FIRST TERM EXAM-2024-25
Class – XI
Subject – CHEMISTRY

Time: 3 Hours   Max. Marks: 70

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 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. Which of the following statements about a compound is incorrect?

(a) One gram atoms of carbon contains Avogadro's number of atoms.

(b) One mole of oxygen gas contains Avogadro's number of molecules.

(c) One mole of electrons stands for 6.02×10^{23} electrons.

(d) One mole of hydrogen gas contains Avogadro's number of atoms.

2. Number of atoms in 0.1 mole of ozone (O_3) gas is

(a) 6.02×10^{22}

(b) 1.80×10^{23}

(c) 3.60×10^{23}

(d) 1.80×10^{22}

3. When 22.4L of H_2 (g) is mixed with 11.2L of Cl_2 (g), each at STP, number of moles of HCl(g) formed is equal to

(a) 1 mole of HCl (g)

(b) 2 moles of HCl (g)

(c) 0.5 mole of HCl (g)

(d) 1.5 moles of HCl (g)

4. Identify the incorrect statement from the following

(a) All the five 5d orbitals are different in size as compared to respective 4d orbitals.

(b) All the five 4d orbitals have shapes similar to respective 3d orbitals.

(c) In an atom, all the five 3d orbitals have same energy in free state.

(d) The shapes of d_{xy}, d_{yz}, d_{xz} are similar and dx^2-y^2 and dz^2 are similar.

5. Radius of hydrogen atom in ground state is 0.53Å. Radius of Li^{2+} ion (Z=3) in a similar state is

(a) 0.17Å

(b) 0.53Å

(c) 0.265Å

(d) 1.06Å

6. Which of the following is not a permissible arrangement of electrons in an atom?

(a) $n = 4$, $l = 0$, $m_l = 0$, $m_s = -1/2$

(b) $n = 5$, $l = 3$, $m_l = 0$, $m_s = +1/2$

(c) $n = 3$, $l = 2$, $m_l = -3$, $m_s = -1/2$

(d) $n = 3$, $l = 2$, $m_l = -2$, $m_s = -1/2$

7. For how many orbital/(s) are following quantum numbers possible $n=3$, $l=2$ and $m_l = +2$?

(a) 1

(b) 2

(c) 3

(d) 4

8. An atom with electronic configuration $1s^2 2s^2 2p^6 3s^2 3p^6 3d^3 4s^2$ will be place in ----

(a) Fifth group, fourth period

(b) Fifth period, fourth group

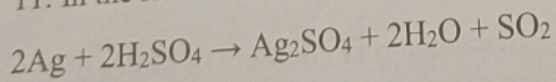(c) Second period, fourth group

(d) Fourth period, second group.

9. In BF_3, hybridization and number of electrons around the central atom, respectively are

(a) sp^3 and 4

(b) sp^3 and 6

(c) sp^2 and 6

(d) sp^2 and 8

10. Which of the following diatomic molecular species has only π-bonds according to molecular orbital theory?

(a) N_2

(b) C_2

(c) Be_2

(d) O_2

11. In the reaction:

$$2Ag + 2H_2SO_4 \rightarrow Ag_2SO_4 + 2H_2O + SO_2$$

Sulphuric acid acts as:

(a) Oxidising agent

(b) Reducing agent

(c) Catalyst

(d) Acid as well as oxidant

12. Which of the following can not disproportionate?

(a) $HClO_4$

(b) $HClO_2$

(c) $HClO$

(d) $HClO_3$

13. **Assertion:** Lesser the lattice enthalpy, more stable is the ionic compound.
Reason: Lattice enthalpy is greater for ions with higher charge and smaller radii.

(a) Both Assertion & Reason are true and reason is the correct explanation of the assertion.

(b) Both Assertion & Reason are true but reason is not the correct explanation of the assertion.

(c) Assertion is a true statement but Reason is false.

(d) Assertion is false but Reason is true.

14. **Assertion:** In NH_3, N is sp^3 hybridised, but bond angle is found to be 107°.
Reason: Decrease in bond angle is due to repulsion between the lone pairs.

(a) Both Assertion & Reason are true and reason is the correct explanation of the assertion.

(b) Both Assertion & Reason are true but reason is not the correct explanation of the assertion.

