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SESSION ENDING EXAM (2024-25)

CLASS: XI **SUBJECT: CHEMISTRY**

M.M.: 70 **Time: 3.00 Hrs.**

General Instructions:

Read the following instructions carefully.

(a) There are 33 questions in this question paper with internal choice.
(b) SECTION A consists of 16 multiple choice questions carrying 1 mark each.
(c) SECTION B consists of 5 short answer questions carrying 2 marks each.
(d) SECTION C consists of 7 short answer questions carrying 3 marks each.
(e) SECTION D consists of 2 case-based questions carrying 4 marks each.
(f) SECTION E consists of 3 long answer questions carrying 5 marks each.
(g) All questions are compulsory.
(h) Use of log tables and calculators is not allowed.

SECTION A

The following questions are multiple-choice questions with one correct answer. Each question carries 1 mark. There is no internal choice in this section.

1. One mole of oxygen gas at STP is equal to_____. 1
   (a) 6. 022 x 10^{22} molecules of oxygen
   (b) 6.022 x 10^{23} atoms of oxygen
   (c) 16 g of oxygen .
   (d) 32 g of oxygen atom

2. The magnetic quantum number (m) for p-orbitals can have the values: 1
   (a) 0 (b) -1, 0, +1
   (c) -2, -1, 0, +1, +2 (d) -3, -2, -1, 0, +1, +2, +3

3. Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons? 1
   (a)Pauli's exclusion principle (b) Heisenberg's uncertainty principle.
   (c) Hund's rule of maximum multiplicity (d) Aufbau principle

4. In which of the following pair, the ions are iso-electronic? 1
   (a) Na^+, Mg^{2+} (b) Al^{3+}, O^-
   (c) N^{3-}, Cl^- (d) Ca^{2+}, N^{3-}

5. The correct order of first ionization potential among following elements - Be, B, C, N and O is 1
   (a) B < Be < C < O < N (b) B < Be < C < N < O
   (c) Be < B < C < N < O (d) Be < B < C < O < N

6. Which of the following molecules can form intermolecular hydrogen bonds? 1
   (a) CH_4 (b) HCl (c) NH_3 (d) C_2H_2

7. The enthalpies of all elements in their standard states are: 1
   (a) Unity (b) zero (c) < 0 (d) different for each element

8. For a process to occur under adiabatic conditions, the correct condition is:-
(a) $\Delta T = 0$ (b) $\Delta p = 0$ (c) $q=0$ (d)$w =0$ 1

9. Which salt, when dissolved in water, will produce a basic solution? 1
(a) KCl (b) $NaNO_3$ (c) Na_2CO_3 (d) NH_4Cl

10. The strongest conjugate base out of the following species is: 1
(a) NO_3^- (b) Cl^- (c) SO_4^{2-} (d) CH_3COO^-

11. What is the oxidation state of Cr in CrO_4^{2-} ? 1
(a) +5 (b) + 6 (c) +7 (d) +4

12. Which of the following is NOT a method of purification of organic compounds? 1
a) Sublimation b) Chromatography
c) Distillation d) Electrolysis

Assertion and Reason Type Questions

In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct option out of the choices given below for each question.

(a) A & R both are correct statement and R is the correct explanation of A.
(b) A & R both are correct statement but R is not the correct explanation of A.
(c) A is correct statement but R is wrong statement.
(d) **A is wrong statement but R is correct statement**.

13. **Assertion (A):** Molarity of a solution is independent of temperature.
Reason (R): Number of moles of solute present per liter of solution is called molarity of solution. 1

14. **Assertion (A):** Electron gain enthalpy becomes less negative as we go down a group. 1
Reason (R): Size of the atom increases on going down the group and the added electron would be farther from the nucleus**.**

15. **Assertion (A):** The ionic bond in sodium chloride (NaCl) is formed due to the attraction between Na^+ and Cl^- ions. 1
Reason (R): Ionic bonds are formed when atoms with high electronegativity lose electrons, and atoms with low electronegativity gain electrons, resulting in the formation of oppositely charged ions.

