CBSE Board
Class XI Chemistry

Time: 3 Hours **Marks: 70**

General Instructions

1. All questions are compulsory.
2. Question nos. 1 to 8 are very short answer type questions and carry 1 mark each.
3. Question nos. 9 to 18 are short answer type questions and carry 2 marks each.
4. Question nos. 19 to 27 are also short answer type questions and carry 3 marks each.
5. Question nos. 28 to 30 are long answer type questions and carry 5 marks each.
6. Use log tables if necessary, use of calculators is not allowed.

Q. 1 Explain why o- nitrophenol has a lower boiling point than p – nitrophenol? [1]

Q. 2 Out of CO_2 and BF_3, which one of them will have a larger bond angle and why? [1]

Q. 3 Which of the following will be a state function? [1]

(i) Distance travelled in climbing the hill

(ii) Energy change in climbing the hill

Q. 4 When sodium hydride is electrolyzed; hydrogen gas is liberated at which electrode? [1]

Q. 5 Why are alkali metals used in photoelectric cells?

Q. 6 Is the eclipsed conformation of propane has the same or different energy as the eclipsed conformation of ethane? [1]

Q. 7 Which of the two - $O_2NCH_2CH_2O^-$ or $CH_3CH_2O^-$ is expected to be more stable and why? [1]

Q. 8 Due to which compound, ozone depletion is caused in Antarctica? [1]

Q. 9 Among the elements B, Al, C and Si: [2]

(a) Which has the highest first ionization enthalpy?

(b) Which has the most negative electron gain enthalpy? Give reason.

Q. 10 Which of the following statements related to the modern periodic table is incorrect and why? [2]

(a) Each block contains a number of columns equal to the number of electrons that can occupy that sub shell.

(b) The d - block has 8 columns, because a maximum 8 electrons can occupy all the orbitals in d - sub shell.

OR

(a) Write the atomic number of the element present in the third period and seventeenth group of the periodic table.

(b) Out of the elements Cr (Z = 24), Mg (Z=12) and Fe (Z =26), identify the element with five electrons in 3d sub shell.

Q. 11 The drain cleaner contains small bits of aluminium which react with caustic soda to produce dihydrogen gas. What volume of dihydrogen at 20°C and 1

bar pressure will be released when 0.15 g of aluminium reacts. [2]

Q. 12 Critical temperature of ammonia and carbon dioxide are 405.5 K and 304.10 K respectively. Which these gases will liquefy first when you start cooling from 500K to their critical temperature [2]

Q. 13 Consider the reaction of water with F_2 and suggest, in terms of oxidation and reduction, which species are oxidized/ reduced. [2]

Q. 14 An element 'A' belongs to group 2 of the periodic table. It shows anomalous behaviour from the rest of the elements of its group. It shows a diagonal relationship with another element 'B'. Chlorides of both 'A' and 'B' have bridged structure in vapour phase. Identify A and B and draw the structures of their respective chlorides. [2]

Q. 15 A metal 'X' is present in chlorophyll. Identify the metal 'X'. How does this metal react with N_2? [2]

Q. 16 Calculate the mass percent of different elements in sodium sulphate,(Na_2SO_4 [2]

Q. 17 A compound (C_7H_{14}) on ozonolysis gives ethanal and pentan–3- one. What is the structure of alkene? [2]

Q. 18 Why does the rain water normally have a pH of about 5.6? When does it become acid rain? [2]

Q. 19 Calculate the molarity of a solution of ethanol in water in which the mole fraction of ethanol is 0.40. [3]

Q. 20 Kavita was playing a game with her friends. As a part of the game they asked her to express a wish. She said that she wanted to be able to see the atom. Atomic dimensions are from 10^{-12} m and nucleus is 10^{-15} m; visible range in the electromagnetic spectrum is for wavelengths in the range of 10^{-7}m. As a student of chemistry [3]

a. Describe how the world would look for kavita if she is granted her wish.

b. What value can you draw from this?

Q. 21 (a) The 4f sub shell of an atom contains 12 electrons. What is the maximum number of electrons having the same spin in it? [3]

(b) Explain the meaning of $4p^6$.

(c) Write the electronic configuration of the atom with atomic number

OR

(a) Calculate the total number of electrons present in one mole of methane.

