DAV BR PUBLIC SCHOOL
SESSION 2024-25
Half Yearly Examination
PRACTICE PAPER **Class:XI**
Subject: CHEMISTRY

Time Allowed: 3hrs **MM: 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

1. What volume of hydrogen gas at 273K and 1 atm pressure will be consumed in obtaining 21.6 g of elemental boron (atomic mass = 10.8) form the reduction of boron trichloride by hydrogen **1**

(a) 89.6L (b) 67.2L (c) 44.8L (d) 22.4L

2. Photoelectric effect established that light **1**

a) behaves like particles b) behaves like magnetic fields
c) behaves like waves d) behaves like rays

3. Choose the incorrect statement **1**

a)An element with high electronegativity always has high electron affinity
b)Electron gain enthalpy is the property of an isolated atom
c)Electronegativity is the property of a bonded atom
d)Both electronegativity & electron affinity are equally proportional to nuclear charge & inversely proportional to atomic size

4. Which has maximum number of atoms? **1**

(a) 24g of C (12) (b) 56g of Fe(56) (c) 27g of Al (27) (d)108g of Ag (108)

5. In element P with electron ic configuration [Ar] 4s1 will combine with an element of_____ configuration to form a highly soluble ionic solid with high melting point **1**

a) $[Ar]4s^2$ b) $[Ne]3s^2\ 3p^3$ c) $[Ne]\ 3s^2\ 3p^5$ d) $[Ar]\ 4s^2 3^2$

6. The formation of Mg^{2+} is as follows **1**

I. $Mg_{(g)} + Mg^{+}_{(g)} + e^{-} - 737\ KJ\ mol^{-1}$

II. $Mg^{+}_{(g)} + Mg^{2+}_{(g)} + e^{-} - 1450\ KJ\ mol^{-1}$

The energy required in the second steps is higher because

a) Mg^+ is more electropositive b) Mg^+ has larger size than Mg

c) Mg^+ tends to loose only one electron d) Mg^+ has smaller size than Mg

7. The atomic no. of B = atomic of A+18 , Statements A & B to **1**
a) Same pd & same gp b) Same pd but different gp
c) Different pd but same gp d) Different pd and different gp

8. The ratio of de Broglie wavelengths of a deuterium atom to that of an α - particle, when the velocity of the former is five times greater than that of later, is **1**
a) 4 b) 0.2 c) 2.5 d) 0.4

9. Which of the following molecule has not zero dipole moment? **1**

(a) NF_3 (b) BF_3 (c) CO_2 (d) BeF_2

10. Which of the following statement is irrelevant for sigma bond? **1**
(a) Strength of sigma bond is not related with overlapping of atomic orbitals.
(b) Sigma - bond can form by overlapping of S - P orbitals.
(c) Sigma - bond can form by overlapping of end of atomic orbitals of inner center axis.
(d) This type of overlapping is also known as axial overlapping.

11. In which molecule intra molecular hydrogen bond can be form? **1**
(a) o - nitro phenol (b) aniline (c) ethylene glycol (d) all of these

12. In water bond angle is 104°. 30min because **1**
(a) Oxygen atom is sp3 hybridised
(b) Repulsion between lone pair election and bonding pair electron
(c) Oxygen has high electronegetivity.
(d) H_2O molecule possesses "V" - shape.

In questions 13 to 16 Given below are two statements labelled as Assertion (A) and Reason (R) 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

13. Assertion (A) :F atom has lesser electron gain enthalpy than Cl atom **1**

Reason(R):The size of F is very small therefore electron electron repulsion is high

14. Assertion (A): 01.231 has five significant figures. **1**

Reason (R): All numbers right to the decimal point are significant.

15. Assertion (A): The bond order of helium is always zero. **1**

Reason (R): The number of electrons in bonding molecular orbital and antibonding molecular orbital is equal.

16. Assertion(A): Pure water, irrespective of its source always contain hydrogen and oxygen in the ratio 1 : 8 by mass. **1**
Reason (R): Total mass of reactants and products remains constant during physical or chemical change.

SECTION B

17. How much potassium chlorate should be heated to produce 2.24L of oxygen at NTP? **2**

18. Why are 2d and 3f orbitals not possible? **2**

OR

2×10^8 atoms of carbon are arranged side by side. Calculate the radius of carbon if the length of this arrangement is 2.4 cm.

