Chemistry

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

Iodine-131 is used in the detection of diseases in the thyroid. This is because of the relatively low half-life (8 hours), as this means that the radioactive nature of the isotope will not be in the patients body for a long period of time.

–9–

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
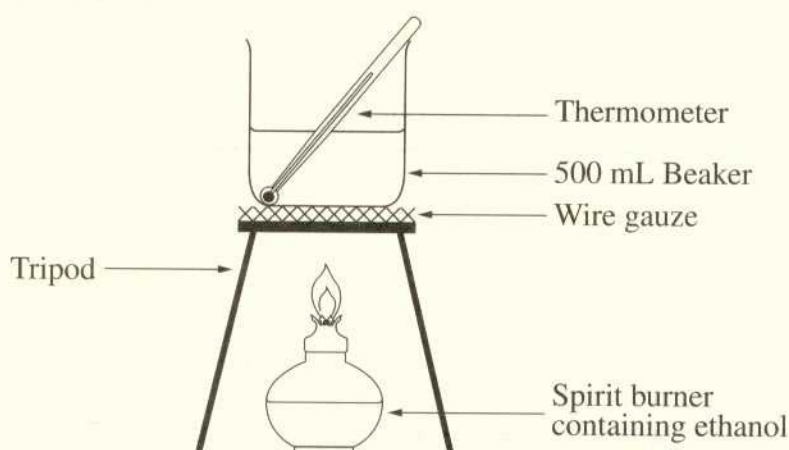
Lab data:

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 heat loss of water

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

2

① The thermometer should be set up veritically above the ~~bea~~ Container and not touched the bottom of the beaker

② To move the burner close to the Beaker because the outside flamme is the hottest so it will speed up the reaction to prevent ~~teh~~ less heat lost (~~sav~~ in shorter time).

Question 17 continues on page 11

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

$$\Delta H = CmT$$

$$= 4.18 \times 10^3 \times \frac{250}{1000} \times (059 - 19)$$

$$= 41800 \text{ J}$$

$$= 41.8 \times 10^3 \text{ kJ}$$

**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.
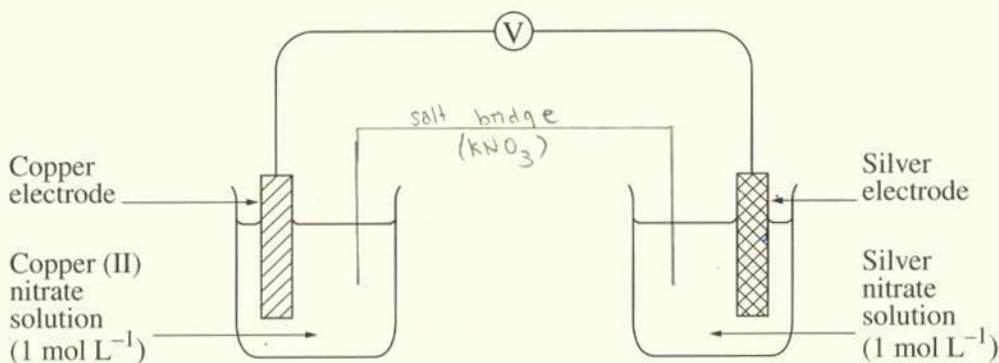
(a) Complete the above diagram by drawing a salt bridge. **1**

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

$Cu_{(s)} \rightarrow Cu^{2+} + 2e^-$ -0.34 V

$Ag^+ + e^- \rightarrow Ag_{(s)}$ 0.80 V

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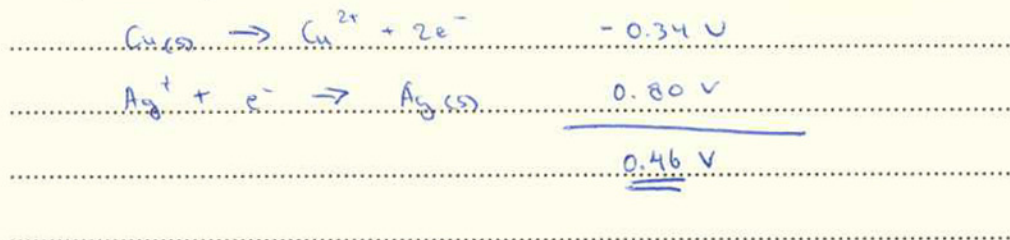
(c) A student removes the voltmeter from the circuit and replaces it with an **3** electrical generator. The generator causes the copper electrode to increase in mass.

$Cu^{2+} + 2Ag \rightarrow Cu$

$O_2 + 2Ag^+ \rightarrow Cu$

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

Because copper electrode is oxidise (oxidation).

$Cu_{(s)} \rightarrow Cu^{2+}_{(aq)} + 2e^-$

$Ag^+_{(aq)} + e^- \rightarrow Ag_{(s)}$

$Cu_{(s)} + 2Ag^+_{(aq)} \rightarrow Cu^{2+}_{(aq)} + 2Ag_{(s)}$