



বাংলাদেশ আর্মি ইন্টারন্যাশনাল ইউনিভার্সিটি অব সায়েন্স এন্ড টেকনোলজি (বাইউস্ট), কুমিল্লা
 BANGLADESH ARMY INTERNATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY (BAIUST), CUMILLA

Mid Term Examination, Fall 2025
 Department of Computer Science and Engineering
 Level-1, Term-I
 Course Code: CHEM-111
 Course Title: Chemistry
 Credit Hour: 03

Notes:

Time: 1 hour 30 minutes

a. Answer any 03 (three) of the following 04 (four) question.

Full Marks: 90

b. Each question carries 30 marks.

c. Figure on the right of each question indicate marks for respective question.

1. a. Discuss Heisenberg's Uncertainty principle with mathematical expression. 06
- b. Illustrate the shapes of s, p and d orbitals with labeled diagrams showing the geometrical shapes and orientations of these orbitals in three-dimensional space. 12
- c. The energy transition in hydrogen atom occurs from $n = 3$ to $n = 2$ energy level. 12
 $(R = 1.097 \times 10^7 \text{ m}^{-1})$. Calculate the wavelength of the emitted electron.
2. a. Discuss Arrhenius, Bronsted- Lowry and Lewis concept of acid base with their limitations. 09
- b. Determine the pH and pOH of the given solutions: 09
 1. 0.3 M CH_3COOH solution where, $K_a = 1.8 \times 10^{-5}$
 2. 0.5 M NH_4Cl solution where, $K_b = 1.75 \times 10^{-5}$
 3. 0.05 M H_2SO_4 solution
- c. A buffer solution is made from 0.3 M benzoic acid ($\text{C}_6\text{H}_5\text{COOH}$, $K_a = 6.3 \times 10^{-5}$) and 0.5 M sodium benzoate ($\text{C}_6\text{H}_5\text{COONa}$). Calculate the pH of this buffer. 12
3. a. Discuss the term colligative properties with its types. 08
- b. Calculate the vapour pressure lowering caused by the addition of 100 g of sucrose (mol. mass = 342 g) to 1000 g of water if the vapour pressure of pure water at 25°C is 23.8 mm Hg. 12

$$[\text{H}^+] = K_a \times c$$

- c. Lithium (Li), Sodium (Na), Potassium (K), Rubidium (Rb), and Cesium (Cs) 10
show clear trends in their atomic radius, ionization energy and electronegativity. Use the elements of the alkali metal series to **explain** how these properties change down the group.
4. a. **Discuss** the postulates of Bohr's atomic model with its limitations. 10
- b. **Explain** the top-down and bottom-up methods of nanoparticle synthesis and give examples of techniques used in each method. 10
- c. The uncertainty in the position and velocity of a particle are 10^{-10} m and 5.27×10^{-24} m sec⁻¹ respectively. **Calculate** the mass of the particle. 10