THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
CHEMISTRY
Paper 3
PRACTICAL
2006

1   You are provided with:

- 4.5 g of solid A in a boiling tube.
- Solution B, 0.06 M acidified Potassium manganate (VII)

You are required to determine:

(1)   the solubility of solid A at different temperatures

(2)   the number of moles of water of crystallisation in solid A.

Procedure

(a)   Using a burette, add 4 cm³ of distilled water to solid A in the boiling tube. Heat the mixture while stirring with the thermometer to about 70°C. When all the solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid A first appear. Record this temperature in table 1.

(b)   Using the burette, add 2 cm³ of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until all the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid A first appear.

(c)   Repeat procedure (b) two more times and record the temperatures in table 1. Retain the contents of the boiling tube for use in procedure (e).

(d)   (i)   Complete table 1 by calculating the solubility of solid A at the different temperatures. The solubility of a substance is the mass of that substance that dissolves in 100 cm³ (100 g) of water at a particular temperature.

Table 1

Volume of water in the boiling tube (cm³)	Temperature at which crystals of solid A first appear (°C)	Solubility of solid A (g/100 g water)
4		
6		
8		
10		

(6 marks)

(ii)   On the grid provided, plot a graph of the solubility of solid A (vertical axis) against temperature.   (3 marks)
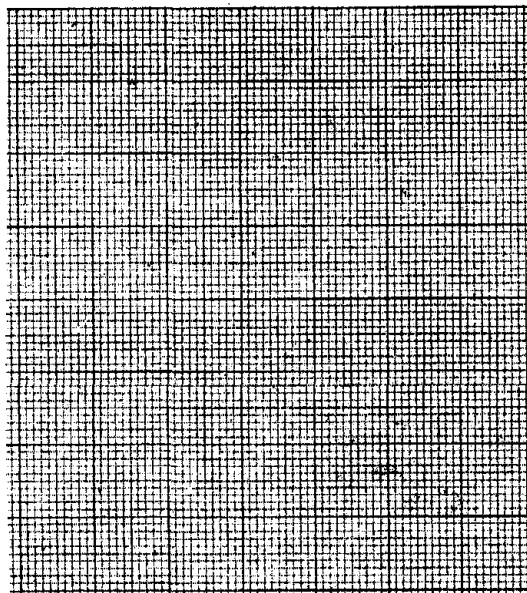
(iii)   Using your graph, determine the temperature at which 100 g of solid **A** would
         dissolve in 100 cm³ of water.   (1 mark)

(e)   (i)   Transfer the contents of the boiling tube into a 250 ml volumetric flask. Rinse
              both the boiling tube and the thermometer with distilled water and add to the
              volumetric flask. Add more distilled water to make up to the mark. Label this
              solution A. Fill a burette with solution B. Using a pipette and a pipette filler,
              place 25.0 cm³ of solution A into a conical flask. Warm the mixture to about
              60°C. Titrate the hot solution A with solution B until a permanent pink colour
              persists. Record your readings in table 2. Repeat the titration two more times
              and complete table 2. (Retain the remaining solution B for use in question ⸴
              b(i)).

       Table 2

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution B used (cm³)			

                                                                               (3 marks)
       (ii)   Calculate the:

               I   average volume of solution B used   (1 mark)

II   number of moles of potassium manganate (VII) used   (1 mark)

III   number of moles of A in 25 cm³ of solution A given that 2 moles of potassium manganate (VII) react completely with 5 moles of A
      (1 mark)

IV   relative formula mass of A.   (3 marks)

(iii)   The formula of A has the form $D.xH_2O$. Determine the value of x in the formula given that the relative formula mass of D is 90.0 and atomic masses of oxygen and hydrogen are 16.0 and 1.0 respectively.   (2 marks)

2   You are provided with solid E. Carry out the tests below. Write your observations and inferences in the spaces provided.

(a)   Place about one third of solid E in a clean dry test-tube and heat it strongly.

Observations	Inferences
(1 mark)	(1 mark)

(b)   Place the remaining solid E in a boiling tube. Add about 10 cm³ of distilled water. Shake the mixture thoroughly for about one minute. Filter and divide the filtrate into four portions.

Observations	Inferences
(1 mark)	(1 mark)

(i)   To the first portion, add 2 drops of phenolpthalein indicator.

Observations	Inferences
(1 mark)	(1 mark)

(ii)   To the second portion, add 2 cm³ of dilute hydrochloric acid.

Observations	Inferences
(1 mark)	(1 mark)

(iii)   To the third portion, add 5 cm³ of aqueous sodium sulphate.

Observations	Inferences
(1 mark)	(1 mark)