PREBOARD EXAMINATION – 2020-21

Class: XI (CBSE) **Total Marks: 80**

Date……. **SUBJECT - CHEMISTRY** **Time: 3 hrs.**

Read the Instructions Carefully:

1. There are 33 questions in this question paper. All questions are compulsory.
2. Section A: Q. No. 1 to 16 are objective type questions. Q. No. 1 and 2 are passage-based questions carrying 4 marks each while Q. No. 3 to 16 carry 1 mark each.
3. Section B: Q. No. 17 to 25 are short answer questions and carry 2 marks each.
4. Section C: Q. No. 26 to 30 are short answer questions and carry 3 marks each.
5. Section D: Q. No. 31 to 33 are long answer questions carrying 5 marks each.
6. There is no overall choice. However, internal choices have been provided.
7. Use of calculators and log tables is not permitted.

SECTION - A

1. **Read the passage given below and answer the following questions:** (4)

"The orbital wave function or Ψ *for an electron in an atom has no physical meaning. It is simply a mathematical function of the coordinates of the electron. However, for different orbitals the plots of corresponding wave functions as a function of r (the distance from the nucleus) are different. Fig. 2.12(a), gives such plots for 1s (n = 1, l = 0) and 2s (n = 2, l = 0) orbitals.*
According to the German physicist, Max Born, the square of the wave function (i.e., Ψ^2*) at a point gives the probability density of the electron at that point. The variation of* Ψ^2 *as a function of r for 1s and 2s orbitals is*
given in Fig. 2.12(b). Here again, you may note that the curves for 1s and 2s orbitals are different.

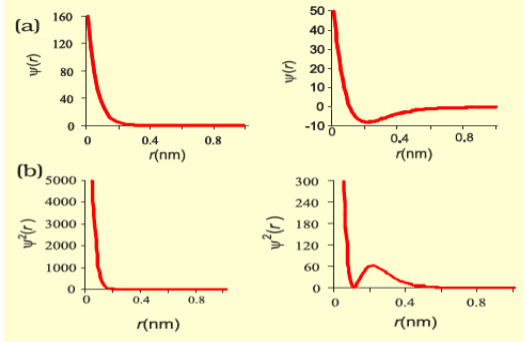


Fig. 2.12 *The plots of (a) the orbital wave function* $\psi(r)$*; (b) the variation of probability density* $\psi^2(r)$ *as a function of distance r of the electron from the nucleus for 1s and 2s orbitals.*

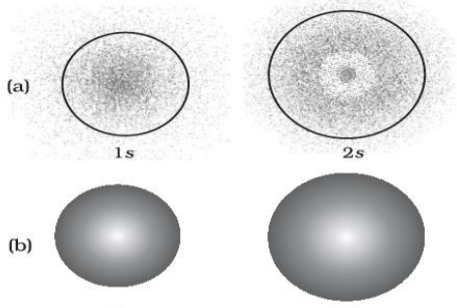


Fig. 2.13 *(a) Probability density plots of 1s and 2s atomic orbitals. The density of the dots represents the probability density of finding the electron in that region. (b) Boundary surface diagram for 1s and 2s orbitals.*

It may be noted that for 1s orbital the probability density is maximum at the nucleus and it decreases sharply as we move away from it. On the other hand, for 2s orbital the probability density first decreases sharply to zero and again starts increasing. After reaching a small maxima it decreases again and approaches zero as the value of r increases further. The region where this probability density function reduces to zero is called nodal surfaces or simply nodes. In general, it has been found that ns-orbital has (n – 1) nodes, that is, number of nodes increases with increase of principal quantum number n. In other words, number of nodes for 2s orbital is one, two for 3s and so on.
These probability density variation can be visualised in terms of charge cloud diagrams [Fig. 2.13(a)]. In these diagrams, the density of the dots in a region represents electron probability density in that region.

