

Shyampur Siddheswari Mahavidyalaya
Department of Chemistry
B.Sc. Semester I Chemistry (Minor/MDC)
Paper : CHEM-H-CC1-(1/3)-Th/CHEM-MD-CC1-(1/3)-Th
Continuous Internal Assessment (CIA) – Model Question

Terms and symbols are carrying their usual meanings.

Q. No.	Question	Marks	Mapped COs
1	Which experiment provided evidence for the wave nature of electrons? (A) Rutherford's gold foil experiment (B) Davisson and Germer experiment (C) Millikan oil drop experiment (D) Stern-Gerlach experiment	1	CO1, CO4
2	Heisenberg's uncertainty principle relates which pair of properties of particles? (A) Position and momentum (B) Energy and wavelength (C) Time and energy (D) Velocity and frequency	1	CO1, CO2
3	Which of the following is a limitation of the Aufbau principle? (A) It does not consider shielding and penetration effects (B) It cannot predict ionization energies (C) It only applies to multi-electronic systems (D) It assumes all orbitals have equal energy	1	CO2, CO4
4	What is the effective nuclear charge experienced by a 3p electron in phosphorus (Z=15) using Slater's rules? (A) +3 (B) +5 (C) +7 (D) +13	1	CO2, CO3
5	According to Valence Bond Theory, the bond in an H ₂ molecule is formed by: (A) Overlap of two 1s orbitals (B) Overlap of one 1s and one 2p orbital (C) Overlap of two 2p orbitals (D) Overlap of 1s and 1p orbitals	1	CO3, CO4
6	Resonance energy is defined as: (A) The energy difference between the hybrid structure and the most stable canonical form (B) The energy required to break all bonds in a molecule	1	CO1, CO3

Q. No.	Question	Marks	Mapped COs
7	(C) The energy difference between the hybrid structure and the least stable canonical form (D) The total energy of the molecule Which of the following is true for an isothermal expansion of an ideal gas? (A) $\Delta U=0$, $q=-w$ (B) $\Delta U \neq 0$, $q=0$ (C) $\Delta H=0$, $q=w$ (D) $\Delta U \neq 0$, $q=w$	1	CO3, CO5
8	For a first-order reaction, the half-life is: (A) Independent of the initial concentration (B) Proportional to the initial concentration (C) Inversely proportional to the initial concentration (D) Proportional to the square of the initial concentration	1	CO3, CO5
9	According to Hückel's rule, which of the following systems is aromatic? (A) Cyclobutadiene (4 π electrons) (B) Cyclohexatriene (6 π electrons) (C) Cyclooctatetraene (8 π electrons) (D) Cyclopropenyl cation (2 π electrons)	1	CO1, CO4
10	Which of the following is an achiral molecule? (A) Lactic acid (B) 2-Butanol (C) Glycine (D) 2-Chlorobutane	1	CO4, CO5

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B.Sc. Semester I Chemistry (Major)

Paper : CHEM-H-CC1-1-Th

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1. The concept of effective nuclear charge helps in explaining the trends in periodic properties. Which of the following statements is INCORRECT regarding effective nuclear charge (Z_{eff})?

- (A) Z_{eff} increases across a period in the periodic table ;
- (B) Z_{eff} decreases down a group in the periodic table ;
- (C) Shielding by core electrons is more effective than shielding by valence electrons ;
- (D) Slater's rules are used to approximate Z_{eff} .

CO Mapping: CO1, CO4

2. Which of the following pairs of elements is expected to show the most significant deviation in their ionization energies, given their positions in the periodic table?

- (A) Be and B ; (B) N and O ; (C) Li and Na ; (D) S and Se .

CO Mapping: CO1, CO4

3. Using Mulliken's electronegativity scale, the electronegativity (χ) of an atom is calculated as:

$$\chi = \frac{1}{2} (\text{I. E.} + E_{\text{A}})$$

where I.E. is the ionization energy, and E_{A} is the electron affinity. For an atom with I.E.=600 kJ/mol and E_{A} =200 kJ/mol, what is its electronegativity?

- (A) 300 ; (B) 400 ; (C) 600 ; (D) 200 .

CO Mapping: CO1, CO3

4. Which of the following molecules is aromatic, based on Hückel's rule?

- (A) Cyclobutadiene ; (B) Cycloheptatrienyl cation ;
- (C) Cyclooctatetraene ; (D) Cyclopropenyl anion .

CO Mapping: CO1, CO2, CO4

5. Given the molecular orbital energy diagram of conjugated dienes, which is the HOMO (highest occupied molecular orbital) of 1,3-butadiene in the ground state?

- (A) π_1 ; (B) π_2 ; (C) π_1^* ; (D) π_2^* .

