BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF CHEMISTRY

MAIN EXAMINATION PAPER

PROGRAMME:	BSc (Hons) CHEMICAL TECHNOLOGY
COURSE:	LABORATORY TECHNIQUES
COURSE CODE:	CH 112
DURATION:	2 HOURS

APR 2025

INSTRUCTIONS TO CANDIDATES

1. Answer **Question 1** and **Two** questions in **Section A** and Two from **Section B.**
2. Each question should start on a fresh page and marks will be allocated as indicated

Question 1

(a) Briefly explain what the following terms mean, when applied to a laboratory report. **[3 marks]**

(i) background theory **[2 marks]**

(ii) safety and hazards **[3 marks]**

(iii) methods **[3 marks]**

(vi) results **[3 marks]**

(vii) conclusions **[2 marks]**

(viii) recommendations

(b) Explain what is meant by the following terms when applied to laboratory information. **[1 mark]**

(i) Accuracy **[1 mark]**

(i) Precision

(c) List two requirements material/sample transfer usually must typically meet. **[2 marks]**

Section A: Answer ANY TWO questions from this section

Question 2

(a) Explain briefly using examples what you understand by the following:

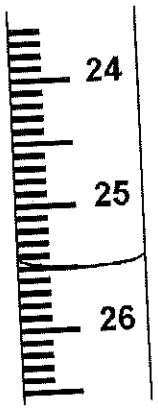
(i) Quantitative glassware **[4 marks]**

(ii) Qualitative glassware **[4 marks]**

(iii) Standard tolerances **[2 marks]**

(iv) States the "metrology principle", that is used to deduce the tolerance of a burette. **[1 mark]**

(b) Calculate the relative percentage error for the following burette reading. **[2 marks]**



(c) Explain whether the size of the relative error linked to the size of the vessel? Use this link to decide if it is better to use two lots of 5 mL or one lot of 10 mL if you want maximum accuracy for a 10 mL aliquot. **[3 marks]**

(d) Giving examples explain the following terms: (i) systematic error (ii) random error **[4 marks]**

Question 3

(a) Explain how you would make 10 ppm, 20 ppm 50 ppm solutions of NaCl using 100 ppm stock solution. **[6 marks]**

(b) Draw typical labelled assembly of distillation and refluxing apparatus. **[12 marks]**

(c) Explain why it is not advisable to dry volumetric glassware in an oven. **[2 marks]**

Question 4

(a) Define the "melting point" of a substance and explain the purpose of determining melting point. **[3 marks]**

(b) If a dirty mortar is used to prepare a sample for melting point determination, how would the actual melting point compare to the expected value for the pure compound? **[2 marks]**

(c) What effect does a loose or tight packing have on the melting point? **[1 mark]**

(d) How are the initial and final temperatures of the melting range determined? **[1 mark]**

(e) What effect does heating too fast have on the melting point? **[2 mark]**

(f) What disadvantage does too slow a heating rate have? **[1 mark]**

(g). Explain the technique of mixed melting point and why it always works. **[1 mark]**

(h) Consider table below give two reason responsible for the variation in melting points. **[2 marks]**

Compound	Melting point/ °C
palmitic acid	63
stearic acid	68 / 69.5
p-nitrobenzaldehyde	106 / 107

(i) You are to determine the boiling point of volatile liquids by simple distillation and identify them on the basis of their physical properties. Explain the following:

(a) Why is it necessary to lightly grease ground-glass joints? **[1 mark]**

(b) Why is the thermometer bulb not immersed in the liquid to determine the boiling range? **[2 marks]**

(c) Why is a heating mantle used rather than a Bunsen burner? **[1 mark]**

(d) Why must the water to the condenser be running before the heating mantle is switched on? **[1 mark]**

(e) What effect does too fast a heating rate have on the boiling range? **[1 mark]**

(f) Why is the distillation stopped before all the sample has been distilled? **[1 mark]**

Section B: Answer TWO questions from this section

Question 5

(a) List two actions that must be taken to ensure employee safety in emergencies. **[2 marks]**

(b) Explain what an emergence action plan must include. **[3 marks]**

(c) Briefly explain the design of a fume-hood and its mode of operation. **[4 marks]**

(d) List three fundamental and essential "ingredients" necessary to produce fire. **[2 marks]**

(e) List four type of fire extinguishers and give example of fuel sources where each type can be applied. **[5 marks]**

(f) Explain the following acronym PASS for the correct use of fire extinguisher. **[4 marks]**

Question 6

(a) Describe three classes that can be used classify degree of a burn injury. **[6 marks]**

(b) Casualties should always be treated in the order of priority, usually given by the "3 Bs" which are; **[3 marks]**

(c) Explain why you should add boiling chips or anti-bumping granules (rough beads or chips of marble, glass, tile or silicon carbide) when refluxing or distillating. **[4 marks]**

(d) Explain why it is not advisable to add boiling chips to hot liquids. **[2 marks]**

(e) Outline the methods that can be used in to induce crystallisation. **[5 marks]**

Question 7

(a) The crude product of an organic reaction may contain a coloured impurity. Explain how you can decolourise the reaction mixture. **[2 marks]**

(b) Explain why an excessive use of decolourising agent should be avoided. **[2 marks]**

(c) Outline the step followed when weighing by difference. **[3 marks]**

(d) Discuss methods that are used to clean glassware in a laboratory. **[8 marks]**

(e) Explain how you can cool reaction mixtures in a laboratory. **[5 marks]**

END OF EXAMINATION