Boundary surface diagrams of constant probability density for different orbitals give a fairly good representation of the shapes of the orbitals. In this representation, a boundary surface or contour surface is drawn in space for an orbital on which the value of probability density $|\Psi^2|$ is constant. In principle many such boundary surfaces may be possible. However, for a given orbital, only that boundary surface diagram of constant probability density is taken to be good representation of the shape of the orbital which encloses a region or volume in which the probability of finding the electron is very high, say, 90%. The boundary surface diagram for 1s and 2s orbitals are given in Fig. 2.13(b). One may ask a question : Why do we not draw a boundary surface diagram, which bounds a region in which the probability of finding the electron is, 100 %? The answer to this question is that the probability density $|\Psi^2|$ has always some value, howsoever small it may be, at any finite distance from the nucleus. It is therefore, not possible to draw a boundary surface diagram of a rigid size in which the probability of finding the electron is 100%. Boundary surface diagram for a s orbital is actually a sphere centred on the nucleus. In two dimensions, this sphere looks like a circle. It encloses a region in which probability of finding the electron is about 90%. Thus, we see that 1s and 2s orbitals are spherical in shape. In reality all the s-orbitals are spherically symmetric, that is, the probability of finding the electron at a given distance is equal in all the directions. It is also observed that the size of the s orbital increases with increase in n, that is, 4s > 3s > 2s > 1s and the electron is located further away from the nucleus as the principal quantum number increases."*
[SOURCE NCERT]

The following questions are multiple choice questions. Choose the most appropriate answer:

(i) Ψ^2 is
(a) The square of the wave function
(b) A mathematical function
(c) 100% probability to find an electron
(d) probability density is less than zero

(ii) The region where this probability density reaches zero is called as
(a) orbital
(b) node
(c) Ψ
(d) Ψ^2

(iii) Number of nodes for 4s orbital is
(a) 4
(b) 5
(c) 3
(d) 2

(iv) Boundary surface diagram of means
(a)A region in which probability of finding electron is about 60%
(b) A region in which probability of finding electron is about 95%
(c) A region in which probability of finding electron is about 99%
(d) A region in which probability of finding electron is about 90%

OR

(iv) The wave function Ψ has
(a) only physical meaning
(b) a physical as well as chemical meaning
(c) only chemical meaning
(d) no physical meaning

2. **Read the passage given below and answer the following questions:** (4)

Periodic Trends and chemical Reactivity

We have observed the periodic trends in certain fundamental properties such as atomic and ionic radii, ionization enthalpy, electron gain enthalpy and valence. We know by now that the periodicity is related to electronic configuration. That is, all chemical and physical properties are a manifestation of the electronic

configuration of elements. We shall now try to explore relationships between these fundamental properties of elements with their chemical reactivity

The atomic and ionic radii, as we know, generally decrease in a period from left to right. As a consequence, the ionization enthalpies generally increase (with some exceptions as outlined in section 3.7.1(a)) and electron gain enthalpies become more negative across a period. In other words, the ionization enthalpy of the extreme left element in a period is the least and the electron gain enthalpy of the element on the extreme right is the highest negative (note: noble gases having completely filled shells have rather positive electron gain enthalpy values). This results into high chemical reactivity at the two extremes and the lowest in the centre. Thus, the maximum chemical reactivity at the extreme left (among alkali metals) is exhibited by the loss of an electron leading to the formation of a cation and at the extreme right (among halogens) shown by the gain of an electron forming an anion. This property can be related with the reducing and oxidizing behaviour of the elements which you will learn later. However, here it can be directly related to the metallic and non-metallic character of elements. Thus, the metallic character of an element, which is highest at the extremely left decreases and the non-metallic character increases while moving from left to right across the period. The chemical reactivity of an element can be best shown by its reactions with oxygen and halogens. Here, we shall consider the reaction of the elements with oxygen only. Elements on two extremes of a period easily combine with oxygen to form oxides. The normal oxide formed by the element on extreme left is the most basic (e.g., Na_2O), whereas that formed by the element on extreme right is the most acidic (e.g., Cl_2O_7). Oxides of elements in the centre are amphoteric (e.g., Al_2O_3, As_2O_3) or neutral (e.g., CO, NO, N_2O). Amphoteric oxides behave as acidic with bases and as basic with acids, whereas neutral oxides have no acidic or basic properties.

Among transition metals (3d series), the change in atomic radii is much smaller as compared to those of representative elements across the period. The change in atomic radii is still smaller among inner-transition metals (4f series). The ionization enthalpies are intermediate between those of s- and p-blocks. As a consequence, they are less electropositive than group 1 and 2 metals.