CO Mapping: CO1, CO4

6. The solubility of an organic compound in water is primarily determined by:

- (A) The polarity of the compound and the ability to form hydrogen bonds ;
(B) Only the molar mass of the compound ;
(C) The number of double bonds in the compound ;
(D) The size of the hydrophobic moiety in the compound .

CO Mapping: CO2, CO3

7. For an ideal gas undergoing an isothermal expansion at 25°C, the work done (w) when the gas volume expands from 1.0 L to 2.0 L is:

$$w = -nRT \ln \frac{V_f}{V_i}$$

What is w in J if n=1 mol?

- (A) -1729 J ; (B) -1444 J ; (C) -571 J ; (D) -1157 J .

CO Mapping: CO3, CO4

8. A reaction has $\Delta H = -100$ kJ/mol and $\Delta S = -200$ J/mol.K. At what temperature will the reaction become non-spontaneous?

- (A) 273 K ; (B) 400 K ; (C) 500 K ; (D) 600 K .

CO Mapping: CO1, CO4

9. For a first-order reaction, if the rate constant (k) is 0.693 min^{-1} , what is the half-life of the reaction?

- (A) 1 minute ; (B) 2 minutes ; (C) 0.5 minutes ; (D) 10 minutes .

CO Mapping: CO1, CO3

10. A solution was prepared by mixing 250 mL 0.2M HCl with 250 mL 0.1M NaOH. What is the pH of the resulting solution?

- (A) 1.0 ; (B) 2.0 ; (C) 3.0 ; (D) 7.0 .

CO Mapping: CO5, CO6

Shyampur Siddheswari Mahavidyalaya
Department of Chemistry
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Paper : CHEM-H-SEC1-1-Th
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Q. No.	Question	Marks	Mapped COs
1	Define and differentiate between absolute error and relative error, providing an example for each. OR Define accuracy, precision, and sensitivity in the context of quantitative analysis. Explain how these figures of merit influence the choice of an analytical method.	2	CO1, CO5
2	Explain the significance of standard solutions in titrimetric analysis and describe the process of preparing a ppm-level solution. OR A solution of 0.2 M HCl is used to titrate 25 mL of NaOH solution. The volume of HCl required to reach the equivalence point is 20 mL. Calculate the molarity of the NaOH solution.	2	CO2, CO5 OR CO2, CO6
3	What are the advantages of using organic reagents over inorganic reagents in gravimetric analysis? Provide two examples of organic reagents and their applications. OR Discuss the differences between co-precipitation and post-precipitation in gravimetric analysis. How can these issues be minimized during the analysis?	2	CO3, CO5 OR CO1, CO3
4	Discuss the importance of BOD and COD in water quality analysis and how they are determined. OR Explain the concepts of BOD and COD, their significance in water quality analysis, and how they differ in determining organic matter in water.	2	CO4, CO6
5	Outline the steps involved in calibrating a pipette and explain why it is essential for accurate quantitative analysis. OR Describe the Volhard's method and the Mohr's method for precipitation titration with silver nitrate. Highlight the differences in their indicators and applications.	2	CO1, CO5 OR CO2, CO3

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Q. No.	Question	Marks	Mapped COs
1	Which of the following is commonly used to detect adulteration in milk? (A) Methyl alcohol (B) Water (C) Caffeine (D) Sorbates	1	CO-1, CO-2
2	Which of the following is a typical method to estimate the fat content in milk? (A) Halphen test (B) Rancidity test (C) Gerber method (D) Saponification test	1	CO-2, CO-4
3	Which artificial sweetener is commonly used in diet sodas? (A) Sucralose (B) Vanillin (C) Saccharin (D) Dulcin	1	CO-1, CO-
4	Which vitamin deficiency causes scurvy? (A) Vitamin A1 (B) Vitamin C (C) Vitamin D (D) Vitamin K1	1	CO-3
5	What is the primary function of Vitamin D in the human body? (A) Blood clotting (B) Bone health (C) Immune function (D) Antioxidant activity	1	CO-3
6	Which of the following oils can be detected as adulterants in edible oils? (A) Castor oil (B) Argemone oil (C) Sesame oil	1	CO-4

Q. No.	Question	Marks	Mapped COs
7	(D) Olive oil Which of the following methods is used to detect the presence of mineral oils in edible fats? (A) Halphen test (B) Gerber test (C) Iodine number (D) Rancidity test	1	CO-4
8	What is the primary component in the manufacturing of soap? (A) Triglycerides (B) Sodium hydroxide (C) Polymers (D) Fatty acids	1	CO-4
9	Which of the following is an example of a secondary battery? (A) Lead-acid battery (B) Dry cell (C) Zinc-carbon battery (D) Fuel cell	1	CO-5
10	Which renewable energy source uses photovoltaic cells to convert sunlight into electricity? (A) Fuel cells (B) Solar energy (C) Wind energy (D) Geothermal energy	1	CO-5