

JB ACADEMY, AYODHYA
HALF YEALRY EXAMINATION 2025-26
CLASS-XI, SUB : CHEMISTRY

Max Mark : 70

Time:3 Hours

General Instructions:

Read the following instructions carefully.

- (a) There are 33 questions in this question paper with internal choices.
- (b) Section-A consists of 16 multiple-choice questions carrying 1 mark each.
- (c) Section-B consists of 5 short answer questions carrying 2 mark each.
- (d) Section-C consists of 7 short answer questions carrying 3 mark each.
- (e) Section-D consists of 2 case- based questions carrying 4 mark each.
- (f) Section-E consists of 3 long answer questions carrying 5 mark each.
- (g) All questions are compulsory.
- (h) Use of log table and calculator is not allowed.

SECTION - A

The following questions are multiple choice questions with one correct answer. Each question carry one mark. There is no internal choice in this section.

Q.1- The solution of A and B are 0.1 and 0.2 molar in a substance. If 100 mL of 'A' are mixed with 25 mL of B and there is no change in volume, then the final molarity of solution is

- (a) 0.15 M
- (b) 0.18 M
- (c) 0.12 M
- (d) 0.30 M

Q.2- A mixture of 24 dm³ of hydrogen and 100 dm³ of oxygen was ignited and the reaction mixture was cooled to room temperature and pressure. What will be volume of gases remaining of the end of the reaction?

- (a) 24 dm³
- (b) 76 dm³
- (c) 88 dm³
- (d) 112 dm³

Q.3- 1 g of M₂CO₃ on treatment with excess HCl produces 0.01186 moles of CO₂. The molar mass of M₂CO₃ in g mol⁻¹ is

- (a) 1186
- (b) 84.3
- (c) 118.6
- (d) 11.86

Q.4- In which of the following set of quantum numbers an electron will have the highest energy?

- (a) 3, 2, 1, ½
- (b) 4, 2, -1, -½
- (c) 4, 1, 0, -½
- (d) 5, 0, 0, ½

Q.5- The radius of second Bohr's orbits for hydrogen atoms is

[$h = 6.6262 \times 10^{-34}$ Js, $m_e = 9.109 \times 10^{-31}$ kg, $e_{\text{change}} = 1.6021 \times 10^{-19}$ C]

- (a) 1.65 Å
- (b) 4.76 Å
- (c) 0.529 Å
- (d) 2.12 Å

Q.6- The number of radial nodes for 3p orbital is _____.

- (a) 3
- (b) 4
- (c) 2
- (d) 1

Q.7- The size of isoelectronic species F, Ne and Na⁺ is affected by

- (a) Nuclear charge (Z)
- (b) Valence principal quantum number (n)
- (c) Electron-electron interaction in the outer orbitals
- (d) None of the factors because their size is the same.

Q.8- The value of ' h ' = 6.63×10^{-34} Js. The speed of light is 3×10^{17} nm s⁻¹. Which value is closer to the wavelength in nanometer of a quantum of light with frequency 6×10^{15} s⁻¹.

- (a) 50
- (b) 75
- (c) 10
- (d) 25

Q.9- Magnetic moment 2.83 BM is given by which of the following ions? [Atomic number Ti = 22, Cr = 24, Mn = 25, Ni = 28]

- (a) Ti^{3+}
(c) Cr^{2+}

- (b) Ni^{2+}
(d) Mn^{2+}

Q.10- Which of the following isoelectronic and isostructural

- (a) CO_3^{2-} , NO_3^{0-}
(c) SO_3^{2-} , NO^{3-}

- (b) ClO^{3-} , CO_3^{2-}
(d) ClO^{3-} , SO_3^{2-}

Q.11- Which of the following is an electron deficient molecule?

- (a) C_2H_6
(c) SiH_4

- (b) B_2H_6
(d) PH_3

Q.12-According to Valence Bond Theory, the overlapping of two half-filled orbitals leads to the formation of a:

- (a) Coordinate bond
(c) Sigma or Pi bond

- (b) Ionic bond
(d) Metallic bond

In the following questions (Q.13-Q.16) a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

Q.13 -(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 and reason both are incorrect statements.

(e) Assertion is wrong statement but reason is correct statement.

Assertion (A): AlCl_3 has significant covalent character despite being formed from a metal and non-metal.

Reason (R): A small cation with a high charge can polarize a large anion, distorting its electron cloud.

Q.14-(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 and reason both are incorrect statements.

(e) Assertion is wrong statement but reason is correct statement.