19. Explain the non-linear shape of H_2S and non-planar shape of PCl_3 using valence shell electron pair repulsion theory. **2**

20. (i)State the hybridisation of N in NH_3 **2**

(ii) Arrange the following in deceasing order of stability O^2 , O^{2-}(superoxide), $O2^{2-}$(peroxide)

21. What is the number of photons of light with wavelength 4000 pm which provide 1 Joule of energy? **2**

22. Write the electronic configurations of the elements with atomic numbers 9, 11, 21 and 36. Stating reasons, predict the following from these configurations: **3**

Which of them has the lowest ionization enthalpy?

Which of them has the highest negative electron gain enthalpy?

Which of them has positive electron gain enthalpy?

23. 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 the whole-number ratio. **3**

Is this statement true? If yes, according to which law?

Give one example related to this law.

24. If the photon of 150pm strikes an atom and one of its inner bound electron is ejected out with a velocity of 1.5 x 107 m s^{-1} .Calculate the energy with which it is bound to the nucleus. **3**

OR

Calculate the radius ratio of 3^{rd} and 5^{th} orbit of He^+.

25. What is the difference between empirical and molecular formula? 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? **3**

26. Using molecular orbital theory, compare the relative stability and magnetic properties of O_2, O^{2+} and O^{2-} species. **3**

27. In a reaction $A+B_2 \rightarrow AB_2$, identify the limiting reagent if any, in the following reaction mixture **3**

(i) 300 atoms of A + 200 molecules of B

(ii) 2 mol of A +3mol of B

(b)Define :-Molarity (ii) Empirical formula (ii) Mole fraction

OR

Calcium carbonate reacts with aqueous HCl to give $CaCl_2$ and CO_2 according to the reaction given below:

$CaCO_3$ (s) + 2HCl (aq) → $CaCl_2$(aq) + CO_2(g) + H_2O(l)

What mass of $CaCl_2$ will be formed when 250 mL of 0.76 M HCl reacts with 1000 g of $CaCO_3$? Name the limiting reagent. Calculate the number of moles of $CaCl_2$ formed in the reaction.

28. Nitrogen has positive electron gain enthalpy whereas oxygen has negative. However, oxygen has lower ionisation enthalpy than nitrogen. Explain why? **3**

SECTION D

The following questions are case -based questions. Read the passage carefully and answer the questions that follow.

29. In a modern periodic table, elements are arranged in the order of increasing atomic numbers which is related to the electronic configuration. Depending upon the type of orbitals receiving the last electron, the elements in the periodic tale have been divided into 4 blocks viz, s, p, d and f. **4**

The modern periodic table consists of 7 periods and 18 groups. Each period begins with the filling of a new energy shell. In accordance with the Aufbau principle, the seven periods have 2, 8, 8, 18, 18, 32 and 32 elements respectively. The seventh period is still incomplete. To avoid the periodic table being too long, the two series of f-lock elements, called lanthanoids and actinoids are placed at the bottom of main body of periodic table.

(a) The electronic configuration of the element which is just above the element with atomic no. 43 in the same group and same block is_____

(i) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^2$

(ii) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3p^5\ 4s^3\ 4s^6$

(iii) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^6\ 4s^2$

(iv) $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^7\ 4s^2$

(b)The elements with atomic number 35, 53 and 85 are all_____

(i) Noble gas (ii) halogens

(iii) heavy metals (iv) light metals

(a) a-(i) b-(i) (c) a-(iii) b-(ii)

(b) a-(iii) b-(iii) (d) a-(i) b-(ii)

(c) The last element of the p-block in 6th period is represented by the outermost electronic configuration.

(i) $7s^2\ 7p^6$

(ii) $5f^{14}\ 6d^{10}\ 7s^2\ 7p^0$

(iii) $4f^{14}\ 5d^{10}\ 6s^2\ 6p^6$

(iv) $4f^{14}\ 5d^{10}\ 6s^2\ 6p^4$

(d)Define atomic radius and how does it vary on moving from left to right in a periodic table

30. Molecular orbitals are formed by the overlap of atomic orbitals. Two atomic orbitals combine to form two molecular orbitals called bonding molecular orbital (BMO) and anti bonding molecular orbital (ABMO). Energy of anti bonding orbital is raised above the parent atomic orbitals that have combined and the energy of the bonding orbital is lowered than the parent atomic orbitals. Energies of various molecular orbitals for elements hydrogen to nitrogen increase in the order : **4**

