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.

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**

Cobalt-60 is important in medicine, for treatment of cancer. When the nucleas disintegrates it gives off gamma rays, and it is these rays ~~that~~ that are able to penetrate deeply into the body tissue and kill the cancer cells. A half life of 1-6yrs is appropriate so that it has a reasonable life in the instrument, and also emits a reasonable and sufficient amount of radiation.

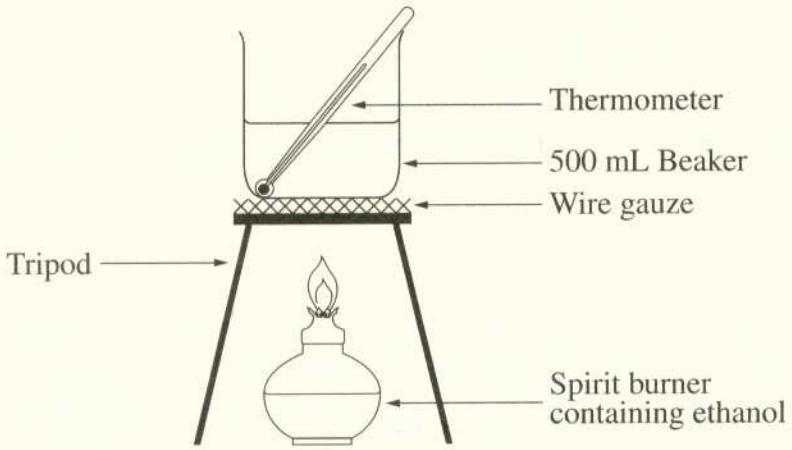
Marks

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**

Some of the heat generated by the ethanol is lost to the atmosphere.

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

Keep the thermometer off the glass - removing any chance of it being heated more than the water. Cover the beaker so that no mass can be lost from the water through steam.

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**

$Q = mc\Delta t$ $m = 250\ g$

$= 250 \times 4.18 \times 40°C$ $c = 4.18$

$= 41800\ J$ / $2.3\ g$ $\Delta t = 40°C$

$= 18173.9\ J$ / $1\ g \times 34$ $n = 0.0676$

$= 617913.04\ J$ / mole $mm = 34$

$= 617.913\ kJ$ / mole

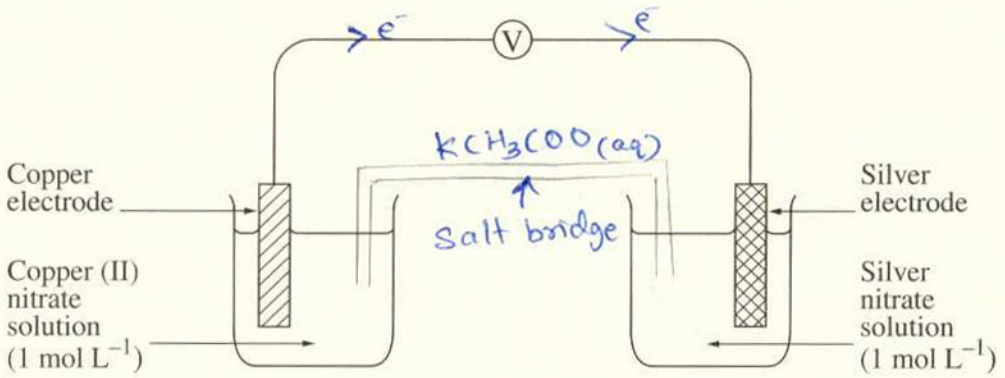
End of Question 17

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**

$E^\circ_T = E^\circ_{Red} + E^\circ_{oxi}$

$= 0.80 + (-0.34)$

$= 0.46\ V$

(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.

Cu^{2+} ions in solution is reduced to solid copper on the copper electrode. The generator's negative terminal is connected with copper electrode thus providing it with electrons.

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