

THE OPEN UNIVERSITY OF SRI LANKA  
FACULTY OF HEALTH SCIENCES  
DEPARTMENT OF BASIC SCIENCES  
ACADEMIC YEAR 2022/2023 – SEMESTER I  
BACHELOR OF PHARMACY HONOURS  
BSU3340-PHARMACEUTICAL CHEMISTRY I-LEVEL 03  
FINAL EXAMINATION  
DURATION: 3 HOURS



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DATE: 31<sup>st</sup> MARCH 2023

TIME: 09.30 a.m. – 12.30 p.m.

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**IMPORTANT INSTRUCTIONS TO CANDIDATES**

- This question paper consists of **03** pages containing **05** questions
- Write answers for all questions in 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 - 2022/23****BSU3340- PHARMACEUTICAL CHEMISTRY I****FINAL EXAMINATION**

**Write answers in booklets provided.**

1. a) Sodium (Na) and Potassium (K) are in the same group of the periodic table. Explain why the first ionization energy of Na is higher than that of K. (05 marks)
  - b) Write the electron configuration of  $\text{Fe}^{2+}$  (Atomic number of Fe is 26) and explain why  $\text{Fe}^{3+}$  is smaller in size than  $\text{Fe}^{2+}$ . (05 marks)
  - c) You are provided with the following information about an unknown chemical compound. Purity 100%, Molar mass 194.2 g/mol, contains 49.48% carbon, 5.15% hydrogen, 28.88% nitrogen, and 16.49% oxygen by mass. Deduce the molecular formula of the compound. Molar masses of C, H, N and O are 12.01 g/mol, 1.00 g/mol, 14.0 g/mol and 16.00 g/mol, respectively. (05 marks)
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2. a) Propanol ( $\text{C}_3\text{H}_7\text{OH}$ ) 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. (05 marks)
  - b) When two different liquids are mixed together at 25 °C, the temperature of the reaction mixture decreased. What thermodynamic condition must be satisfied to make this a spontaneous reaction? (05 marks)
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3. a) What are amphiprotic substances? (02 marks)
  - b) Explain why an aqueous solution of  $\text{NaHCO}_3$  can be used to relieve heartburn and acid indigestion. The acidity constants of  $\text{H}_2\text{CO}_3$  and  $\text{HCO}_3^-$  are  $4.3 \times 10^{-7}$  and  $5.6 \times 10^{-11}$ , respectively. (For an acid-base conjugate pair  $K_a K_b = K_w$ ). (08 marks)
  - c) A buffer is made by adding 0.500 mol  $\text{CH}_3\text{COOH}$  and 0.400 mol  $\text{CH}_3\text{COONa}$  to enough water to make 1.000 L solution. Acidity constant,  $K_a$  of  $\text{CH}_3\text{COOH}$  is  $1.8 \times 10^{-5}$ .
    - (I) Calculate the pH of this buffer solution.
    - (II) Calculate the pH after adding 0.02 mole of  $\text{NaOH}$  to the solution (assume the volume change here is negligible). (20 marks)



4. a) Write the solubility-product constant,  $K_{sp}$ , for calcium phosphate  $\text{Ca}_3(\text{PO}_4)_2$ . (03 marks)
- b) Solid  $\text{CaCl}_2$  is added to a beaker containing a saturated solution of  $\text{Ca}_3(\text{PO}_4)_2$  in equilibrium with undissolved  $\text{Ca}_3(\text{PO}_4)_2(\text{s})$ . What will happen:  
(I) to the amount of solid  $\text{Ca}_3(\text{PO}_4)_2$  at the bottom of the beaker?  
(II) to the concentration of  $\text{Ca}^{2+}$  ions in solution?  
(III) to the concentration of  $\text{PO}_4^{3-}$  ions in solution? (06 marks)
- c) At room temperature, the molar solubility of calcium phosphate,  $\text{Ca}_3(\text{PO}_4)_2$  is  $2.6 \times 10^{-6}$  mol/L. Calculate the  $K_{sp}$  of this ionic compound. (06 marks)
5. a) Tablet containing  $\text{FeSO}_4$  is often prescribed to patients suffering from iron deficiency. A 1.0 g tablet was dissolved in water and diluted up to 250.0 mL with sulfuric acid. A 25.00 mL of this solution was then titrated against 0.0150 mol/L  $\text{KMnO}_4$  solution. The end-point of the titration was obtained at 17.50 mL. Calculate the  $\text{Fe}^{2+}$  mass percentage of the tablet, assuming that  $\text{KMnO}_4$  will not oxidize any other substances present in the tablet. (Atomic mass of iron is 56 g/mol). Show your calculations with balanced reactions. (20 marks)
- b) Explain how  $\text{KMnO}_4$  acts as a self-indicator in this titration? (05marks)
- c) Could  $\text{HCl}$  be used instead of  $\text{H}_2\text{SO}_4$  acid in the step of sample preparation? (05marks)

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