Assertion (A): In Bohr's theory velocity of electron in n^{th} orbit is a_n .

Reason (R): The energy of an electron in 3s orbital of H-atom is -1.5 eV .

Q.15-(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 and reason both are incorrect statements.

(e) Assertion is wrong statement but reason is correct statement.

Assertion (A): 1 mole Zn reacts with dil. H_2SO_4 to form 22.4 L of H_2 at STP.

Reason (R): 1 mole of every gas at STP occupies $V = 22.4 \text{ L}$ and 1 mole of Zn liberates 1 mole of H_2 at STP.

Q.16-(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 and reason both are incorrect statements.

(e) Assertion is wrong statement but reason is correct statement.

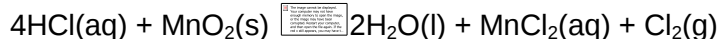
Assertion (A): Mass of 1 atom of hydrogen in grams is 1.66×10^{-24} g.

Reason (R): Mass of 1 atom of hydrogen atom is 1 g.

SECTION - B

This section contains 5 questions with internal choice in one question. The following questions are very short answer type contain only 2 marks each.

Q.17- Chlorine is prepared in laboratory by treating manganese dioxide (MnO_2) with aqueous hydrochloric acid according to the reaction:



How many grams of HCl react with 5.0 g of manganese dioxide?

(Atomic mass of Mn = 55 u, O = 16, H = 1, Cl = 35.5 u)

Or

How much sugar ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) will be required if each person on the earth is given 10^{15} moles of sugar per day. Population of the earth is 3×10^{10} .

Q.18- When would the wavelength associated with an electron be equal to the wavelength associated with a proton? Mass of electron = 9.1095×10^{-28} g;

Mass of proton = 1.6725×10^{-24} g.

Q.19- The quantized energy of an electron in hydrogen atom for the n th level is given by

Calculate the energy required to remove the electron completely from an excited hydrogen atom when its quantized level, n is 3. ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$).

Q.20- Would you expect the second electron gain enthalpy of O as positive, more negative or less negative than the first electron gain enthalpy? Justify your answer.

Q.21- Which of the following has highest lattice energy and why?

CsF, CsCl, CsBr, CsI

SECTION - C

This section contains 7 questions with internal choice in one question. The following questions are very short answer type contain only 3 marks each.

Q.22- A welding fuel gas contains carbon and hydrogen only. Burning a small sample of it in oxygen gives 3.38 g of carbon dioxide, 0.690 g of water and no other products. A volume of 10 L (measured at STP) of this welding gas is found to weigh 11.6 g. Calculate (i) empirical formula, (ii) molar mass of the gas and (iii) molecular formula. (At. wt. of C = 12, H = 1, O = 16 u).

Q.23- Calculate the weight of FeO formed from 2 g of VO and 5.75 g of Fe_2O_3 . Also, report the limiting reagent.



(Atomic mass of V = 51.4, O = 16, Fe = 55.9 g)

OR

If 4 g of NaOH dissolves in 36 g of H_2O , calculate the mole fraction of each component in the solution. Also, determine the molarity of solution (specific gravity of solution is 1 g ml^{-1}).

Q.24- What is the energy in ergs, required to shift the electron of the hydrogen atom from the first Bohr orbit to the fifth Bohr orbit and what is the wavelength of the light emitted when the electron returns to the ground state? The ground state electron energy is -2.18×10^{-11} ergs.

Q.25- (i) Write the electronic configuration of the following ions:

(a) H^-

(b) Na^+

(c) O^{2-}

(d) F^-

(ii) What are the atomic numbers of elements whose outermost electrons are represented by

(a) $3s^1$, (b) $2p^3$ and (c) $3p^5$?

(iii) Which atoms are indicated by the following configurations?

(a) [He] $2s^1$

(b) [Ne] $3s^2 3p^3$

(c) [Ar] $4s^2 3d^1$

Q.26- (i) Arrange the following ions in the order of increasing ionic radii.

Na^+ , Mg^{2+} , F^- , O^{2-}

(ii) Explain why Be has higher ionization enthalpy than B.

(iii) Predict the formula of compound which might be formed by silicon and bromine.

Q.27- (i) Write the general electronic configuration of *d*-block elements.

(ii) Which of the following elements has most positive electron gain enthalpy? F, N and Ne

(iii) How would you explain the fact that first ionization enthalpy of sodium is lower than that of magnesium but its second ionization enthalpy is higher than that of magnesium?

