



INDIAN SCHOOL AL WADI AL KABIR

Second Assessment 2022-23

SUB: Chemistry (043)

Date: 29 /11/2022

Time Allowed :3 hour

Class: XI

Maximum Marks: 70

General instructions:

1. All questions are compulsory.
 2. Section A: Question nos. 1 to 14 are very short answer and Objective type questions and carry one mark each.
 3. Section B: Questions nos. 15 to 18 are assertion-reason type questions and each question carry one mark
 4. Section C: Question no. 19 and 20 consists of sub division questions based on the passage.
 6. Section D: Question nos. 21 to 27 are short answer type I questions and carry 2 marks each.
 7. Section E: Question nos. 28 to 32 are short answer type II questions and carry 3 marks each
 8. Section F: Question nos. 33 to 35 are long answer type questions and carry 5 marks each
 9. Use of log tables and calculators are not allowed.
 10. There is no overall choice in the question paper. However internal choices are given in the sections.
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Section A

Questions 1 to 14 are multiple choice questions with one correct answer: There is no internal choice in this section.

1. What will be the molarity of solution which contains 5.85 grams of sodium chloride in 500 ml of solution? (Atomic mass of Na = 23 u Atomic mass of Cl= 35.5 u) (1)
(a) 4 mol/L (b) 20 mol/L (c) 0.2 mol/L (d) 2 mol/L
2. What is the mass percentage of carbon in carbon dioxide? (1)
(a) 0.034 % (b) 27.27% (c) 3.4 % (d) 28.7 %
3. Successive ionisation enthalpies (in kJ mol⁻¹) of elements are shown below: (1)

A	590	1150	4900	6500	8150
B	520	3000	4700	6350	7900

C 630 700 950 1500 2130

D 1200 2200 3600 5000 6300

The sequence showing the first five ionisation energies of a group 2 metal is

(a) A

(b) B

(c) C

(d) D

4. Identify the incorrect statement from the following. (1)

(a) First ionization enthalpy of boron is less than that of beryllium.

(b) First ionization enthalpy of oxygen is less than that of nitrogen.

(c) First ionization enthalpy of oxygen is less than that of fluorine.

(d) First ionization enthalpy of phosphorous is less than that of Sulphur.

5. Which of the following sets of quantum numbers are not possible? (1)

(a) $n = 1, l = 0, ml = 0, ms = -1/2$

(b) $n = 5, l = 1, ml = -1, ms = +1/2$

(c) $n = 2, l = 2, ml = 0, ms = +1/2$

(d) $n = 4, l = 3, ml = -2, ms = -1/2$

6. Identify the molecule having sidewise overlapping of atomic orbitals. (1)

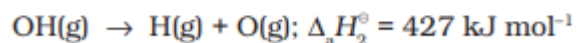
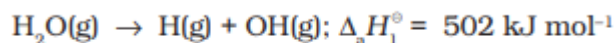
(a) CH₄

(b) CO₂

(c) NH₃

(d) H₂O

7. The difference in the O-H bond enthalpy in the following reactions is due to _____ (1)



(a) change in bond length.

(b) resonance

(c) change in bond angle

(d) changed chemical environment

- 8 Oxidation number of P in PO_4^{3-} ion is (1)
(a) -3
(b) +7
(c) +5
(d) +3
9. Which of the following is not an example of redox reaction? (1)
(a) $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$
(b) $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$
(c) $2\text{K} + \text{F}_2 \longrightarrow 2\text{KF}$
(d) $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + 2\text{HCl}$
10. The empirical formula and Molar mass of a compound are CH_2O and 180 grams respectively What (1)
will be the molecular formula of the compound?
(a) $\text{C}_9\text{H}_{18}\text{O}_9$
(b) CH_2O
(c) $\text{C}_6\text{H}_{12}\text{O}_6$
(d) $\text{C}_2\text{H}_4\text{O}_2$
11. What will be the wavelength of a ball of mass 200 g moving with a velocity of 5ms^{-1} ? (1)
a) 6.626×10^{-34} m
b) 6.626×10^{-31} m
c) 6.626×10^{-37} m
d) 6.626×10^{-33} m
12. Which of the following species will have the largest and the smallest size? (1)
 $\text{S}^{2-}, \text{Cl}^-, \text{K}^+, \text{Ca}^{2+}$
a) largest species is S^{2-} and the smallest species is Ca^{2+}
b) largest species is Cl^- and the smallest species is K^+
c) largest species is Ca^{2+} and the smallest species is S^{2-}
d) largest species is K^+ and the smallest species is Cl^-