In a group, the increase in atomic and ionic radii with increase in atomic number generally results in a gradual decrease in ionization enthalpies and a regular decrease (with exception in some third period elements as shown in section 3.7.1(d)) in electron gainenthalpies in the case of main group elements.
Thus, the metallic character increases down the group and non-metallic character decreases. This trend can be related with their reducing and oxidizing property which you will learn later. In the case of transition elements, however, a reverse trend is observed. This can be explained in terms of atomic size and ionization enthalpy. **[SOURCE: NCERT]**

In these questions (Q. No (i) to (iv)), a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(i) **Assertion:** As_2O_3 is acidic in nature
Reason: Oxides of elements in the centre of the periodic table are amphoteric
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements. But, reason is not correct explanation for assertion.
(c) Assertion is correct statement. But, reason is wrong statement.
(d) Assertion is wrong statement. But, reason is correct statement.

(ii) **Assertion:** Chemical reactivity is maximum at the extremes and lowest in the centre of the periodic table
Reason: Extreme left is exhibited by the loss of an electron leading to the formation of cation and at the extreme right shown by the gain of an electron forming an anion.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements. But, reason is not correct explanation for assertion.
(c) Assertion is correct statement. But, reason is wrong statement.
(d) Assertion is wrong statement. But, reason is correct statement.

(iii) **Assertion:** Transition metals are less electropositive than group 1 and group 2
Reason: Ionization enthalpies are intermediate between s and p blocks.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements. But, reason is not correct explanation for assertion.
(c) Assertion is correct statement. But, reason is wrong statement.
(d) Assertion is wrong statement. But, reason is correct statement.

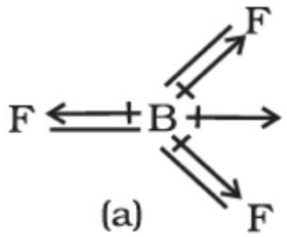
(iv) **Assertion:** Ionisation enthalpy of Extreme left is high
Reason: The metallic character of an element which is highest at the extreme left.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements. But, reason is not correct explanation for assertion.
(c) Assertion is correct statement. But, reason is wrong statement.
(d) Assertion is wrong statement. But, reason is correct statement.

OR

(v) **Assertion:** The electron gain enthalpy of the element on the extreme right is the highest negative.
Reason: Noble gases having completely filled shells haver positive electron gain enthalpy
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements. But, reason is not correct explanation for assertion.
(c) Assertion is correct statement. But, reason is wrong statement.
(d) Assertion is wrong statement. But, reason is correct statement.

3. Molarity (M) can be defined as (1)
(a) Number of moles of solute present in 1 Litre of the solvent.
(b) Number of moles of solute present in 1 Litre of the solution
(c) Number of moles of solute present in 1 Kg of solvent
(d) Number of moles of solute present in 1 Kg of Solution

4. What is the Dipole moment of BF_3 molecule? (1)



(a)

(a) 0
(b)120
(c) 90
(d)180

5. Equal volumes of all gases under the same conditions of temperature and pressure contain equal number of molecules. (1)
(a)Avogadro's Law
(b)Boyle's Law
(c)Charles' Law
(d)Gay Lussac's Law

OR

At constant volume, pressure of a fixed amount of gas varies directly with the temperature.

(a)Avogadro's Law
(b)Boyle's Law
(c)Charles' Law
(d)Gay Lussac's Law

6. "Enthalpy change which occur when one mole of an ionic compound dissociates into its ions in gaseous state" (1)
(a) Standard enthalpy of combustion
(b) Enthalpy of atomization
(c) Bond Enthalpy
(d) Lattice Enthalpy

7. Dihydrogen gas is obtained from natural gas by partial oxidation with steam as per following endothermic reaction: $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$ What will happened to the equilibrium by increasing pressure? (1)
(a)Equilibrium shift towards the left
(b)Equilibrium shift towards the right
(c)No change in equilibrium
(d)Reaches equilibrium fast

OR

Dihydrogen gas is obtained from natural gas by partial oxidation with steam as per following endothermic reaction: $CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$ What will happened to the equilibrium by increasing temperature?
(a)Equilibrium shift towards the left
(b)Equilibrium shift towards the right
(c)No change in equilibrium
(d)Reaches equilibrium fast

