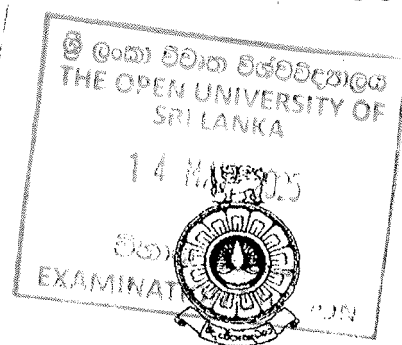




THE OPEN UNIVERSITY OF SRI LANKA
 FACULTY OF HEALTH SCIENCES
 DEPARTMENT OF BASIC SCIENCES
 ACADEMIC YEAR 2024/2025 – SEMESTER I
 BACHELOR OF PHARMACY HONOURS
 BSU3340-PHARMACEUTICAL CHEMISTRY I-LEVEL 03
 FINAL EXAMINATION
 DURATION: 3 HOURS

DATE: 14th MAY 2025

TIME: 1.30 pm – 4.30 pm

IMPORTANT INSTRUCTIONS TO CANDIDATES

- This question paper consists of **03** pages containing **05** questions
- Write answers for all questions in the booklets provided.
- Clearly state your **Index Number** in your answer script
- Having any unauthorized materials, mobile phones in your possession is a punishable offence
- Calculators are allowed



BACHELOR OF PHARMACY HONOURS - LEVEL 03 - 2024/25

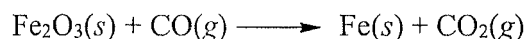
BSU3340- PHARMACEUTICAL CHEMISTRY I

FINAL EXAMINATION

Write answers in booklets provided.

1.

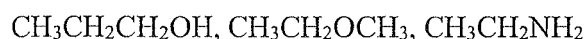
- a) Hematite (Fe_2O_3) is one of the major iron ores. In a blast furnace, iron is extracted by reducing hematite with carbon monoxide (CO). The unbalanced chemical equation for this reaction is provided below. Calculate the mass of iron that can be produced from 500 g of Fe_2O_3 . The atomic masses of iron and oxygen are 55.8 and 16.0, respectively. (06 marks)



- b) Arrange the following compounds in order of **increasing** boiling points. (03 marks)



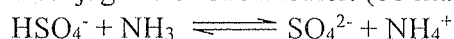
- c) Which of the following will have intermolecular hydrogen-bonding? (02 marks)



- d) Propanol ($\text{C}_3\text{H}_8\text{OH}$) and Ethyl methyl ether ($\text{CH}_3\text{CH}_2\text{OCH}_3$) have the same molar mass. Which one has a higher boiling point? Explain your answer. (04 marks)

2.

- a) For the following reactions, label each species as an acid or a base. Indicate the species that are conjugates of one another. (06 marks)



- b) Benzoic acid and its salts are used as food preservatives. What is the concentration of benzoic acid in an aqueous solution of 0.015 M sodium benzoate? What is the pH of the solution? K_a for benzoic acid is 6.3×10^{-5} . (08 marks)
- c) Consider a weak acid, HA. Provide the chemical equation for the ionization of HA in an aqueous solution. (02 marks)
- d) Derive the Henderson-Hasselbalch equation for the HA. (04 marks)
- e) Blood contains multiple acid-base systems that help maintain its pH at approximately 7.4. One of the key buffering systems involves carbonic acid and the hydrogen carbonate ion. What should be the ratio of $[\text{HCO}_3^-]$ to $[\text{H}_2\text{CO}_3]$ in the blood to maintain the pH at 7.40? (05 marks)



3.

- a) How Gibb's free energy change (ΔG) is related to entropy change (ΔS) and enthalpy change (ΔH) at given temperature T. (Provide the equation). (04 marks)
- b) Explain why endothermic dissolution favors at high temperature? (06 marks)
- c) Calculate the dissolution enthalpy of LiCl in water using the data provided below. (08 marks)
 LiCl Lattice energy: -834 kJ/mol LiCl Hydration energy: -884 kJ/mol
- d) Determine whether the dissolution process is endothermic or exothermic. (02 marks)

4.

- a) Lead (II) arsenate has been used as an insecticide, and it is slightly soluble in water. Write the solubility-product constant, K_{sp} , for Lead (II) arsenate, $\text{Pb}_3(\text{AsO}_4)_2$. (04 marks)
- b) If the solubility of Lead (II) arsenate is $3.0 \times 10^{-5} \text{ g/L}$, calculate the solubility product constant? The molar mass of Lead (II) arsenate is 899 g/mol . (08 marks)
- c) Explain the effect of common ions (eg: adding $\text{Pb}(\text{NO}_3)_2$) to the solubility and to the K_{sp} of Lead (II) arsenate. (03 marks)
- d) Explain why non-aqueous solvents are useful in pharmacology. (05 marks)

5. A fertilizer sample contains ammonium iron(II) sulfate, $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$, as its iron source. An 8.50 g portion of this fertilizer is dissolved and diluted to 250.0 mL using dilute sulfuric acid. A 25.00 mL aliquot of the resulting solution is titrated with 0.010 M potassium permanganate solution. The atomic mass of iron (Fe) is 55.85 .

- a) Write the balanced redox reaction between permanganate ion and Fe^{2+} in the acidic medium. (08 marks)
- b) If the end-point of the titration was observed with 24.50 mL of titrant, calculate the concentration of Fe^{2+} ions. (04 marks)
- c) Calculate the number of moles of Fe^{2+} in the original fertilizer sample. (04 marks)
- d) Calculate the ion percentage in the fertilizer sample. (04 marks)

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