KCSE PREDICTIONS 2020

CHEMISTRY PAPER 3

1. You are provided with;
- Solution A containing 6.95g of Iron II Sulphate heptahydrate R.F.M = 278 in 250cm^3 of solution
- Solution B of potassium manganate (VII)
- Solution C of hydrogen peroxide.

You are required to

(a) Standardize the potassium manganate (VII) solution C

(b) Determine the concentration of hydrogen peroxide solution C.

PROCEDURE I

Pipette 25cm^3 of solution A into a conical flask.

Fill the burette with solution B. Titrate this solution against solution A until the first permanent pink colour appears. Record your results in table I and repeat the procedure to fill the table 1 below.

Table 1

II	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution B used (cm^3)			

(4 marks)

(i) Calculate the average volume of solution B used (1 marks)

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(ii) Given that the equation for the reaction is

$Mno^-_{4(aq)} + 5Fe^{2+}_{(aq)} + 8H^+_{(aq)} \longrightarrow Mn^{2+}_{(aq)} + 5Fe^{3+}_{(aq)} + 4H_2O_{(l)}$

Calculate

a) The number of moles of Iron II sulphate solution A used (1mark)

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b) The number of moles of solution B that reacted. (1mark)

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c) The concentration of the potassium manganate (VII) solution B in moles per litre. (1mark)

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PROCEDURE II

Pipette 25cm^3 of hydrogen peroxide, solution C into a conical flask. Fill the burette with solution B. Titrate this solution against solution C until the first permanent pink colour appears. Record results in table II.

TABLE II

Titre number	I	II	III
Final burette reading cm^3			
Initial burette reading cm^3			
Volume solution B used cm^3			

(4marks)

(i) Work out average volume of potassium manganate (VII) solution B used. (1mark)

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(ii) Given that the equation for the reaction is

$2MnO^-_{4\,(ag)} + 5H_2O_{(aq)} + 6H^+_{(aq)} \longrightarrow 2Mn^{2+}_{(aq)} + 8H_2O_{(l)\,(aq)} + 5O_{2(aq)}$

Calculate

a) The number of moles of Potassium Manganate (VII) solution B that reacted. (1mark)

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b) The number of moles of hydrogen peroxide solution C that reacted. (1mark)

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c) The concentration of hydrogen peroxide solution C in moles per dm^3(mol dm^{-3}) (1mk)

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2. You are provided with 4g of Solid F.
You are required to determine the solubility of solid F at different temperatures.
PROCEDURE

a) Carefully transfer all solid F in a clean boiling test tube and using a burette, add 15cm^3 of distilled water. Heat the mixture while stirring with a thermometer to about 85^{0}C. when all the solid has dissolved, allow the solution to cool while stirring with the thermometer. Note the temperature at which the crystals of solid F first appear. Record this temperature in Table III.

b) Transfer 5cm^3 of distilled water to the contents in the boiling tube. Warm the mixture while stirring with the thermometer until the solid dissolve. Allow the mixture to cool while stirring. Note and record the temperature at which crystals first appear.

c) Repeat procedure (b) two or more times and record the temperatures in table III.