16. **Assertion (A):** In a redox reaction, one substance is oxidized while another is reduced. 1
Reason (R): Oxidation involves the gain of electrons, whereas reduction involves the loss of electrons.

SECTION -B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type and carry 2 marks each.

17. How much mass of sodium acetate, CH_3COONa is required to make 500 mL of 0.375 molar aqueous solution. Molar mass of sodium acetate is 82.0245 g mol^{-1}. 2

18. Calculate the energy of a photon emitted during a transition from n = 5 state to the n = 2 state in the hydrogen atom? 2

19. What are Buffer solutions? Give an example each of an acidic and a basic buffer. 2

OR

The pK_a of acetic acid is 4.76 and pK_b of NH_4OH is 4.75. Calculate the pH of ammonium acetate solution

20. Balance the following redox reaction by ion electron method:- 2

$MnO_4^- + I^- \rightarrow MnO_2 + I_2$ (Basic medium)

21. An alkene 'A' on ozonolysis gives a mixture of ethanal and pentan-3-one. Write the structure and IUPAC name of A**.** 2

SECTION -C

This section contains 7 questions with internal choice in one question. The following questions are short answer type and carry 3 marks each.

22. An organic compound containing carbon, hydrogen and oxygen gave the percentage composition as C = 40.687% H = 5.085% and O=54.228%. The vapour density of the compound is 59. What will be its empirical and molecular formulae. 3

23. Among the elements of the second period Li to Ne. Pick out the element: 3

(a) with the highest first ionisation enthalpy.
(b) with the highest electronegativity
(c) with the largest atomic radius Give reasons for your choice.

24. (a) State Hess's law of constant heat summation. 1

Ca (b) Calculate the standard enthalpy of formation of CH_3OH (l) from the following data :- 2

(i) (i) CH_3OH (l) + $3/2O_2$ (g) $\rightarrow CO_2(g) + 2H_2O(l)$; $\Delta_f H = -726kJ/mol$

(ii) C (graphite) + O_2 (g) $\rightarrow CO_2(g)$; $\Delta_c H = -393kJ/mol$

(iii) $H_2(g) + \frac{1}{2} O_2$ (g) $\rightarrow H_2O(l)$; $\Delta_f H = -286kJ/mol$

OR

For the reaction :- 2A (g) + B (g) $\rightarrow$ 2D (g) ,

$\Delta U^0 = -10.5$ kJ and $\Delta S^0 = -44.1 JK^{-1}$ at 298K. Calculate ΔG^0 for the reaction and predict whether the reaction may occur spontaneously.($R=8.314 \times 10^{-3}$ kJ/K/mol.)

3

25. What will be the conjugate bases for the following Bronsted acids: 3

HF , H_2SO_4 , HCO_3^- , HCl , HNO_3, $HClO_4$

26. (a) Suggest a method to purify:- 1

(i) Camphor containing traces of common salt.
(ii) liquid which decomposes at its boiling point.

(b) (b) In sulphur estimation, 0.157 g of an organic compound gave 0.4813 g of barium sulphate. What is the percentage of sulphur in the compound? 2

27. (a) What type of isomerism is exhibited by the following pairs of isomers: 1

i) Propan-1-ol and Propan-2-ol
ii) Propanone and Propanal

(b) Using curved-arrow notation, show the formation of reactive intermediates when the covalent bond undergoes heterolytic cleavage in CH_3–CN. 1

(c) Explain why $(CH_3)_3C^+$ is more stable than $CH_3CH_2^+$ and CH_3^+ is the least stable cation. 1

28. (a) Draw cis- trans isomers of but-2-ene 1

(b) Explain the following with the help of chemical equations:-
(i) Wurtz reaction (ii) Friedel Crafts alkylation reaction 2

SECTION -D

The following questions are case-based questions. Each question carries 4 marks. Read the passage and answer the questions that follow.