- 13 Choose the incorrect statements (1)
- (a) The molecular orbitals are filled in accordance with the Aufbau principle obeying Pauli's Exclusion principle and the Hund's rule.
 - (b) Bonding molecular orbitals are formed by constructive interference of atomic orbitals.
 - (c) All bonding molecular orbitals are labelled as sigma.
 - (d) Bonding molecular orbitals are more stable than anti bonding molecular orbitals.
- 14 The oxidation process involves (1)
- (a) Increase in oxidation number
 - (b) Decrease in oxidation number
 - (c) No change in oxidation number
 - (d) none of the above

Section B

Questions 15 to 18 are Assertion and reason type Questions. Choose the correct option from the below given options for each Question

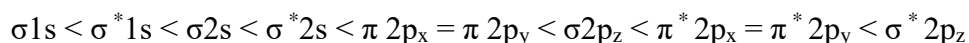
- (A) Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.**
 - (B) Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.**
 - (C) Assertion is correct, but reason is wrong statement.**
 - (D) Assertion is wrong, but reason is correct statement.**
15. Assertion: Molality is preferred over molarity (1)
Reason: Molarity of a solution changes with temperature while molality of the solution doesn't change with temperature.
16. Assertion: Ionisation enthalpy is the energy released while removing an electron from a neutral gaseous atom (1)
Reason: Energy is always absorbed when the electrons are removed.
17. Assertion: In the ground state, nitrogen atom contains 3 unpaired electrons in its 2p sub-shell. (1)
Reason: Pairing of electrons does not take place until all the orbitals are singly occupied.
18. Assertion: The oxidation state of Hydrogen in H_2O is +1 and on CaH_2 is -1 (1)
Reason: CaH_2 is a metal hydride and in metal hydride the oxidation state of Hydrogen is -1

Section C

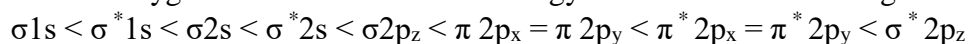
The following questions are case-based questions. Each question has an internal choice and carries 4 (1+1+2) marks each. Read the passage given below and answer the following questions.

19.

Molecular orbitals are formed by the overlap of atomic orbitals. 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:



and for oxygen and fluorine order of energy of molecular orbital is given as:



. Different atomic orbitals of one atom combine with those atomic orbitals of the second atom which have comparable energies and proper orientation. 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. Bond length varies inversely with the bond order.

The bond order is given by the equation $\text{Bond order} = \frac{1}{2} (N_b - N_a)$ where N_b is the number of electrons in the Bonding Molecular orbital and N_a is the number of electrons in the anti-bonding molecular orbitals (1)

- i. How many electrons are paired in Oxygen molecule?
ii. Which of the following pairs is expected to have the same bond order?

- a. O_2 , N_2
b. O_2^+ , N_2^-
c. O_2^- , N_2^+
d. O_2^- , N_2^-

(2)

- iii. Which of the following is nonexistent as per Molecular orbital theory?

- a. H_2^-
b. O_2^-
c. He_2
d. O_2^+

OR

Which of the following is expected to have largest bond length?

- a. O_2
b. O_2^+
c. O_2^-
d. O_2^{2-}

20. Redox reactions are 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 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 cell to complete internal circuit and prevents accumulation of charges. (1)
- (i) What is an electrochemical cell? (1)
- (ii) On which electrode does the oxidation takes place? (2)
- (iii) What is the role of salt bridge in an electro chemical cell? (2)

OR

Why are highly reactive metals considered as strong reducing agents?

Section D

This section contains 7 questions with internal choice in two questions. The following questions are very short answer type and carry 2 marks each.

21. How many moles of methane are required to produce 22 g CO₂? (2)
22. Give one iso-electronic species for (2)
- (a) Na⁺ and (b) Cl⁻

OR

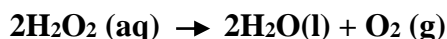
Explain the following: - (a) Heisenberg's Uncertainty Principle (b) Aufbau Principle

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

OR

An element is present in the third period of the p-block. It has 5 electrons in its outermost shell.

