2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

# 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.

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**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**

Technetium 99m is a radioisotope used in medicine as a tracer in the blood stream also other bodily systems. It is ideal for use because of the beta radiation it releases and is relatively short half life so it does not affect the body long term.

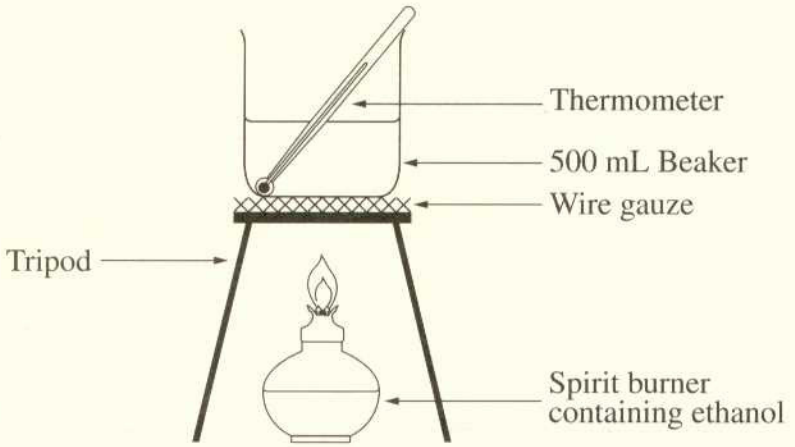
**Marks**

**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:*




*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**

There might be heat loss in system.

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

use a copper beaker with a smaller spacing so that less heat would be lost. For measuring heat change use calorimeter.

**Question 17 continues on page 11**

**Marks**

Question 17 (continued)

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

$\Delta H = -\Delta T \times m \times c$

$= -40 \times \frac{250}{100} \times 4.18 \times 10^3$

$= -41800$ J

mass water = 250g

mass of burner used = 2.3g

$\Delta T = 40\ ^\circ C$

molar heat of combustion $= \frac{41800}{3.83 \times 10^{-2}}$

$= 1091\,383\,812$ J/mol

ethanol

$CH_3CH_2OH$

MM = 60.05

$n = \frac{2.3}{60.05}$

$n = 3.83 \times 10^{-2}$

$J\ kg^{-1}\ K^{-1}$

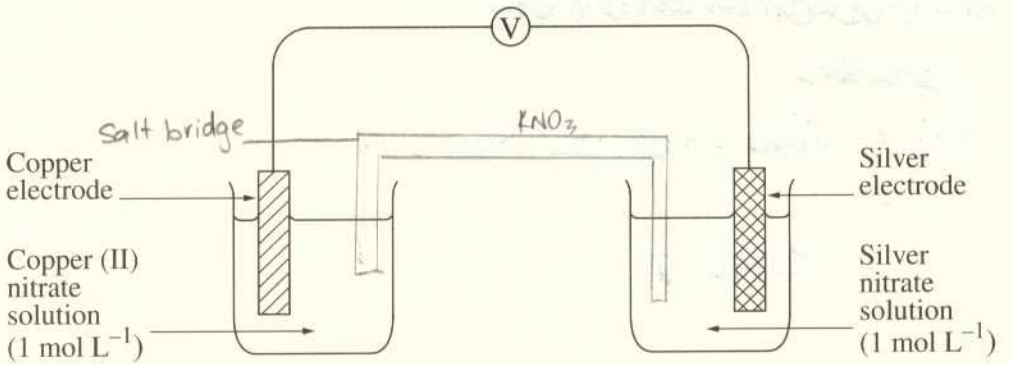
**End of Question 17**

**Please turn over**

**Marks**

**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**

$E^\circ = E^\circ_1 - E^\circ_2$ $Ag^+ + e^- \rightarrow Ag$ 0.8V

$= 0.8 - (-0.34)$ $Cu \rightarrow Cu^{2+} + 2e^-$ -.34V

$= 1.14\,V$

(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.

The copper electrode will increase in mass because there will be a build up of electrons on the copper electrode which will then react with the copper ions in the copper nitrate solution

$Cu^{2+} + 2e^- \rightarrow Cu$