$\sigma 1s < \sigma^* 1s < \sigma 2s < \sigma^* 2s < (\pi 2px \approx \pi 2py) < \sigma 2pz < (\pi^* 2px \approx \pi^* 2py) < \sigma^* 2pz$ andfor oxygen and fluorine order of energy of molecular orbitals is given below :$\sigma 1s < \sigma^* 1$

s< σ2s <σ*2s < σ2pz < (π2px ≈ π2py) <(π*2px ≈ π*2py) < σ*2pz

Different atomic orbitals of one atom combine with those atomic orbitals of the second atom which have comparable energies and proper orientation. Further, if the overlapping is head on, the molecular orbital is called 'Sigma', (σ) and if the overlap is lateral, the molecular orbital is called 'pi', (π). The molecular orbitals are filled with electrons according to the same rules as followed for filling of atomic orbitals. However, the order for filling is not the same for all molecules or their ions. Bond order is one of the most important parameters to compare the strength of bonds.

(i) Define bond order. Write the formula of calculating bond order in molecules.

(ii) Which of the following statements is correct?

(a) In the formation of dioxygen from oxygen atoms 10 molecular orbitals will be formed.

(b) All the molecular orbitals in the dioxygen will be completely filled.

(c) Total number of bonding molecular orbitals will not be same as total number of anti-bonding orbitals in dioxygen.

(d) Number of filled bonding orbitals will be same as number of filled anti bonding orbitals.

(iii) Which of the following molecular orbitals has maximum number of nodal planes?

(a) σ*1s (b) σ*2pz (c) π2px (d) π*2py

(iv) In which of the following molecules, σ2pz molecular orbital is filled after π2px and π2py molecular orbitals?

(a) O_2 (b) Ne_2 (c) N_2 (d) F_2

31. (a)Account for the following: **5**

(i) Although ammonia and water both has distorted tetrahedral geometry bond angle in ,water has less than that of ammonia

(ii) All carbon to oxygen bond in CO_3^{2-} are equivelent.

(iii)CO_2 has zero dipole moment although C--O bond is polar.

(b)Write the molecular orbital configuration of O^{2+} .Also calculate its bond order and magnetic nature.

OR

(a) On the basis of VSEPR theory ,predict the shape of BF_3

(b) Name the molecular orbital formed by the combination of following atomic orbitals (assume Z axis be internuclear axis)

(i) $2P_X + 2P_X$

(ii) $2P_Z - 2P_Z$

(c) In the molecule of ethene (C_2H_4)

(i) How many sigma and pi bonds are present

(ii) Draw the orbital ovelap diagram of showing the double bond formation in ethene

32. (a) How many radial and angular nodes will be there in 5f orbital ? **5**

(b) The unpaired electrons in Al and Si are present in 3p orbital. Which electron will experience more effective charge from the nucleus? Give reason for your answer

(c) A tennis ball of mass 6×10^{-2} kg is moving with a speed of 62 m/ sec. Calculate the wavelength associated with this moving tennis ball. Will the

movement of this ball exhibit a wave character? Explain.

(Plank's constant h = 6.626×10^{-34} Js)

OR

(a) State Heisenberg's Uncertainty Principle. How does it contradicts the Bohr's Model of Atom?

(b) Calculate the frequency and wavelength of the radiation in nanometers emitted when an electron in the hydrogen atom jumps from third orbit to the ground state. (Rydberg constant (R) = 109, 677 cm–1)

33. (i) Consider the following species : P^{3-}, S^{2-}, Cl^{-}, K^{+} and Ca^{2+} **5**

(a) What is common in them?

(b) Arrange them in order of increasing ionic radii.

(ii) Give reason for the following:

(a) Oxygen has less negative electron gain enthalpy than sulphur.

(b) Oxygen has lower first ionization enthalpy than nitrogen and fluorine.

OR

(i)The outer electronic configuration of some elements are:

(a) $3s^2\ 3p^4$ (b) $3d^{10}4s^2$

(c) $3s^2\ 3p^6\ 4s^2$ (d) $6s^2\ 4f^3$

To which block of elements in the periodic table each of these belongs?

(ii) Explain. Explain in brief for the following:

a) Anions are bigger in size than their parent atom.

b) Atomic radius of noble gases is larger than halogens.

c) Fluorine has less negative electron gain enthalpy than chlorine

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