- (i) Predict its group.
- (ii) How many unpaired electrons does it have?
24. What shapes are associated with the following hybrid orbitals. (2)
- (a) sp² (b) sp³d (c) sp (d) sp³d²
25. a) Can a Π bond be formed without the formation of σ bond? (2)
- b) How many σ and Π bonds are in Ethyne?
- c) what is the shape of the Ethyne molecule ?
26. Explain why the reaction (2)



Is considered as a disproportionation reaction

27. Expand each of the following bond-line formulae to show all the atoms including carbon and hydrogen. (2)



Section E

This section contains 5 questions. The following questions are short answer type and carry 3 marks each.

28. (a) What is an orbital ? (3)
 (b) An electron is in one of the 3d orbitals. Give the possible values of n, l and m_l
 (c) Why is BF_3 molecule non-polar?

29. The first ($\Delta_i H_1$) and second ($\Delta_i H_2$) ionisation enthalpies of three elements I, II and III are given below: (3)

Element	I	II	III
$\Delta_i H_1$	403	549	1142
$\Delta_i H_2$	2640	1060	2080

Identify the element which would likely to be

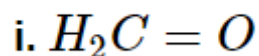
- (a) Non metal
 (b) Alkali metal

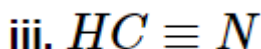
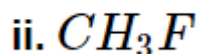
Give reasons for your choice.

OR

Give reasons for the following:

- (a) First ionization enthalpy of Oxygen is slightly lesser than Nitrogen
 (b) O^{2-} is larger in size than Mg^{2+}
 (c) Electron gain enthalpies of noble gases is positive.
30. Explain the geometry of SF_6 molecule by writing the electronic configuration of Sulphur (Atomic number = 16u) and showing the hybridisation involved. (3)
31. Balance the following ionic equation: (3)
- $$\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{SO}_2(\text{g}) \longrightarrow \text{Cr}^{3+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \text{ (In acidic medium)}$$
32. What is the hybridisation of Carbon atom in the following molecules and hence predict the shape of the molecules: (3)





Section F

The following questions are long answer type and carry 5 marks each.

33. a. Calculate the product of uncertainty in position and velocity for an object of mass 10^{-6} kg (5)
- (Given that $h/4\pi = 0.528 \times 10^{-34} \text{ kgm}^2\text{s}^{-1}$)
- b. How many electrons in an atom may have the following quantum numbers
- i) $n=4, m_s = -1/2$ (ii) $n=3, l=0$
- c. Arrange s, p and d sub-shells of the shell in the increasing order of their effective nuclear charge (Z_{eff}) experienced by the electron present in them.
- d. The electronic configuration of the valence shell for Cu is $3d^{10} 4s^1$ and not $3d^9 4s^2$. How is this configuration explained?
- e. Calculate the total number of required angular nodes and radial nodes present in the 3p orbital

OR

- a. Write down all four quantum numbers of
- (i) 19th electron of Cr ($Z=24$)
- (ii) 21st electron of Sc ($Z=21$)
- b. What designations are given to the subshells having
- (i) $n = 2, l = 1$ (ii) $n = 2, l = 0$
34. I. Arrange the following in the **increasing order of** the property mentioned along with it. (5)
- (a) F, Cl, Br and I (electron gain enthalpy)
- (b) Pb, Pb^{2+} and Pb^{4+} (size)
- II. 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?
- III. Ionisation enthalpy decreases in a group from top to bottom. Give reason.

OR

- a) Give two factors influencing electron gain enthalpy.
- b) How does the electron gain enthalpy vary
- (i) across the period
- (ii) down the group
- c) Na^+ has higher value of ionization enthalpy than Ne, even though both have same electronic configuration. Give reason.
- d) Arrange the following isoelectronic species, Na^+ , Mg^{2+} , F^- and O^{2-} . In the increasing order of their size.

35. (a) Define hybridisation
(b) Using the concept of hybridisation, explain the bond formation in
(i) CH_4
(ii) C_2H_4 (5)

OR

- I. Which of the following pair will have the higher value of the property mentioned.
(a) O_2 and F_2 (Bond order). Explain with the help of Molecular orbital theory.
(b) NH_3 and NF_3 (Dipole moment)
II. Draw the Lewis structure of H_2S