(c) Assertion is a true statement but Reason is false.

(d) Assertion is false but Reason is true.

15. **Assertion:** Alkali metals have the least value of ionization enthalpy within a period.
Reason: They precede alkaline earth metals in periodic table.

(a) Both Assertion & Reason are true and reason is the correct explanation of the assertion.

(b) Both Assertion & Reason are true but reason is not the correct explanation of the assertion.

(c) Assertion is a true statement but Reason is false.

(d) Assertion is false but Reason is true.

16. **Assertion:** Process of electron gain by an isolated gaseous atom can be exothermic or endothermic.

Reason: Electron gain enthalpy provides a measure of the ease with which an atom adds an electron to form anion.

(a) Both Assertion & Reason are true and reason is the correct explanation of the assertion.

(b) Both Assertion & Reason are true but reason is not the correct explanation of the assertion.

(c) Assertion is a true statement but Reason is false.

(d) Assertion is false but Reason 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. Balance the given equation in a stepwise manner (any method)
$Cr_2O_7^{2-} + SO_3^{2-} \rightarrow Cr^{3+} + SO_4^{2-}$ (acidic medium)

18. Give reason for the following :   (1x2)

(a) Ethanol is soluble in water.

(b) Benzene is less reactive inspite of presence of three double bonds.

19.
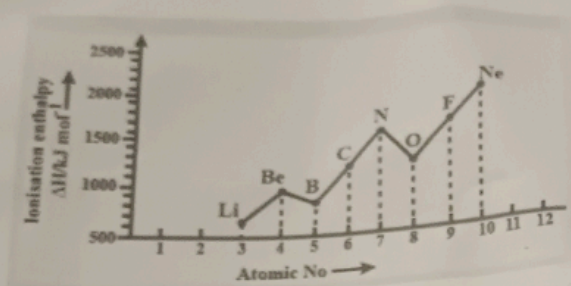
Observe the graph and explain the following: (1x2)

(a) Δ_iH of Be is more than that of B.

(b) Noble gases have very high value of Δ_iH in their respective period.

20. If velocity of the electron in Bohr's first orbit is 2.19×10^6 ms^{-1}, calculate the wavelength associated with it. (h = 6.626×10^{-34} Js , mass of electron = 9.1×10^{-31} kg)

21. Calculate mole fraction of the solute in a 1.0 molal aqueous solution.

OR

Calculate the mass of sodium acetate (CH_3COONa) required to make 500mL of 0.375M aqueous solution. (Molar mass of sodium acetate is 82.0 g mol^{-1}).

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. (a) Identify oxidizing and reducing agent in the following redox reaction.   (1x3)

$$2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$$
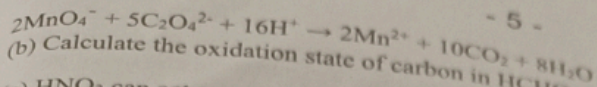
(b) Calculate the oxidation state of carbon in HCHO.

(c) HNO₂ can act as oxidizing and reducing agent both while HNO_3 is only an oxidizing agent. Why?

23. (a) Calculate the formal charge on 'N' in NO_3^-. (1x3)

(b) Axial bonds in PCl₅ are longer than equatorial bonds. Why?

(c) Which of the two is stronger and why? Sigma bond or pi bond

24. (a) Use molecular orbital theory to explain why Be₂ molecule does not exist? (2)

(b) Draw the shape of σ1s. (1)

25. (a) Write electronic configuration, predict the block, group and period of the element with Z=24. (2)

(b) Write general electronic configuration of p-block elements. (1)

26. (a) Chlorophyll contains 2.68% magnesium by mass. Calculate the number of magnesium atoms in 2.0 g chlorophyll. (atomic mass of Mg = 24g/mol) (2)

(b) In a binary solution, mole fraction of one of the components is 'x'. What is the mole fraction of other component? (1)

OR

An organic compound contains 57.8% C, 3.6% H and rest is oxygen. Its molar mass is 166g/mol. What is its molecular formula? (3)

27. State Heisenberg's uncertainty principle. Calculate the uncertainty in position of a dust particle with mass of 1mg if uncertainty in its velocity is $5.5 \times 10^{-20} ms^{-1}$. (h=6.626x10⁻³⁴ Js)

28. (a) How many orbitals are associated with $l = 3$? (1x3)
(b) How many electrons will be present in n = 4 with m_s value of −1/2?
(c) How many unpaired electrons are there in Mn^{2+} (Z = 25)?

