are expanded isothermally and reversibly from a pressure of 1.6 bar to 1 bar at 298 K.

Q. 24 Explain electrolysis of molten NaCl.

Q. 25 Describe the manufacturing of H_2SO_4 by contact process.

Q. 26 What is action of following on Lanthanoids ?
(a) mineral acid (b) nitrogen (c) sulphur

Section - D

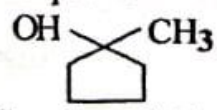
Attempt any THREE. **(12)**

Q. 27 If the coordination number of cation in an ionic acid is 4, what type of void is occupied by cation ?

Q. 28 Write any two uses of Argon. Give the graphical representation of first order reaction.

Q. 29 Write the general electronic configuration of 6d-series. How will you convert (i) Acetaldehyde into propan-2-ol (ii) Acetaldehyde into ethanol ?

Q. 30 On which ground it was inferred that glucose contains five Hydroxyl groups ? Draw the structure α–D–(–)–Fructofuranose.

Q. 31 Ridhima wants to detect structure of surface of material. Name the technique she has to use. Write the IUPAC name of 

What is esterification ? Explain.

(4) .....