

KENDRIYA VIDYALAYA SANGATHAN, LUCKNOW REGION
SESSION ENDING EXAMINATION (2023-24)
CLASS-XI

SUBJECT- CHEMISTRY (043)

MM: 70

Time: 3 Hours

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 very short answer questions carrying 2 mark each.
- d) Section C consists of 7 short answer questions carrying 3 marks each.
- e) Section D consists of 2 case study 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 calculators is not permitted.

SECTION A

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

1. What are the number of oxygen molecules in 0.5 mol of CaCO_3 ? 1
(A) $1.0 \times 6.022 \times 10^{23}$ (B) $1.5 \times 6.022 \times 10^{23}$
(C) $0.5 \times 6.022 \times 10^{23}$ (D) $3.0 \times 6.022 \times 10^{23}$
2. Which of the following group of species are isoelectronic? 1
(A) O^{2-} , F^- , Na , Mg^{2+} (B) O^- , F^- , Na^+ , Mg^+
(C) O^{2-} , F^- , Na^+ , Mg^{2+} (D) O^{2-} , F^- , Na , Mg^{2+}
3. Energy of an electron is given by $E_n =$ 1
(A) $-2.18 \times 10^{-18} \text{ J } [Z^2 / n^2]$ (B) $-2.18 \times 10^{-14} \text{ J } [Z^2 / n^2]$
(C) $2.18 \times 10^{-18} \text{ J } [Z / n^2]$ (D) $-2.18 \times 10^{-18} \text{ J } [Z^2 / n]$
4. The statement that is not correct for periodic classification of element is : 1
(A) The properties of elements are periodic function of their atomic numbers.
(B) Nonmetallic elements are less in number than metallic elements.
(C) For transition elements, the 3d- orbitals are filled with electrons after 3p- orbitals and before 4s- orbitals.
(D) The first ionization enthalpies of elements generally increase with increase in atomic number as we go along a period.
5. Which of the following statements are correct? 1
(A) Helium has the highest first ionization enthalpy in the periodic tables.
(B) Chlorine has less negative electron gain enthalpy than fluorine.
(C) Mercury and bromine are gases at room temperature.
(D) In any period, atomic radius of alkali metal is the highest.
6. The strongest conjugate base is: 1
(A) Cl^- (B) Br^- (C) I^- (D) F^-
7. Which one of the following pairs of solutions not an acidic buffer ? 1
(A) $\text{H}_2\text{CO}_3 + \text{Na}_2\text{CO}_3$ (B) $\text{H}_3\text{PO}_4 + \text{Na}_3\text{PO}_4$

- (C) $\text{HClO}_4 + \text{NaClO}_4$ (D) $\text{CH}_3\text{COOH} + \text{CH}_3\text{COONa}$
- 8 Identify the correct statement in relation to the following reaction : 1
 $\text{Zn} + 2\text{HCl} \longrightarrow \text{ZnCl}_2 + \text{H}_2$
- (A) Zinc is acting as an oxidant (B) Chlorine is acting as a reductant
 (C) Hydrogen is acting as an reductant (D) Zinc is acting as a reductant
- 9 Acetone (CH_3COCH_3) and Propanal ($\text{CH}_3\text{CH}_2\text{CHO}$) are 1
 (A) Position isomers (B) Functional group isomers
 (C) Geometrical isomers (D) Optical isomers
- 10 A mixture of o-nitrophenol and p-nitrophenol can be separated by 1
 (A) Sublimation (B) Steam distillation
 (C) Fractional crystallization (D) Simple distillation
- 11 Number of bonds in benzene is 1
 (A) 6 -sigma and 3- pi bonds (B) 12- sigma and 3-pi bonds
 (C) 3-sigma and 12- pi bonds (D) 6- sigma and 6- pi bonds
- 12 Heating a mixture of sodium acetate and soda-lime gives 1
 (A) Benzene (B) Methane (C) Ethane (D) Ethyne
- From Q.N. 13 to16, a statement of Assertion (A) is given followed by a corresponding statement of reason (R) just below it. Of the statements, mark the correct answer as :**
- (A) Both A and R are true and R is correct explanation of A.
 (B) Both A and R are true but R is not the correct explanation of A.
 (C) A is true but R is false.
 (D) A is false but R is true.
- 13 Assertion : All isotopes of a given element show the same type of chemical behavior. 1
 Reason : The chemical properties of an element are controlled by the number of electrons in the atom.
- 14 Assertion : The number of radial nodes in 3s and 4p orbitals is not equal. 1
 Reason : The number of radial nodes in any orbital depends upon the value of 'n' and 'l'.
- 15 Assertion : Electron gain enthalpy of elements become less negative as we go down a group. 1
 Reason : Size of the atom increases on going down the group and the added electron would be farther from the nucleus
- 16 Assertion : Lassaigne's extract is boiled with dil. HNO_3 before testing for halogens by AgNO_3 . 1
 Reason : CN^- and S^{2-} ions present in the extract interfere with the test of halide ions by AgNO_3 .

