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Centre Number

Chemistry

Section I (continued)

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Student Number

Part B – 60 marks

Attempt Questions 16-29

Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 16 (2 marks)

Poly(vinyl chloride), PVC, is an important industrial polymer.

(a) Draw a section of the polymer chain of PVC, showing THREE repeating units. **1**

(b) Describe ONE use of PVC in terms of ONE of its properties. **1**

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Question 17 (5 marks)

Ethanol can be produced industrially either by the hydration of ethylene or by fermentation.

- (a) Write a balanced equation for the industrial production of ethanol by the hydration of ethylene. **1**

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- (b) Write a balanced equation for the industrial production of ethanol by fermentation. **1**

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- (c) Justify the increased production of ethanol by fermentation in Australia. **3**

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Question 18 (4 marks)

Discuss the benefits of a recently developed biopolymer. In your answer you should identify the raw material and process or organism from which it is produced.

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Question 19 (5 marks)

- (a) Identify a radioisotope used in medicine. 1

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- (b) Explain a use of this medical radioisotope in terms of ONE of its *chemical* properties. 1

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- (c) Examine the table below. 3

Properties of Radioisotopes

Radioisotope	Major types of emission	Half-life
X	gamma	73 hours
Y	gamma	5.2 years
Z	alpha	433 years

Assess the potential of these THREE isotopes for use in medicine in terms of their radioactive emissions and half-lives.

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Question 20 (4 marks)

- (a) Define the term *electrolyte*. **1**

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- (b) Identify the electrolyte in EITHER a dry cell OR a lead-acid cell. **1**

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- (c) In terms of cost and practicality, compare the cell selected in (b), to ONE of the following cells: **2**

- button cell
- fuel cell
- vanadium redox cell
- lithium cell
- liquid junction photovoltaic device

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Question 21 (5 marks)

With the aid of appropriate equations, explain why the dihydrogen phosphate ion, H_2PO_4^- , is amphoteric, yet an aqueous solution of KH_2PO_4 has a pH greater than 7.

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Question 22 (3 marks)

Describe an example of a chemical reaction in industry which produces sulfur dioxide gas and explain how this can lead to a decrease in the pH of natural waterways. Include appropriate chemical equations in your response. **3**

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Question 23 (4 marks)

A titration was carried out in order to determine the concentration of an acetic acid solution. The end point of the titration was reached when 18.7 mL of a standard solution of 0.125 mol L^{-1} sodium hydroxide had reacted with 25.0 mL of the dilute acetic acid solution.

- (a) Calculate the concentration of the acetic acid solution. 2

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- (b) In this titration, a 25.0 mL pipette was initially rinsed with distilled water and then used immediately to transfer the acetic acid solution to a conical flask. 2
Identify the error associated with this procedure and explain how the error would affect the accuracy of the result.

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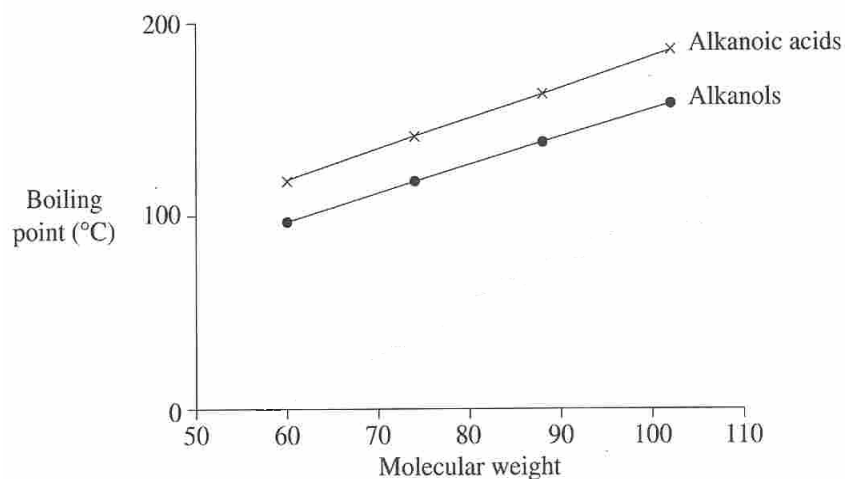
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Question 24 (8 marks)

- (a) (i) Outline the trends and relationships shown in the graph below.

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- (ii) Explain ONE trend or relationship outlined in part (i).

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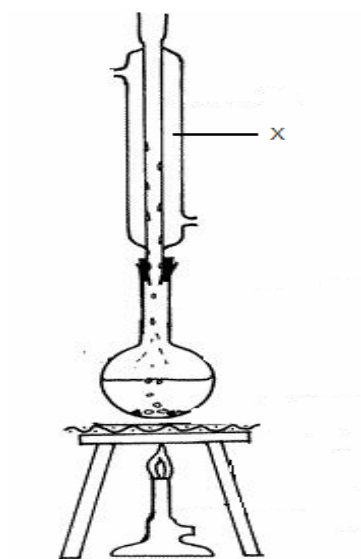
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Question 24 continues on page 18

Question 24 (continued)

- (b) (i) The apparatus used for refluxing is drawn below:

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Identify the part of this apparatus labelled X.

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- (ii) Evaluate the appropriateness of using reflux in the preparation of an ester.

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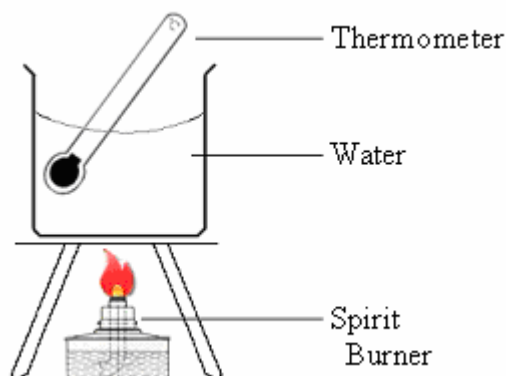
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End of question 24

Question 25 (4 marks)

A student was asked to compare the heats of combustion of ethanol and 1-butanol. She selected her apparatus and set it up as shown in the diagram below:



- (a) Write a suitable hypothesis for this experiment. 1

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- (b) Identify TWO variables which should be controlled in this experiment. 1

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- (c) In industry, combustion reactions are monitored to ascertain whether complete combustion is occurring. Identify ONE problem associated with *incomplete* combustion and outline ONE way the reaction can be managed to overcome the problem. 2

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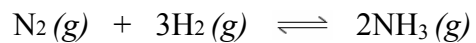
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Question 26 (3 marks)

Justify the need for monitoring the temperature of the reaction vessel during the industrial production of ammonia by the Haber process:

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Question 27 (4 marks)

A student wanted to determine the phosphorus content in a certain brand of washing powder. The phosphorus was precipitated as $\text{Ca}_2\text{P}_2\text{O}_7$ and then filtered. A 4.42 g sample of washing detergent resulted in a precipitate of mass 0.232 g.

- (a) Identify TWO procedures that the student would need to perform, after filtration and before weighing, in order to increase the accuracy of the experiment. 2

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- (b) Calculate the percentage of phosphorus, by mass, in the sample. 2

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Question 28 (3 marks)

The molecules O_2 and O_3 are allotropes.

- (a) Define the term *allotropes*. **1**

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- (b) Draw a Lewis diagram for ozone, identifying the co-ordinate covalent bond. **2**

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[illegible]

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