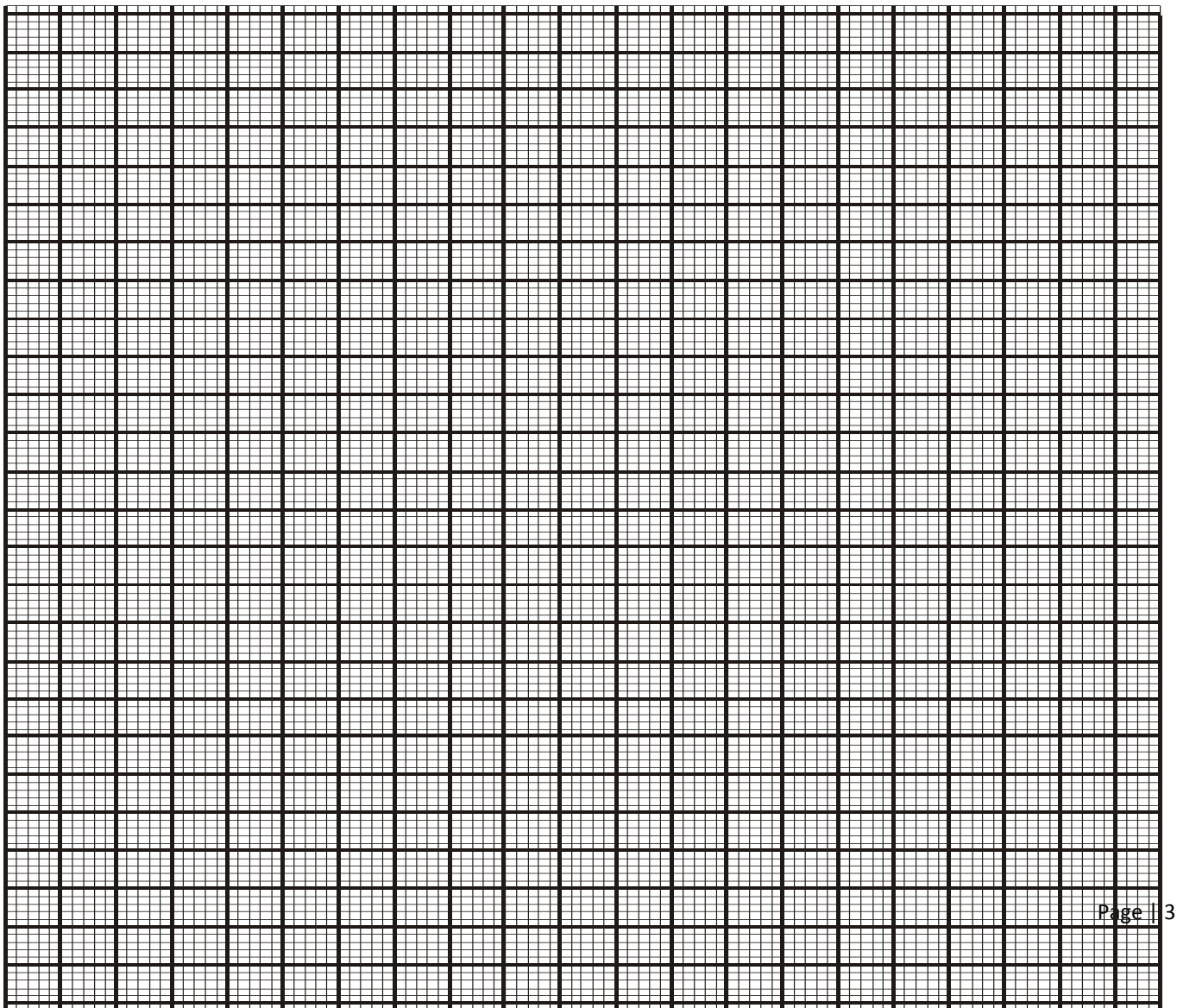
d) Complete table III by calculating the solubility of solid F at the different temperatures.

TABLE III

Volume of water in the boiling tube (cm^3)	Temperature at which crystals of solid F first appear.	Solubility of solid F in g / 100g of water.
15		
20		
25		
35		
40		

(6marks)

(i) On the grid provided plot a graph of solubility of solid F (vertical axis) against temperature (horizontal axis). (3marks)



(ii) Using your graph, determine the temperature at which 15g of solid F, would dissolve in 100cm^3 of water. (1mark)

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3. **You are provided with solid D. carry out the following tests and write down all the observations and inferences.**

a) Place half spatula end full of solid D in a dry test tube. Heat gently then strongly until there is no further change.

Observations	inferences
(1mark)	(1mark)

b) Place the remaining solid D in a test tube, add about 10cm^3 of distilled water and shake vigorously. Divide the mixture into four portions.

i. To the 1st portion, add 2M sodium hydroxide solution drop wise until in excess.

Observations	inferences
(1mark)	(1mark)

ii. To the 2nd portion, add ammonia solution drop wise till in excess.

Observations	inferences
(1mark)	(1mark)

iii. To the fourth portion add 4 drops of sodium chloride.

Observations	inferences
(1mark)	(1mark)

II. You are provided with liquid E, Carry out the following tests on it.

a) Place about one spatula end full of liquid E on a metallic spatula and ignite it in a Bunsen burner flame.

Observations	inferences
(1mark)	(1mark)

b) To $2cm^3$ of liquid E add 3 drops of acidified $KMnO_4$. Solution B.

Observations	inferences
(1mark)	(1mark)

c) To $2cm^3$ of liquid E add 3 drops of acidified $K_2Cr_2O_7$.

Observations	References
(1mark)	(1mark)