Indian School Al Wadi Al Kabir

Assessment II (2024-2025)

Class: XI | Sub: Chemistry (043) | Max. Marks: 70

Date: 01/12/2024 | Set - II | 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 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. What will be the molarity of a solution, which contains 5.85 g of NaCl(s) per 500 mL? (Na = 23 u, Cl = 35.5u)
   (a) 4 mol L^{-1}
   (b) 20 $molL^{-1}$
   (c) 0.2 $molL^{-1}$
   (d) 2 $molL^{-1}$

2. The number of atoms present in one mole of an element is equal to Avogadro number. Which of the following element contains the greatest number of atoms?
   (a) 4 g He (atomic mass = 4 u)
   (b) 46 g Na (atomic mass = 23 u)
   (c) 0.40 g Ca (atomic mass = 40 u)
   (d) 12 g He (atomic mass = 4u)

3. Two electrons in the same orbital may be identified with:
   (a) n (b) l (c) m_l (d) m_s

4 Maximum number of electrons in a subshell of an atom is determined by the following:
   (a) $2n^2$ (b) $4l + 2$ (c) $2l + 1$ (d) $4l - 2$

5. The element with the lowest ionisation potential in first group is
   (a) Na (b) K (c) Rb (d) Cs

6. H_2O has a net dipole moment, while BeF_2 has zero dipole moment, because:
   (a) H_2O molecule as linear while BeF_2 is bent.
   (b) BeF_2 molecule is linear while H_2O is bent.
   (c) Fluorine is more electronegative than oxygen.
   (d) Be is more electronegative than oxygen.

7. The elements with atomic numbers 9, 17, 35, 53, 85 are all ———-
   (a) halogens.
   (b) noble gases.
   (c) alkali earth metals.
   (d) transition metals.

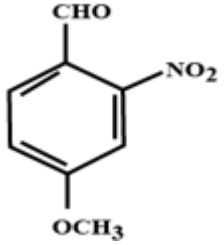
8. CCl_4 is insoluble in water because:
   (a) CCl_4 is non-polar and water is polar.
   (b) Water is non-polar and CCl_4 is polar.
   (c) Water and CCl_4 are both polar.
   (d) None of the above.

9. Which of the following is a redox reaction?
   (a) $NaCl + KNO_3 \rightarrow NaNO_3 + KCl$
   (b) $Mg(OH)_2 + 2NH_4Cl \rightarrow MgCl_2 + 2NH_4OH$
   (c) $CaC_2O_4 + 2HCl \rightarrow CaCl_2 + H_2C_2O_4$
   (d) $Zn + 2AgCN \rightarrow 2Ag + Zn(CN)_2$

10. The oxidation number of Xe in $BaXeO_6$ is
   (a) 8
   (b) 6
   (c) 4
   (d) 10

11. The displacement of electrons in a multiple bond in the presence of attacking reagent is called
   (a) Inductive effect.
   (b) Electrometric effect.
   (c) Resonance effect.
   (d) Hyper conjugation effect.

12. What is the correct IUPAC name of the following compound?



   (a) 4-Methoxy-2-nitrobenzaldehyde
   (b) 4-Formyl-3-nitroanisole
   (c) 4-Methoxy-6-nitrobenzaldehyde
   (d) 2-Formyl-5-methoxy nitrobenzene

13. **Assertion (A)**: The empirical mass of ethene is half of its molecular mass.
   Reason (R): The empirical formula represents the simplest whole-number ratio of various atoms present in a compound.
   Select the most appropriate answer from the options given below:
   (a) Both A and R are true and R is the 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.

14. **Assertion(A)**: Scandium is a transition element.
Reason(R): In the ground state, there is an unpaired electron in the 3d subshell of Sc.
Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the 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.

15. **Assertion(A)**: The resultant dipole moment of NH_3 is greater than that of NF_3.
Reason(R): Fluorine is more electronegative than Nitrogen.
Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the 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

16. **Assertion (A)**: Propan-1-ol and Propan-2-ol are functional group isomers.
Reason (R): Functional group isomers have same molecular formula but different functional groups.
Select the most appropriate answer from the options given below:
(a) Both A and R are true and R is the 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

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. (a) Arrange s, p and d sub-shells of a shell in the increasing order of effective nuclear charge (Z_{eff}) experienced by the electron present in them.
(b) Show the distribution of electrons in oxygen atom (atomic number 8) using orbital diagram.

OR

(a) Give the electronic configuration of Ni^{2+} ion. (Atomic number of Ni = 28u)
(b) Calculate the total number of angular nodes and radial nodes present in 3p orbital.

18. Predict the shapes of the following molecules based on hybridisation.
(a) BCl_3 (b) CH_4 (c) CO_2 (d) NH_3

19. (a) Assign oxidation numbers to the underlined element in the compound
$NaH_2\underline{P}O_4$
(b) Predict if the reaction between the following is feasible:
$Fe^{3+}_{(aq)}$ and $I^-_{(aq)}$ $E^o_{(Fe^{3+}/Fe^{2+})} = 0.771V$
$E^o_{(I_2/I^-)} = 0.54\ V$

20. Identify the substance oxidised, reduced, oxidising agent and reducing agent in the following reaction:
$2AgBr_{(s)} + C_6H_6O_{2(aq)} \rightarrow 2Ag_{(s)} + 2HBr_{(aq)} + C_6H_4O_{2(aq)}$

21. Draw bond line formulae for:
(a) 2,3-Dimethylbutanal.
(b) Heptan-4-one.

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. If two elements can combine to form more than one compound, the masses of one element that combine with a fixed mass of the other element, are in whole-number ratio.
(a)Which law is stated here?