29. Thermodynamics involve energy changes in chemical reactions and other processes. Internal energy is total energy stored in a substance. We can specify absolute value of volume but not the absolute value of internal energy. We can measure only change in internal energy ($\triangle U$). Work done on the system is taken as positive and work done by the system is taken as negative. Heat (q) absorbed by the system is +ve and heat given out by system is negative. $\triangle U = q + w$ according to first law of thermodynamics. $\triangle H$ (enthalpy change) is measured at constant pressure, $\triangle U$ is measured at constant volume. $\triangle H$, $\triangle S$ (entropy change), $\triangle G$ (free energy change) and temperature help to decide spontaneity of the process. 1

(a) For the reaction H_2 (g) → 2H (g), what will be the signs of ΔH and ΔS?

(b) State the correct thermodynamic conditions in terms of ΔH and ΔS for a reaction to be spontaneous at all temperatures. 1

(c) In a process, 701J of heat is absorbed by a system and 394J of work is done by the system . What is the change in internal energy for the process? 2

OR

(c) What will be free energy change for a reaction having:
ΔH= 31400 J, ΔS=32 JK^{-1} mol^{-1} at 1000°C ?

30. The tetra valence of carbon and the formation of covalent bonds by it are explained in terms of its electronic configuration and its state of hybridization. A systematic name of an organic compound is generally derived by identifying the parent hydrocarbon and the functional group attached to it. Various elements present in organic compounds are detected by Lassaigne's test, during which the covalent compounds are converted into ionic compounds by fusion with metallic sodium which are then detected by their usual tests. Various methods used for purification of organic compounds are based on the nature of the compound and the impurity present in it.

(a) What is the state of hybridization of each carbon in CH_3CN? 1

(b)Write the IUPAC name of CH_3─ CH─ CH═ CH─ CHO 1

CH_3

(c) i)bClassify the following molecules/ions as electrophile or nucleophile:
HS^-, BF_3 2

(ii) What is the principle involved in adsorption chromatography?

OR

(c) Define Inductive effect & Electrometric effect

SECTION -E

This section contains 3 questions with internal choice in the entire three questions. The following questions are long answer type and carry 5 marks each.

31. (a)Explain: - (i) Pauli's exclusion principle (ii) Hund's rule of maximum multiplicity 2

(b) A golf ball has a mass of 40 g and a speed of 45 m/s. If the speed can be measured within accuracy of 2%, calculate the uncertainty in its position Given h= 6.626×10^{-34}Js 3

OR

(a) Using s, p, d, f notation describe the orbital with the following quantum numbers:- 1

(i) n=4, l=2 (ii) n=5, l =3

(b)Write the electronic configurations of the following species: - 2

(i) Cu (ii) Cr

(c) What will be the wavelength of a ball of mass 0.1 kg moving with a velocity of 10 m/s ? 2

h= 6.626×10^{-34}Js

32. (a)Using molecular orbital theory, write the electronic configuration of the following species and calculate their bond orders. 3

(i). O_2^+ (ii). O_2^- (iii) O_2^{2-}

(b) Give reasons why the dipole moment of NH_3 is greater than that of NF_3 ? 2

OR

(a) What is hybridisation of atomic orbitals? 1

(b) Mention any two differences between a sigma bond and a pi bond 2

(c) Describe sp^3 hybridisation with the help of an example. 2

33. (a) Complete the reactions: 3

(i) $CH_3\text{-}CH_2\text{-}CH{=}CH_2 + HBr \rightarrow$

(ii) $C_6H_5OH + Zn \xrightarrow{Heat} \square \rightarrow$

(iii) $CH_3\text{-}CH_2\text{-}Cl \xrightarrow[\Delta]{alc.KOH} \rightarrow$

2

b) What are conformations? Represent the conformations of ethane by Sawhorse projections

OR

(a) Complete the reactions: 2

(i) $CH_3\text{-}CH_2\text{-}OH \xrightarrow[\Delta]{conc.H_2SO_4} \rightarrow$

(ii) $CH_3 - CH = CH_2 + HBr \xrightarrow[\Delta]{Benzoyl\ peroxide} \rightarrow$

3

(b) How will you convert :

(i) Benzene to Nitrobenzene
(ii) n- Hexane to Benzene
(iii) Benzene to Acetophenone