SECTION D

The following questions are case based questions. Each question has an internal choice and carries 4 (1+1+2) marks each.

29. Read the passage given below and answer the following questions:
There are many types of electromagnetic radiations, which differ from one another in wavelength (or frequency). These constitute what is called electromagnetic spectrum. Different regions of the spectrum are identified by different names. Some examples are: radio frequency region around 10^6 Hz, used for broadcasting; microwave region around 10^{10} Hz used for radar. Planck assumed that radiation could be sub-divided into discrete chunks of

energy. He suggested that atoms and molecules could emit or absorb energy only in discrete quantities and not in a continuous manner. He gave the name quantum to the smallest quantity of energy that can be emitted or absorbed in the form of electromagnetic radiation.

(1)

(a) Give mathematical relationship between energy and wavelength.

(1)

(b) What are electromagnetic radiations? Mention a property of these.

(c) What is the number of photons of light with a wavelength of 4000 pm that provide 1J of energy? $(c = 3 \times 10^8 \text{ m/s})$ (2)

OR

(c) Calculate the wavelength and frequency of a light wave whose period is 2.0×10^{-10} s. (2)

30. Read the passage given below and answer the following questions:

Electron gain enthalpy of an element is the energy change when a neutral isolated gaseous atom accepts an extra electron. We can denote it by $\Delta_{eg}H$. Greater the amount of energy released in the above process, higher is the electron gain enthalpy of the element. It is measured in electron volts per atom or kJ per mole.

The tendency of an atom in a molecule to attract the shared pair of electrons towards itself is known as electronegativity. It is a dimensionless property because it is only a tendency. It basically indicates the net result of tendencies of atoms in different elements to attract the bond forming electron pairs.

(a) Which of the two has higher $\Delta_{eg}H$ and why? F or Cl (1) .

(b) Identify the most and the least electronegative element in third period of modern periodic table. (1)

(c) Predict the sign of $\Delta_{eg}H$ of noble gases. Give reason for your answer. (2)

OR

(c) How does $\Delta_{eg}H$ generally vary on moving across a period? Give reason for your answer.

SECTION E

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

31. Attempt any five of the following: (1x5)
(a) How many electrons in Zn (Z=30) have (sum of principal and angular quantum number) i.e. $(n+l) = 4$?
(b) State Pauli's exclusion principle.
(c) How many electrons in an atom may have the following quantum numbers? $n = 3, l = 0$
(d) How many angular nodes are there in 3s?
(e) Which of the two has higher energy 5s or 4p?
(f) Name the series in hydrogen spectrum which falls in UV region.
(g) Give one point of difference between emission and absorption spectrum.

32. (a) Define (i) molarity   (ii) molality.   (1)

(b) Which of the two (above) is preferred to express concentration of a solution and why?

(c) A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen gas produces 3.38 g carbon dioxide, 0.690 g of water and no other products. (2) Calculate the percentage of carbon and hydrogen in the compound.

OR

(a) Will molality of a solution be affected by temperature? Give reason for your answer. (2)

(b) A solution is labelled 35% (w/w). What is the mass of solute and solvent in solution? (3)

(c) 10L of a gaseous fuel weigh 11.6g at (STP). Calculate molar mass of the fuel. (1)

33. (a) Which of the two has higher bond angle and why? NH_3 or NH_4^+ (1)

(b) NCl_5 does not exist while PCl_5 exists. Explain on the basis of hybridization. (2)

(c) Draw and name the shape of following molecules:

(i) XeF_4 (ii) SO_2 (1)

(d) How many sigma and pi bonds are there in benzene?

OR

(a) Give an example of a compound which contains ionic, covalent and coordinate bonds.

(b) Predict the hybridization of central atom in (i) XeF_2 (ii) BrF_5

(c) Give one point of difference between bonding and antibonding molecular orbital.

(d) Give an example of a compound with intramolecular H-bonding. Show this with the help of structure.

(e) Which of the two is more covalent and why? NaBr or NaI