SECTION - B

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

17. Chlorine is prepared in the laboratory by treating manganese dioxide (MnO_2) with 2
 aqueous hydrochloric acid according to the reaction:
 $4\text{HCl} + \text{MnO}_2 (\text{S}) \longrightarrow 2\text{H}_2\text{O} (\text{l}) + \text{MnCl}_2 (\text{aq}) + \text{Cl}_2 (\text{g})$

How many grams of HCl react with 5.0 g of manganese dioxide ?

Atomic mass of Mn = 55 u.

18. Yellow light emitted from a sodium lamp has a wavelength(λ) of 580 nm. Calculate the frequency(ν) and the wave number ($\bar{\nu}$) of the yellow light. 2
19. Describe hybridisation in case of PCl_5 . Why are the axial bond longer as compared to the equatorial bond ? 2

OR

What is meant by the term bond order? Calculate the bond order of O_2^+ .

20. For the reaction, $2 \text{A(g)} + \text{B(g)} \longrightarrow 2 \text{D(g)}$, $\Delta U^0 = -10.5 \text{KJ}$ and $\Delta S^0 = -44.10 \text{JK}^{-1}$. Calculate ΔG^0 for the reaction and predict whether the reaction may occur spontaneously. 2
21. What are electrophiles and nucleophiles ? Explain with examples. 2

SECTION C

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

- 22 (a) State Pauli's exclusion principle. 1 3
(b) Write all the four quantum numbers of the last electron of chlorine. 1
(c) Write electronic configuration of Cr (24). 1

- 23 Explain why ? 3

- (a) Electron gain enthalpy of fluorine is less negative than that of chlorine.
(b) First ionization enthalpy of nitrogen is greater than that of oxygen.
(c) Write IUPAC name and symbol of element having atomic number 118.

Calculate the standard enthalpy of formation of $\text{CH}_3\text{OH(l)}$ from the following data : 3

- (i) $\text{CH}_3\text{OH(l)} + 3/2 \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)} + 2\text{H}_2\text{O(l)}$; $\Delta_r H^0 = -726 \text{KJmol}^{-1}$
24 (ii) $\text{C(s)} + \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)}$; $\Delta_c H^0 = -393 \text{KJmol}^{-1}$
(iii) $\text{H}_2\text{(g)} + 1/2 \text{O}_2\text{(g)} \longrightarrow \text{H}_2\text{O(l)}$; $\Delta_f H^0 = -286 \text{KJmol}^{-1}$

OR

State Hess's Law of constant heat summation. 1

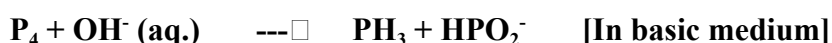
Using Hess's Law, Calculate the enthalpy of formation of carbon monoxide(CO) from the following data: 2

- (i) $\text{C(s)} + \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)}$; $\Delta_r H^0 = -393.5 \text{kJ mol}^{-1}$
(ii) $\text{CO(g)} + 1/2 \text{O}_2\text{(g)} \longrightarrow \text{CO}_2\text{(g)}$; $\Delta_r H^0 = -283.0 \text{kJ mol}^{-1}$

- 25 Permanganate (VII) ion, in basic solution oxidises iodide ion I^- to produce molecular iodine (I_2) and manganese (IV) oxide MnO_2 . Write a balanced ionic equation to represent this redox reaction.

OR

Balance the following equation by ion electron method



- 26 (a) Define Inductive effect. 3
(b) Why tertiary carbocation is more stable than primary and secondary carbocation?
(c) Write the name and structures of geometrical isomers of 2-Butene.
- 27 (a) Write IUPAC of the following compound: 1 3
(i) $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{CHO}$ (ii) $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)\text{CH}_2\text{OH}$

- b) On complete combustion, 0.246 g of an organic compound gave 0.198 g of carbon dioxide and 0.1014 g of water. Determine the percentage composition of carbon and hydrogen in the compound. 2
- 28 (a) An alkene "A" on ozonolysis gives a mixture of ethanal and pentan-3-one. Write the structure of 'A'. 1 3
- b) Complete the following reaction: 2
- (i) $\text{CH}_3\text{CH}_2\text{-Br} + \text{Na} \xrightarrow{\text{Dry Ether}}$
- (ii) $\text{CH}_3\text{-CH}_2\text{Cl} \xrightarrow{\text{alc. KOH, heat}}$

Section D

The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage carefully and answer the questions that follow.

- 29 Read the text carefully and answer the questions : 1+2+1

A system in thermodynamics refers to that part of universe in which observations are made and remaining universe constitutes the surroundings. The wall that separates the system from the surroundings is called boundary.

The State of the System must be described in order to make any useful calculations by specifying quantitatively each of the properties such as its pressure (p), volume (V), and temperature (T) as well as the composition of the system. In thermodynamics, the state of a system is introduced. The state of a thermodynamic system is described by its measurable or macroscopic (bulk) properties. We can describe the state of a gas by quoting its pressure (p), volume (V), temperature (T), amount (n) etc. Variables like p, V, T are called state variables or state functions because their values depend only on the state of the system and not on how it is reached.