8. Name the catalyst used for the preparation of ammonia from Hydrogen and Nitrogen? (1)
(a)Fe
(b)Pt
(c)Pd
(d)Ni

OR

Isotopes are elements having
(a)Same atomic number and Same mass number
(b)Same atomic number but, different mass number
(c)Different atomic number and different mass number
(d)Different atomic number but, same mass number

9. Lithium showing diagonal relationship with (1)
(a) Beryllium
(b) Magnesium
(c) Sodium
(d) Hydrogen

OR

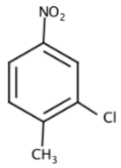
Flame colour produced by Sodium metal in flame photometry
(a) Violet
(b) Red
(c) Yellow
(d) Blue

10. Maximum oxidation state shown by P-Block elements is total valence electrons of : (1)
(a)Sum of P electrons
(b)Sum of S and P electrons
(c)Sum of S electrons
(d)Sum of S, P and D electrons

OR

First members of the P block elements differ from the rest of the group members based on the following (i) Small size (ii) Absence of d orbitals (iii) Charge (iv) Shielding effect . Choose the correct option.
(a)(i) & (ii)
(b)(i), (ii), (iii) & (iv)
(c)(ii) & (iv)
(d)(i), (ii) & (iii)

11. IUPAC Name of (1)



(a)4-Methyl-5-chloro-nitrobenzene
(b)2-Chloro-1-methyl-4-nitrobenzene
(c)4-Nitro-2-chloro-1-methylbenzene
(d)1-methyl-2-chloro-4-nitrobenzene

12. **Assertion:** Toluene on Friedal Crafts methylation gives ortho and para xylene (1)
Reason: CH_3 -group bonded to benzene ring increases electron density at ortho and para position.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements, but reason is not correct explanation for assertion
(c)Assertion is correct statement but reason is wrong statement.
(d)Assertion is wrong statement but reason is correct statement.

13. **Assertion:** Hydrogen has one electron in its orbit but it produces several spectral lines. (1)
Reason: There are many excited energy levels available.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements, but reason is not correct explanation for assertion
(c)Assertion is correct statement but reason is wrong statement.
(d)Assertion is wrong statement but reason is correct statement

14. **Assertion:** Three states of matter are the result of balance between intermolecular forces and thermal energy of the molecules. (1)
Reason: Intermolecular forces tend to keep the molecules together but thermal energy of molecules tends to keep them apart.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements, but reason is not correct explanation for assertion
(c)Assertion is correct statement but reason is wrong statement.
(d)Assertion is wrong statement but reason is correct statement

15. **Assertion:** Reaction quotient (Q_c) of a reaction at any time decides the direction in which the reaction will proceed. (1)
Reason: The value of reaction quotient(Kc) cannot be greater than the equilibrium constant.
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements, but reason is not correct explanation for assertion
(c)Assertion is correct statement but reason is wrong statement.
(d)Assertion is wrong statement but reason is correct statement

16. **Assertion:** $TlCl_3$ is more stable than TlCl (1)
Reason: +1 oxidation state of Tl is more stable than +3
(a) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(b) Assertion and reason both are correct statements, but reason is not correct explanation for assertion
(c)Assertion is correct statement but reason is wrong statement.
(d)Assertion is wrong statement but reason is correct statement

SECTION - B

17. (a) Define Photoelectric effect. (2)
(b) Calculate the energy of one photon whose frequency is 1×10^{15} Hz

18. Define electronegativity. How does it differ from electron gain enthalpy? (2)

19. (a) Define Boyle's Law (2)
(b) A balloon is filled with hydrogen at room temperature. It will burst if pressure exceeds 0.2 bar. If at 1 bar pressure the gas occupies 2.27 L volume, up to what volume can the balloon be expanded?

20. (a) Explain adiabatic system (2)
(b) Explain extensive property. Give an example.

21. (a) Define Standard enthalpy of formation. (2)
(b) Define Hess's law of constant heat summation.

OR

The standard enthalpies of formation of CO_2 (g), H_2O (l) and CH_4 (g) are -393.5 and -286.2 and -74.8 kJ $mole^{-1}$, respectively. Calculate the enthalpy of combustion of methane.

22. Explain disproportionation reaction with a suitable example (2)

23. Justify that the reaction: (2)
$2Cu_2O$ (s) + Cu_2S (s) → 6Cu (s) + SO_2 (g)
is a redox reaction. Identify the species oxidized/reduced, which acts as an oxidant and which acts as a reductant.

