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XI-D

# TAGORE INTERNATIONAL SCHOOL
## VASANT VIHAR, NEW DELHI
### MID -TERM EXAMINATION (2024-25)
### CHEMISTRY
### CLASS: XI

अहम्,
सोम्य:
अस्मि

Date: 20.09.24
No. of Pages: 08

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.

## 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.

Q1    The correct order of electronegativity of Na, O and F is

a) $Na > O > F$

b) $O > F > Na$

c) $O > Na > F$

d) $F > O > Na$ (1 mark)

Q2    If the electronic configuration of an element is $1s^2\, 2s^2\, 2p^6\, 3s^2\, 3p^6\, 3d^2\, 4s^2$, the four electrons involved in chemical bond formation will be

a) $3p^6$

b) $3p^6, 4s^2$

c) $3p^6, 3d^2$

d) $3d^2, 4s^2$ (1 mark)

Q3      Usings s,p,d, and f notation, choose the orbital with n=4, l=3 quantum numbers

    a) 4p
    b) 4d
    c) 3d                                  (1 mark)
    d) 4f

Q4      Which of the following is responsible to rule out the existence of definite paths or trajectories of electrons?

    a) Pauli's exclusion principle.
    b) Heisenberg's uncertainty principle.
    c) Hund's rule of maximum multiplicity.          (1 mark)
    d) Aufbau principle.

Q5      Which of the following statements indicates that a law of multiple proportions is being followed.

    a) Sample of carbon dioxide taken from any source will always have carbon and oxygen in the ratio 1:2
    b) Carbon forms two oxides namely $CO_2$ and CO, where masses of oxygen which combine with fixed mass of carbon are in the simple ratio 2:1.
    c) When magnesium burns in oxygen, the amount of magnesium taken for the reaction is equal to the amount of magnesium in magnesium oxide formed.
    d) At constant temperature and pressure 200 mL of hydrogen will combine with 100 mL oxygen to produce 200 mL of water vapour         (1 mark)

Q6      $2H_2O_2 \rightarrow 2H_2O + O_2$  The following reaction is a

    a ) Combination reaction
    b) Decomposition reactions
    c) Disproportionation reactions            (1 mark)
    d) Displacement reactions

Q7      In the conversion of $Br_2$ to $Br^{3}$ , the oxidation number of Br changes from:

    a) zero to +5
    b) +1 to +5
    c) +2 to +5                            (1 mark)
    d) 0 to - 3

**Q8** The oxidation state of P in $NaH_2PO_4$ is

a) +5
b) +3
c) -2
d) -5

(1 mark)

**Q9** The oxidation number of an element in a compound is evaluated on the basis of certain rules. Which of the following rules is not correct in this respect?

a) The oxidation number of hydrogen is always +1.
b) The algebraic sum of all the oxidation numbers in a compound is zero.
c) An element in the free or the uncombined state bears oxidation number zero.
d) The oxidation number of fluorine is usually − 1.

(1 mark)

**Q10** Using the standard electrode potential, find out the pair between which redox reaction is not feasible.

$E°$ values : $Fe^{3+}/Fe^{2+} = + 0.77$; $\quad I_2/I^- = + 0.54$;

$Cu^{2+}/Cu = + 0.34$; $\qquad Ag^+/Ag = + 0.80$ V

a) $Fe^{3+}$ and $I^-$
b) $Ag^+$ and $Cu$
c) $Fe^{3+}$ and $Cu$
d) $Ag$ and $Fe^{3+}$

(1 mark)

**Q11** Assertion (A): De - Broglie equation has significance for any microscopic or sub - microscopic particles.
Reason (R): De - Broglie wavelength is inversely proportional to the mass of the object.
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.

(1 mark)

**Q12** Assertion (A): Matter waves consist of oscillating electric and magnetic fields.
Reason (R): Matter waves require medium for propagation.

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.

(1 mark)

Q13 Identify which is not a redox reaction

a) $CuO + H_2 \rightarrow Cu + H_2O$
b) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
c) $2K + F_2 \rightarrow 2KF$ (1 mark)
d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

Q14 The number of atoms present in one mole of an element is equal to Avogadro number. Which of the following elements contains the greatest number of atoms?

a) 4g He
b) 46g Na
c) 0.40g Ca (1 mark)
d) 12g He

Q15 In the emission spectrum of hydrogen atom, the Balmer series falls in the

a) Ultraviolet region
b) X - ray region
c) Infra - red region (1 mark)
d) Visible region

Q16 Successive filling of 3s and 3p orbitals give rise to the third period. The number of elements present in this period are
a) 4
b) 2
c) 6 (1 mark)
d) 8

## SECTION B

This section contains 5 questions with an internal choice in one question.

