Section I (continued)

Part B – 60 marks
Attempt Questions 16–27
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 (3 marks)

Radioisotopes are used in industry, medicine and chemical analysis. For ONE of these fields, relate the use of a named radioisotope to its properties.

3

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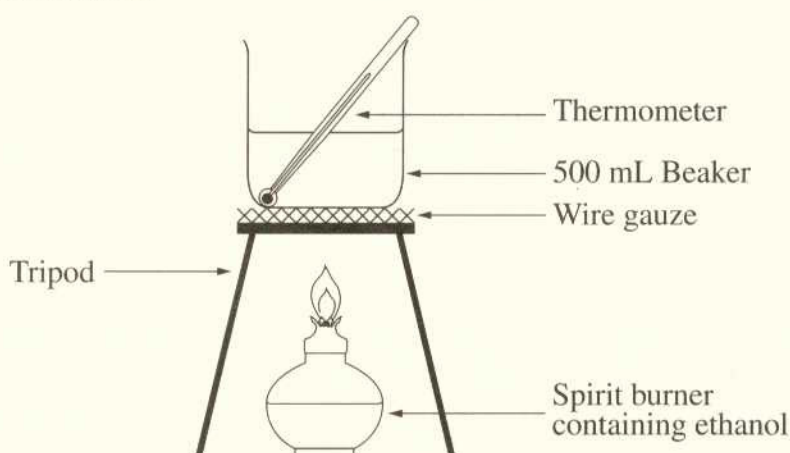
Question 17 (6 marks)

Students were asked to perform a first-hand investigation to determine the molar heat of combustion of ethanol.

The following extract is from the practical report of one student.

Apparatus used:

Thermometer
500 mL Beaker
Wire gauze
Tripod
Spirit burner containing ethanol

Lab data:

Mass of water	=	250.0 g
Initial mass of burner	=	221.4 g
Final mass of burner	=	219.1 g
Initial temperature of water	=	19.0°C
Final temperature of water	=	59.0°C

(a) After completing the calculations correctly, the student found that the answer did not agree with the value found in data books. Suggest ONE reason for this. **1**

The student rounded off to one decimal point. The data book may have used any number of decimal points.

(b) Propose TWO adjustments that could be made to the apparatus or experimental method to improve the accuracy of the results. **2**

1. The distance of the flame from the beaker
2. The thickness of the wire gauze and beaker.

Question 17 (continued)

(c) Calculate the molar heat of combustion of ethanol, using the student's data. **3**

$n = \dfrac{M}{m}$ mass of water $= 250.0\,g$

In. m. of burner 221.4

F. m. of burner 217.1

$\overline{2.3}$ decrease.

In. temp. of water $= 19$

F. temp. of water $= 59.$

$\overline{40°}$ increase.

$n = \dfrac{2.3}{40}$ molar heat of combustion $= 0.0575$

$n = 0.0575$

End of Question 17

Please turn over

Question 18 (6 marks)

A galvanic cell was made by connecting two half-cells. One half-cell was made by putting a copper electrode in a copper (II) nitrate solution. The other half-cell was made by putting a silver electrode in a silver nitrate solution. The electrodes were connected to a voltmeter as shown in the diagram.
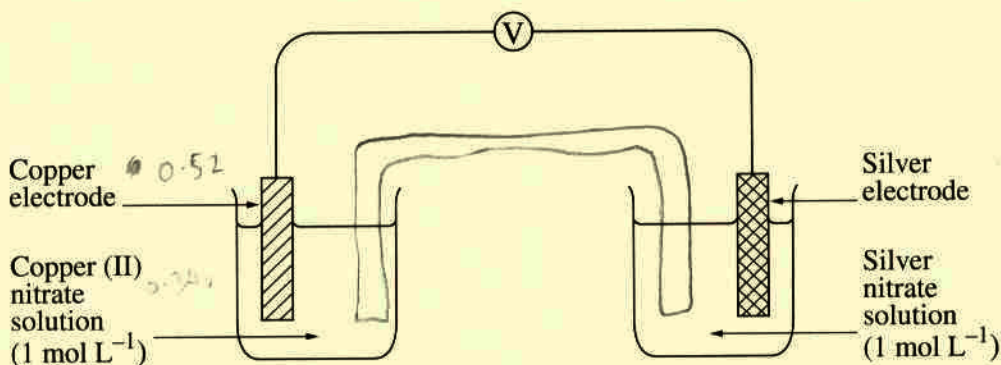
(a) Complete the above diagram by drawing a salt bridge. **1**

(b) Using the *standard potentials* table in the data sheet, calculate the theoretical voltage of this galvanic cell. **2**

$$V = 0.80 - 0.52$$
$$= 0.28$$

(c) A student removes the voltmeter from the circuit and replaces it with an electrical generator. The generator causes the copper electrode to increase in mass. **3**

Explain, using an equation, why the copper electrode will increase in mass.

$$Cu^{2+} + 2e^- \rightleftharpoons Cu$$
$$Au \rightleftharpoons Au^{2+} + 2e^-$$
$$Cu^{2+} + Au \rightleftharpoons Cu + Au^{2+}$$