By conventions of IUPAC in chemical thermodynamics. The q is positive, when heat is transferred from the surroundings to the system and the internal energy of the system increases and q is negative when heat is transferred from system to the surroundings resulting in decrease of the internal energy of the system.

Let us consider the general case in which a change of state is brought about both by doing work and by transfer of heat. We write change in internal energy for this case as: $\Delta U = q + w$. The equation i.e., $\Delta U = q + w$ is mathematical statement of the first law of thermodynamics, which states that the energy of an isolated system is constant. It is commonly stated as the law of conservation of energy.

- Q.1. State first law of thermodynamics and write its mathematical form. 1
- Q.2. What are extensive and intensive properties? Explain with examples. 2
- Q.3. What are state functions? Give examples. 1

- 30 Read the text carefully and answer the questions : 4

After having some idea about the terms atoms and molecules, One atomic mass unit is defined as a mass exactly equal to one-twelfth of the mass of one carbon – 12 atom. Molecular mass is the sum of atomic masses of the elements present in a molecule. The mole, symbol mol, is the SI unit of amount of substance. One mole contains exactly 6.022×10^{23} elementary entities. This number is the fixed numerical value of the Avogadro constant, N_A , when expressed in the unit mol^{-1} and is called the Avogadro number. The mass of a carbon-12 atom was determined by a mass spectrometer and found to be equal to 1.992648×10^{-23} g. Knowing that one mole of carbon weighs 12 g, the number of atoms

in it is equal to $12\text{g/mol C-12} / 1.992648 \times 10^{23} \text{ g} / \text{C-12 atom} = 6.0221367 \times 10^{23} \text{ atoms/mol}$.

The mass of one mole of a substance in grams is called its molar mass. The molar mass in grams is numerically equal to atomic molecular/formula mass in u.

An empirical formula represents the simplest whole number ratio of various atoms present in a compound, whereas, the molecular formula shows the exact number of different types of atoms present in a molecule of a compound. Many a time, reactions are carried out with the amounts of reactants that are different than the amounts as required by a balanced chemical reaction.

1) One atomic mass unit (amu) is defined as a mass exactly equal to one-twelfth of the mass of oneatom.

- (a) Hydrogen -1 (b) Carbon -12
(c) Oxygen -12 (d) Chlorine -35

2) The mass of one mole of a substance in grams is called its.

- (a) Atomic mass (b) Molecular Weight
(c) Molecular mass (d) molar mass.

3) The empirical formula of ethanoic acid is

- (a) CHO (b) C_2HO_2
(c) CH_2O (d) CH_2O_2

4) Two mole contains exactly ...elementary entities.

- (a) $6.02214076 \times 10^{21}$ (b) $6.02214076 \times 10^{22}$
(c) 12.044×10^{23} (d) 0.2214076×10^{24}

SECTION E

The following questions are long answer questions. All questions have an internal choice and carry 5 marks each.

- 31 (a) State Le-Chatelier's principle. 1+2+
(b) Describe the effect of : 2
(i) Addition of H_2 (ii) Addition of CH_3OH
(iii) Removal of CO (iv) Removal of CH_3OH

On the equilibrium of the reaction : $2\text{H}_2(\text{g}) + \text{CO}(\text{g}) \rightleftharpoons \text{CH}_3\text{OH}(\text{g})$

(c) Classify the following as Lewis acids and bases- (a) OH^- (b) F^- (c) BF_3 (d) NH_4^+

OR

- (a) What is meant by common ion effect ?
(b) Calculate the pH of a $1.0 \times 10^{-8} \text{ M}$ solution of HCl . (given:- $\log 1.10 = 0.0414$). 1+2+2
(c) Arrange the following in increasing order of acidic strength-
(i) HF , HCl , HBr , HI
(ii) CH_4 , NH_3 , H_2O , HF

- 32 (a) State Huckel's rule of aromaticity. What are necessary and sufficient conditions for a molecule to be aromatic? 2
- (b) Give the following reactions- 1
- (i) Friedal Craft acylation of benzene with acetyl chloride 1
- (ii) Reduction of phenol with zinc dust. 1
- (iii) Sodium acetate react with soda lime. 1
- OR**
- (a) State Markovnikov's rule. 1
- (b) Write the mechanism of addition of HBr to propene. 2
- (c) Perform the following conversion: 2
- (i) Ethyne to Ethanal
- (ii) Benzene to Nitrobenzene
- 33 Answer any five question: 5×1
- Accounts for the following:
- (i) Sigma bonds, is stronger than pi bond.
- (ii) NF_3 is pyramidal while BF_3 is triangular planar.
- (iii) O_2 is paramagnetic .
- (iv) H_2O is liquid but H_2S is gas .
- (v) P-Nitrophenol has higher boiling point than o- Nitrophenol.
- (vi) Dipole moment of BeH_2 is zero.
- (vii) Shape of H_2O is angular.