

Step Academy official

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STUDENT NAME	
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CLASS	New 1st Year (FSC/ICS)
SUBJECT	Chemistry
TOTAL MARKS	100
Paper Type	

Q1. Choose the correct answer.

17X1=17

1. Formulas helps us to determine the number of orbitals in a subshell:

- (A) $2n^2$ (B) n^2 (C) $n - l$ (D) $2(l+1)$

2. Which of the following orbitals is dumb bell shaped?

- (A) s-orbital (B) p-orbital (C) d-orbital (D) f-orbital

3. The electronic configuration of an atom is $1s^2 2s^2 2p^4$ The number of unpaired electrons in this atom is:

- (A) 0 (B) 2 (C) 4 (D) 6

4. Valence bond theory explains bonding through:

- (A) Delocalized electrons (B) Molecular orbitals (C) Overlap of atomic orbitals (D) Hybrid orbitals

5. A π bond is:

- (A) Weaker than σ bond (B) Formed first (C) Stronger than π bond (D) A type of ionic bond

6. The formation of multiple bonds involves:

- (A) Only σ bonds (B) Only π bonds (C) One σ and one or more π bonds (D) One π and one or more σ bonds

7. The statement about VBT is correct is:

- (A) It explains magnetism well (B) It considers molecular orbitals (C) It involves orbital overlap (D) It cannot explain shape

8. Efficiency of a chemical reaction can be checked by calculating:

- (A) Amount of limiting reactant (B) Amount of product formed (C) Amount of Reactant in excess (D) Amount of reactant left

9. Theoretical yield is obtained by:

- (A) Calculations after experiments (B) Calculation after balanced chemical equation (C) Just calculating the amount of reactants (D) By comparing with actual yield

10. When the temperature of a liquid decreases, kinetic energy and fluidity:

- (A) Kinetic energy increases, fluidity increase (B) Kinetic energy decreases, fluidity increase (C) Kinetic energy increases, fluidity decreases (D) Kinetic energy decreases, fluidity decreases.

11. Honey has a significantly higher viscosity than water. It is due to:

- (A) The lower density as compared to water. (B) The presence of large sugar molecules that can form hydrogen bonds (C) The higher surface tension of honey. (D) The lower average kinetic energy of molecules in honey at room temperature.

12. Which bond dissociation energy value would indicate the strongest bond between two specific atoms?

- (A) The smallest positive value (B) A value close to zero. (C) The largest positive value (D) A negative value
13. If a reaction's equation is multiplied by a coefficient (e.g., doubled), how must the ΔH value for that reaction be treated when applying Hess's Law?
- (A) ΔH remains unchanged (B) ΔH is divided by the coefficient (C) ΔH is multiplied by the coefficient (D) ΔH is raised to the power of the coefficient
14. Rate equation is obtained by using the coefficient of:
- (A) Products (B) Products in rate determining step (C) Reactants in rate determining step (D) Reactant normal in equation
15. Increase in temperature increases the rate of reaction of:
- (A) Endothermic reaction (B) Exothermic reaction (C) Both forward and backward reactions (D) All of these
16. In the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3 + Al_2O_3$ *acts as*: acts as:
- (A) Auto catalysis (B) Retarder (C) Promoter (D) Enzyme
17. A catalytic reaction where all the reactants, products and catalyst are in same phase is called:
- (A) Auto catalysis (B) Heterogeneous catalysis (C) Homogenous catalysis (D) Poison catalyst

Q2. Write short answers of the following questions. Any 8

8X2=16

- 1 . What is the importance of Moseley's law?
- 2 . State Moseley's Law.
- 3 . What is the origin of line spectrum?
- 4 . Why it is so that two electrons with same spin cannot reside in an orbital?
- 5 . Why can't the value of the azimuthal quantum number (ℓ) be equal to the principal quantum number (n)?
- 6 . Write down shape of the d - orbitals.
- 7 . What is the Aufbau principle? Give example.
- 8 . What is the Hund's rule? Give example.
- 9 . How does VBT explain the strength of a covalent bond?
- 10 . Why is σ bond stronger than π bond?
- 11 . What are the limitations of VBT?
- 12 . Predict the magnetic nature of N_2 .

Q3. Write short answers of the following questions. Any 8

8X2=16

- 1 . Explain the hybridization in NH_3 and its shape.
- 2 . Why does He_2 not exist according to MOT?
- 3 . Calculate the mass in grams of 2.74 moles of $KMnO_4$.
- 4 . Calculate the number of moles of O, N, and Mg atoms in 9 g of $Mg(NO_3)_2$
- 5 . One mg of K_2CrO_4 has thrice the number of ions than the number of formula units when ionized in water?

- 6 . A gas occupies 22.4 L at STP. Can we always assume it contains 1 mole? Explain.
- 7 . Is it possible for two gases to have the same molar mass but different densities under the same conditions? Why or why not?
- 8 . Describe a method to verify experimentally if a solution is exactly 1.0 M.
- 9 . Why don't heavier gas molecules in a mixture settle to the bottom of the container due to gravity, similar to how sand settles in water?
- 10 . Water is a liquid at room temperature but H₂S is a gas. Give reason.
- 11 . Why larger molecules generally exhibit higher viscosities than smaller molecules with similar intermolecular forces?
- 12 . Is there any property of liquid crystal, that they exhibit that are not typically found in either conventional solids or liquids?

Q4. Write short answers of the following questions. Any 6

6X2=12

- 1 . Why are smaller liquid droplets more spherical than larger ones?
- 2 . Why does wind increase the rate of evaporation of a liquid?
- 3 . What fundamental difference in the behavior of gas and liquid molecules at higher temperatures regarding expansion?
- 4 . Can an energy profile diagram definitively prove the exact molecular mechanism of a reaction? Explain briefly.
- 5 . If a reaction has $\Delta H = 0$ what determines if it will be spontaneous based on its energy profile and related concepts?
- 6 . State Hess's Law of Heat Summation in your own words and explain its significance in thermochemistry.
- 7 . Densities are given in g dm⁻³ but not in g cm⁻³ Why?
- 8 . How the rate of evaporation depends on the surface area?
- 9 . How do we determine the ΔH in the laboratory for food, fuel etc?

Q5. Write short answers of the following questions. Any 6

6X4=24

- 1 . Explain the difference between the atomic number and the nucleon number of an atom.
- 2 . Explain the deflection of fundamental sub-atomic particles in the electric field.
- 3 .
An electron has quantum numbers: $n = 3, \ell = 2, m = 0, s = +1/2$ What orbital is it in, and how many electrons can occupy this orbital type in that shell?
- 4 . Predict the hybridization and shape of $AlCl_3$
- 5 . Explain why H₂O has a bent shape.
- 6 . Prove that one mole of each N₂, CO₂, and H₂ contains an equal number of molecules.
- 7 . Prove that one mole of each N₂, CO₂, and H₂ contains an equal number of molecules.
- 8 . Explain why adding more water to a solution doesn't change its mass of solute.
- 9 . Law of conservation of mass has to be obeyed in stoichiometric calculations. How?
- 10 . Evaporation takes place at all temperatures. Explain.