OR

Balancing the given Redox Reaction based on Ion electron or Half reaction method:
Reaction between nitric acid and iodide to give hydro-iodic acid and nitrogen(IV) oxide

24. Differentiate between hard and soft water. List one disadvantage of hard water (2)

OR

List some the physical properties of water

25. Show all the three-electron movement in organic reactions (2)

SECTION - C

26. (a) Write the Lewis dot structure for atom of Oxygen (3)
(b) Write one limitation of octet rule.
(c) How do you express the bond strength in terms of bond order?

27. (a) Define Equilibrium Law (3)
(b) Write the equilibrium constant (Kc) for the reaction:
$4NH_3\ (g) + 5O_2\ (g) \rightleftharpoons 4NO\ (g) + 6H_2O\ (g)$
(c) Write the equilibrium constant (K_p) for the given reaction in terms of K_c
$N_2(g) + 3H_2\ (g) \rightleftharpoons 2NH_3\ (g)$

OR

(a)Explain the term 'dynamic equilibrium'
(b) At equilibrium, the concentration of $N_2=3.0\times10^{-3}M$, $O_2=4.2\times10^{-3}M$ and $NO=2.8\times10^{-3}M$ in a sealed vessel at 800K. What will be K_c for the reaction
$N_2\ (g) + O_2\ (g) \rightleftharpoons 2NO\ (g)$

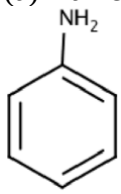
28. (a) What is the oxidation state of K in KO_2 (3)
(b) What is the colour of Na (sodium) to an oxidizing flame
(c) Give one point of difference between Lithium (Li) and other alkali metals

OR

(a) What is the oxidation state of Na in Na_2O_2
(b) What is the colour of K (potassium to an oxidizing flame.
(c) Give one point of difference between Beryllium (Be) and other alkaline earth metals.

29. (a) Boron trifluoride behave as a Lewis acid – Justify (3)
(b) Explain the term 'Inert Pair effect'
(c) "Half-life of Carbon – 14 is 5770 years" What do you understand from this?

30. (a) Name the following compound (3)



(b) In which C – C bond of $CH_3CH_2CH_2Br$ the inductive effect is expected to be the least.
(c) Explain $(CH_3)_3C^+$ is more stable than $CH_3CH_2^+$ and CH_3^+ is the least stable cation.

SECTION - D

31. (a) Calculate the molecular mass of glucose (5)
(b) Define molarity
(c) What do you mean by limiting reagent
(d) Calculate the amount of water (g) produced by the combustion of 16 g of methane

OR

(a) Calculate the molecular mass of sulphuric acid
(b) What do you mean by empirical formula
(c) Define molality

(d) The density of 3M solution of NaCl is 1.25 g mL^{-1}. Calculate the molality of the solution. [Mass of Na = 23 u ; Cl = 35.5 u]

32. (a) Draw the geometrical structure of BF_3 ; What is the name of this geometrical shape (5)
(b) Explain sp^3 hybridization with an example.
(c) What do you mean by Bond angle
(d) Calculate the bond order of O_2^+
(e) Explain Intermolecular hydrogen bond with an example.

OR

(a) Draw the geometrical structure of NH_3 ; What is the name of this geometrical shape
(b) Explain sp^3d hybridization with an example
(c) What do you mean by bond length
(d) Calculate the bond order of O_2
(e) Explain intramolecular hydrogen bond with an example.

33. (a) Write IUPAC name of the following: $(CH_3)_3C\ CH_2\ C\ (CH_3)_3$ (5)
(b) Explain Wurtz reaction
(c) Predict the product : $CH_3 – CH = CH_2 + H–Br \xrightarrow{[(C_6H_5CO)_2O_2}$
(d) What effect does branching of an alkane chain has on its boiling points?
(e) Write one method of preparation of Benzene

OR

(a) Write IUPAC name of the following: $(CH_3)_2C\ (C_2H_5)_2$
(b) Explain Friedal-Crafts alkylation reaction
(c) Predict the product : $CH_3 – CH = CH_2 + H–Br$ →
(d) What do you mean by H$\ddot{u}$ckel Rule.
(e) Why is wurtz reaction not preferred for the preparation of alkanes containing odd number of carbon atoms?

-END-