Q.28- Differentiate between a polar and a non-polar covalent bond with suitable examples. Predict whether the compound formed between Ba and Cl is ionic or covalent. Justify your answer using the type of elements involved.

SECTION – D

The following questions are case-based questions. Each question has an internal choice and carries 4(1+1+2) Marks each. Read the passage carefully and answer the questions that follow.

Q.29- Observe the table and answer the following questions:

Periodic trends in valence of

Group	1	2	13	14	15	16	17
Formula of Hydride	LiH	CaH ₂	B ₂ H ₆	CH ₄	NH ₃	H ₂ O	HF
	NaH		AlH ₃	SiH ₄	PH ₃	H ₂ S	HCl
	KH			GeH ₄	AsH ₃	H ₂ Se	HBr
				SnH ₄	SbH ₃	H ₂ Te	HI
Formula of oxide	Li ₂ O	MgO	B ₂ O ₃	CO ₂	N ₂ O ₃ , N ₂ O ₅	SO ₃	–
	Na ₂ O	CaO	Al ₂ O ₃	SiO ₂	P ₄ O ₆ , P ₄ O ₁₀	SeO ₃	Cl ₂ O ₇
	K ₂ O	SrO	Ga ₂ O ₃	GeO ₂	As ₂ O ₃ , As ₂ O ₅	TeO ₃	–
		BaO	In ₂ O ₃	SnO ₂	Sb ₂ O ₃ , Sb ₂ O ₅	–	–
				PbO ₂	Bi ₂ O ₃ , –		

(a) Which oxide in group 14 is acidic in nature?

(b) Which oxide in group 15 is most acidic?

(c) (i) In group 1 which oxide is most basic shown in table?

(ii) Why is SO₃ more acidic than SO₂?

OR

(c) (i) What is valence electron in group 14 elements?

(ii) What is nature of SiO₂?

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

s-orbitals are spherical in shape, *p*-orbitals are dumb bell shaped and *d*-orbitals are double dumbbell shaped. Transition metals involve *d*-orbitals which are incompletely filled. They lose electrons from outermost s-orbital first and then from *d*-orbitals. Bohr's theory could explain spectrum of hydrogen successfully but could not explain Zeeman effect, stark effect, dual nature of electron and shapes of molecules. It could not explain spectrum of multi electron species.

- (a) The splitting of spectral lines in magnetic field is called which effect?
 (b) The splitting of spectral lines in electric field is known which principle?
 (c) Draw the shape of (i) dz_2 orbital (ii) $d_{x^2-y^2}$.

OR

(c) What is relationship between  of radiation emitted in unielectron species with Rydberg's constant? Specify n_1 and n_2 for Paschen series.

SECTION – E

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

Q.31- A vessel contains 1.6 g of dioxygen at STP (273.15 K, 1 atm pressure). The gas is now transferred to another vessel at constant temperature where pressure becomes half of the original pressure.

Calculate

- (i) volume of the new vessel.
 (ii) number of molecules of dioxygen.

OR

A box contains some identical red coloured balls, labelled as A, each weighing 2 grams. Another box contains identical blue coloured balls, labelled as B, each weighing 5 grams. Consider the combinations AB, AB_2 , A_2B and A_2B_3 and show that the law of multiple proportion is applicable.

Q.32- (i) Why is +2 oxidation state of Mn (25) quite stable, while the same is not true for iron (26)?
 (ii) What is meant by dual nature of electrons?

Calculate the energy and wavelength of the photon emitted by hydrogen atom when electron makes a transition from $n = 2$ to $n = 1$. Given that the ionisation potential is 13.6 eV. ($1 \text{ eV} = 1.6 \times 10^{-19} \text{ J}$)

OR

Threshold frequency, ν_0 is the minimum frequency which a photon must possess to eject an electron from a metal. It is different for different metals. When a photon of frequency $1.0 \times 10^{15} \text{ s}^{-1}$ was allowed to hit a metal surface, an electron having $1.988 \times 10^{-19} \text{ J}$ of kinetic energy was emitted. Calculate the threshold frequency of this metal. Show that an electron will not be emitted if a photon with a wavelength equal to 600 nm hits the metal surface.

Q.33- Discuss the trends observed in the Modern Periodic Table in relation to the following properties:

- a) Valency
 b) Atomic size
 c) Metallic and non-metallic character
 d) Ionization energy
 e) Electronegativity

OR

Explain the formation of an ionic bond with the help of a labeled diagram. Use sodium and chlorine as an example. Also, list and explain any three physical properties of ionic compounds.