(b) An atomic orbital has n = 3. What are the possible values of l and m_l ?

Q. 22 Explain the hybridisation of SF_4 ? [3]

Q. 23 (a) Write the expression for equilibrium constant for the reaction: [3]

$$H_2\ g + I_2\ s \rightleftharpoons 2HI\ g$$

(b) Calculate the pH of a buffer solution containing 0.2 mole of NH_4Cl and 0.1 mole of NH_4OH per litre. Given K_b for $NH_4OH = 1.85 \times 10^{-5}$

Q. 24 Consider the reaction: [3]

$2SO_2\ g\ + O_2\ g\ \rightleftharpoons 2SO_3\ g\ + 189.4\,kJ$. Indicate the direction in which the equilibrium with shift when:

(a) Temperature is increased

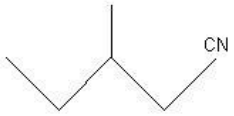
(b) Pressure is increased

(c) Concentration of SO_2 is increase

Q. 25 Balance $P + HNO_3 \longrightarrow H_3PO_4 + NO_2 + H_2O$ by oxidation number method. [3]

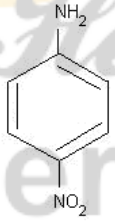
Q. 26 Write the IUPAC names of: [3]

(a)



(b)

(c)



Q. 27 (a) Arrange the following carbanions in the increasing order of their stability:-

$CH_3\ _3\bar{C}, CH_3\bar{C}H_2, \bar{C}H_3, CH_3\ _2\bar{C}H$ [3]

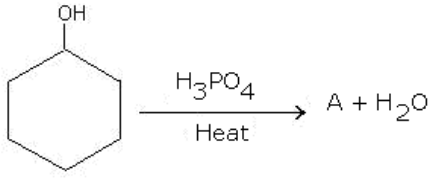
(b)What is the hybridisation of the negatively charged carbon atom in a carbanion?

Q. 28 (a) Compound 'A' with the molecular formula C_5H_8 reacts with hydrogen in the presence of Lindlar's catalyst to form a compound B with the molecular formula C_5H_{10}. A on reacting with sodium in liquid ammonia forms a compound 'C' with the same molecular formula as that of B. Identify 'A', 'B' and 'C'. Give the chemical reactions involved. [5]

(b) Write the chemical reaction involved in Kolbe's electrolytic process. What are the products formed at cathode and anode?

OR

(a) Complete the reactions and identify A, B and C.



$$CH_3CH = CH_2 + HBr \longrightarrow B$$
$$\downarrow (i)\ O_3\ (ii)\ Zn/H_2O$$
$$C \quad + \quad HCHO$$

$$CaC_2 + H_2O \rightarrow Ca(OH)_2 + E$$

Q. 29 For the reaction $NH_4Cl(s) \longrightarrow NH_3(g) + HCl(g)$ at 25°C, enthalpy change $\Delta H = +177\ kJ\ mol^{-1}$ and entropy change $\Delta S = +285\ JK^{-1}\ mol^{-1}$. Calculate free energy change ΔG at 25°C and predict whether the reaction is spontaneous or not. [5]

OR

Calculate the enthalpy of formation of benzene, using the following data-

$$C_6H_6\ (l) + \frac{15}{2} O_2(g) \longrightarrow 6\ CO_2(g) + 3H_2O(l) \quad \Delta_C H^\theta = -3266.0\ kJ$$

$$C(s) + O_2(g) \longrightarrow CO_2(g) \quad \Delta_f H^\theta = -393.1\ kJ$$

$$H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(l) \quad \Delta_f H^\theta = -286.0\ kJ$$

Q. 30 Explain giving reasons for the following: [5]

a. Boron does not form B^{3+} ions.
b. Molten aluminium bromide is a poor conductor of electricity.
c. BCl_3 is more stable than $TlCl_3$.
d. B-Cl bond has a dipole moment but BCl_3 has zero dipole moment.
e. Al is used to make transmission cables.

OR

Explain the following reactions:

a. Silicon is heated with methyl chloride at high temperature in the presence of copper powder
b. CO is heated with ZnO
c. Reaction of boron trifluoride with $LiAlH_4$ in diethyl ether
d. Reaction of boron trifluoride with sodium hydride at 450 K
e. Reaction of diborane and water