Q17 Express the following in the scientific notation with 2 significant figures-
a) 0.088   b) 35,000 (2marks)

Q18 The outer electronic configuration of some elements are:
a) $3s^2 3p^4$   b) $3d^{10}4s^2$
To which block of elements in the periodic table each of these belong? (2marks)

OR

Among the elements of the second period Li to Ne pick out the element with the highest first ionisation energy .Give the reason for your choice. (2marks)

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Q19 Define wavelength. A hypothetical electromagnetic wave is shown in the figure. Find out the wavelength of the radiation. (2marks)



Q20 Give a reason for the following.
a) Halogens act as a good oxidising agent.
b) Electron gain enthalpy of noble gas is almost zero. (2marks)

Q21 a) Define isoelectronic species.
b) The radius of Na+ cation is less than that of Na atom. Give a reason. (2 marks)

## SECTION C

This section contains 7 questions with an internal choice in one question.

Q22 A compound contains 4.07 % hydrogen, 24.27 % carbon and 71.65 % chlorine. Its molar mass is 98.96 g. What are its empirical and molecular formulas?
(atomic masses C= 12u. O = 16u, Cl = 35.5 u ) (3 marks)

Q23 a) What is the basic difference between the terms electron gain enthalpy and electronegativity?
b) Which of the following element , F or Cl would have a more negative electron gain enthalpy and why? (3 marks)

Q24 a) List two conditions for the formation of ionic compounds .
b) Show the formation of a Sodium Chloride molecule using electron dot structures/ Lewis structures. (3 marks)

Q25 a) Define wave number.
b) Calculate the uncertainty in the velocity of a wagon of mass 3000 kg whose position is known to an accuracy of ±10 pm. **Planck's constant = $6.63 \times 10^{-34}$ Js** (3 marks)

Q26 a) Which of the following orbitals are possible :1p, 2s, 2p and 3f.?

b) Among the following pairs of orbitals, which orbital will experience more effective nuclear charge         (i) 2s and 3s                    (ii) 3d and 3p ? (3 marks)
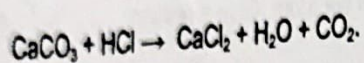
**Q27** Consider the following reaction:

$$NH_4NO_3 + Na_3PO_4 \rightarrow (NH_4)_3PO_4 + NaNO_3$$
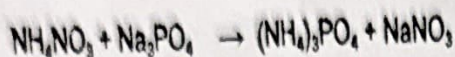
(Given Molar mass: $NH_4NO_3 = 80.0$ g/mol , $Na_3PO_4 = 164.0$ g/mol, $NaNO_3 = 85.0$ g/mol, $(NH_4)_3PO_4 = 149.0$ g/mol )

Which reactant is limiting, assuming we started with 30.0 grams of ammonium nitrate and 50.0 grams of sodium phosphate. What is the mass of $NaNO_3$ that can be formed? What mass of the excess reactant is left over? (3 marks)

OR

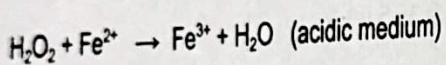Calcium carbonate reacts with aqueous HCl according to the equation:

$$CaCO_3 + HCl \rightarrow CaCl_2 + H_2O + CO_2.$$

What mass of calcium chloride will be formed when 250ml of 0.76 M HCl reacts with 1000 g of $CaCO_3$? Name the limiting reagent and calculate the number of moles of $CaCl_2$ formed?