(b) Give one example related to this law.
(c) Hydrogen gas is prepared in the laboratory by reacting dilute HCl with granulated zinc. Following reaction takes place.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

Calculate the volume of hydrogen gas liberated at STP when 32.65 g of zinc reacts with HCl.
(1 mol of a gas occupies 22.7 L volume at STP; atomic mass of Zn = 65.3 u.)

23. (a) A cricket ball of mass 100 g is thrown by a bowler at a speed of 10 m/s. Calculate the de Broglie wavelength of the ball. ($h=6.626 \times 10^{-34}$ Js)
(b) Table-tennis ball has a mass 10 g and uncertainty in velocity is 3.6m/s. What will be the uncertainty in speed? ($h=6.626 \times 10^{-34}$ Js)

24. (a) How would you explain the fact that first ionisation enthalpy of sodium is lower than that of magnesium but its second ionisation enthalpy is higher than that of magnesium?
(b) Explain the following:
(i) Electronegativity of elements increases on moving from left to right in the periodic table.
(ii) Ionisation enthalpy decrease in a group from top to bottom.

OR

(a) How does the metallic and non-metallic character vary on moving from left to right in a period?
(b) The radius of Na^+ cation is less than that of Na atom. Give reason.
(c) What are isoelectronic species? Give examples.

25. (a) Draw the resonating structures of Ozone molecule.
(b) Compare the relative stability of N_2 and N_2^+ using Molecular orbital theory.

26. (a) Balance the following equation.

$$Cr_2O_7^{2-}{}_{(aq)} + SO_{2(g)} \rightarrow Cr^{3+}{}_{(aq)} + SO_4^{2-}{}_{(aq)} \text{ (in acidic solution)}$$

(b) What is disproportionation reaction?

27. (a) Draw the resonance structures for C_6H_5OH. Show the electron shift using curved-arrow notation.

(b) What is an electrophile? Give one example.

28. (a) Identify the type of structural isomerism shown in the below given compounds.

(b) Expand the following bond-line formula to show all the atoms including carbon and hydrogen.

(c) Give the structure of 2,2-Dimethylpentane.

SECTION D

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

29. Many a time, the reactions are carried out with the amount of the reactants that are different than the amount of reactants as required by the balanced reaction. In such situations, one reactant is in more amount than the amount required by balanced chemical reaction. The reactant which is in least amount gets consumed after some time and after that further reaction does not take place whatever be the amount of the other reactant. In a given reaction,23 g of Sodium is mixed with 35.5 g of Chlorine to produce Sodium chloride (Na=23u, Cl=35.5u)

$2Na + Cl_2 \longrightarrow 2NaCl$

(a) Identify the limiting reagent.

(b) Calculate the mass of NaCl produced in this reaction.

(c) Calculate the mass of the excess reactant remained in the end of the reaction.

OR

(c) How many moles of NaCl would be present in 100 mL of 0.02M NaCl solution?

30. In the periodic table, electronegativity increases from left to right in a period and decreases from top to bottom in a group. The non-metallic character of an element is directly related to the electronegativity while the metallic character is inversely related to it.

(a) Arrange the elements N, P, O and S in the order of increasing non-metallic character. Give the reason for the arrangement assigned.

(b) The element with maximum electronegativity belongs to

(i) Period-1, Group 18
(ii) Period -2, Group 17
(iii) Period -3, Group 17
(iv) Period-2, Group-1

(c) Which of the following groups contain metals, nonmetals as well as metalloids?

(v) Group -1
(vi) Group-17
(vii) Group-14
(viii) Group -2

OR

(c) The least metallic element of group-13 is
(i) Aluminium
(ii) Gallium
(iii) Boron
(iv) Indium

SECTION E

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

31. (a) Write any two limitations of Bohr's model of an atom.
(b) Calculate the wavelength of a photon emitted during a transition from n=4 to n=1 state in H atom. (h= 6.626×10^{-34} Js, c = 3×10^{8} m/s)

OR

(a) Write the expression for Bohr frequency rule and explain the terms.
(b) Write the electronic configuration of Cu. (Atomic number 29)
(c) Calculate the momentum of a moving particle which has a de Broglie wavelength of 6626×10^{-12} m. (h= 6.626×10^{-34} Js)

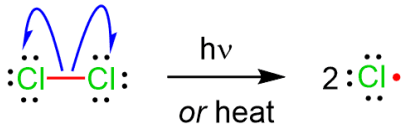
32. (a) Explain the geometry of (i) CH_4 and (ii) SF_6 using VSEPR theory.
(b) What is hybridization?

(c) What shapes are associated with the following hybrid orbitals?
(i) sp^2 (ii) sp^3d (iii) sp (iv) sp^3d^2

OR

(a) Using hybridisation, explain the shape and bond angle of (i) H_2O and (ii) PCl_5.
(b) Give two differences between σ and Π bond.
(c) Give the Lewis dot structure of CO.

33. (a) What is the difference between distillation and distillation under reduced pressure?
(b) Which bond is more polar CH_3-H or CH_3-Cl. Why?
(c) Which method can be used to separate a mixture of water and aniline?
(d) Identify the below given reaction as homolysis or heterolysis and also identify the reactive intermediate produced as free radical or carbocation or carbanion.



(e) What is the type of hybridisation of C atoms in benzene?

OR

(a) Select nucleophiles from the following.

BF_3, NH_3, OH^-, H_3O^+, CN^-.

(b) Arrange the following in increasing order of C – C bond strength:
C_2H_6, C_2H_4, C_2H_2
(c) What are carbanions? How are they formed?
(d) Name the effect that explains the stability of carbocations.
(e) Write the structural formulae of (i) But-2-ene (ii) Propane-1,2,3-triol