(At. Mass Ca= 40 , O=16 ,Cl = 35.5) (3 marks)

**Q28** Balance the following redox reaction by ion electron method:

$$H_2O_2 + Fe^{2+} \rightarrow Fe^{3+} + H_2O \text{ (acidic medium)}$$ (3 marks)

## SECTION D

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

**Q29** Redox reactions are an important class of reactions which are taking place in our daily life. Metals are good reducing agents because they can lose electrons easily whereas non-metals are good oxidising agents which can gain electrons easily. In electrolytic cells, electricity is passed to bring about a redox reaction. All rechargeable batteries act as electrolytic cells while recharging. Electrochemical cells produce electricity as a result of redox reaction. Salt bridge is used in electrochemical cells to complete internal circuits and prevents accumulation of charges.

a) What is an electrochemical cell?
b) Give one example of rechargeable cells widely used in vehicles.
c ) List two functions of salt bridge
d) For the cell $Zn/Zn^{+2} \| Cu^{+2} / Cu$
$$\hat{E}^\circ_{Zn} = -0.736V \quad \text{and} \quad E^\circ_{Cu} = 0.35V$$
Calculate the cell EMF (4 marks)

**Q30**  Read the text carefully and answer the questions:

A qualitative measure of the ability of an atom in a chemical compound to attract shared electrons to itself is called electronegativity. Unlike ionization enthalpy and electron gain enthalpy, it is not a measurable quantity. However, a number of numerical scales of electronegativity of elements viz., Pauling scale, Mulliken - Jaffe scale, Allred - Rochow scale have been developed. In 1922 assigned arbitrarily a value of 4.0 to fluorine, the elements considered to have the greatest ability to attract electrons. The electronegativity of any given element is not constant; it varies depending on the element to which it is bound. Therefore, electronegativity is directly related to the non - metallic properties of elements. It can be further extended to say that electronegativity is inversely related to the metallic properties of elements. Thus, the increase in electronegativities across a period is accompanied by an increase in non - metallic properties (or decrease in metallic properties) of elements.

a) Electronegativity of elements increases on moving from left to right in the periodic table. Justify
b) Arrange the following in increasing order of atomic radii – K, Rb, Li, Na, Cs
c) Why does oxygen have lower ionization enthalpy than nitrogen?

**OR**

c) State two reasons to justify that the metallic character of elements increases on moving down in a group in the modern periodic table.

(4 marks)

## SECTION E

This section contains 3 questions and all questions have an internal choice.

**Q31**  (a) Identify the elements whose outermost electrons are represented by
(i) $2p^3$                       (ii) $3p^5$
(b) State (n+l) rule. Explain it with an example.
(c) Write the electronic configuration of copper (Z= 29)

(5 marks)

**OR**

In the Rydberg equation, a spectral line corresponds to $n_1 = 3$ and $n_2 = 5$
(R= 109677 $cm^{-1}$)
a) Calculate the wavelength and frequency of this spectral line.
b) To which spectral series does this line belong?
c) In what region of the electromagnetic spectrum, will this line fall?

(5 marks)

Q32   a) What is the percentage of carbon, hydrogen and oxygen in ethanol?
b) Calculate the molarity of NaOH in the solution prepared by dissolving its 4 g in
enough water to form 250 mL of the solution.   (5 marks)

OR

A solution contains 25 % water, 25 % ethanol and 50 % acetic by mass.Calculate
the mole fraction of each component.   (5 marks)

Q33   The first ($\Delta iH1$) and the second ($\Delta iH2$) ionization enthalpies (in kJ mol$^{-1}$)) of a
few elements are given below:

| Element | $\Delta i\,H1$ | $\Delta i\,H2$ | $\Delta egH$ |
|---|---|---|---|
| I | 520 | 7300 | -60 |
| II | 419 | 3051 | -48 |
| III | 1681 | 3374 | -328 |
| IV | 1008 | 1846 | -295 |
| V | 2372 | 5251 | +48 |
| VI | 738 | 1451 | -40 |

Identify the following:
a) Least reactive element.
b) A most reactive metal.
c) A most reactive nonmetal.
d) The least reactive nonmetal.
e) A metal that forms a stable binary halide of the formula $MX_2$, (X=halogen).   (5 marks)

OR

Among the electronic configuration of the following elements select an
Alkali metal, alkaline earth metal, d- block transition element, an element of p
block and a noble gas.

a) $1s^2,2s^2,2p^5$
b) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6,3\,d^5, 4s^1$
c) $1s^2, 2s^2, 2p^6, 3s^1$
d) [Ne] $3s^2, 3p^6, 4s^2$
e) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$
f) [Ne] $3s^2, 3p^6$   (5 marks)

****************************ALL THE BEST****************************

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