

KCSE TRIAL 2019

CHEMISTRY PAPER 3 QUESTIONS

1. You are provided with:

- A dibasic acid labeled solution P.
- Solution R containing 5.56 g per litre of potassium carbonate.
- Aqueous sodium hydroxide labeled solution T. You are required to determine the;
 - Concentration of solution P in moles per litre.
 - Molar heat of neutralization of solution P with sodium hydroxide labeled solution T.

PROCEDURE I:

Using a pipette filler, place 25 cm^3 of solution P into a 250 ml volumetric flask. Add distilled water to make 250 ml of solution and label this solution as Q. Place solution Q in a burette. Clean the pipette and use it to place 25.0 cm^3 of solution R into a conical flask. Add 2 drops of methyl orange indicator provided and titrate with solution Q. Record your results in table I. Repeat the titration two more times and complete the table.

Table 1

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

Calculate the: (4 marks)

- Average volume of solution Q used. (1 mark)
- Concentration of potassium carbonate in moles per litre of solution R. (K=39.0,O=16.0,C=12.0) (1 mark)
- Number of moles of potassium carbonate solution R used. (1 mark)
- Concentration of dibasic acid in moles per litre of solution Q. (2 marks)
- Concentration of solution P in moles per litre. (1 mark)

PROCEDURE II

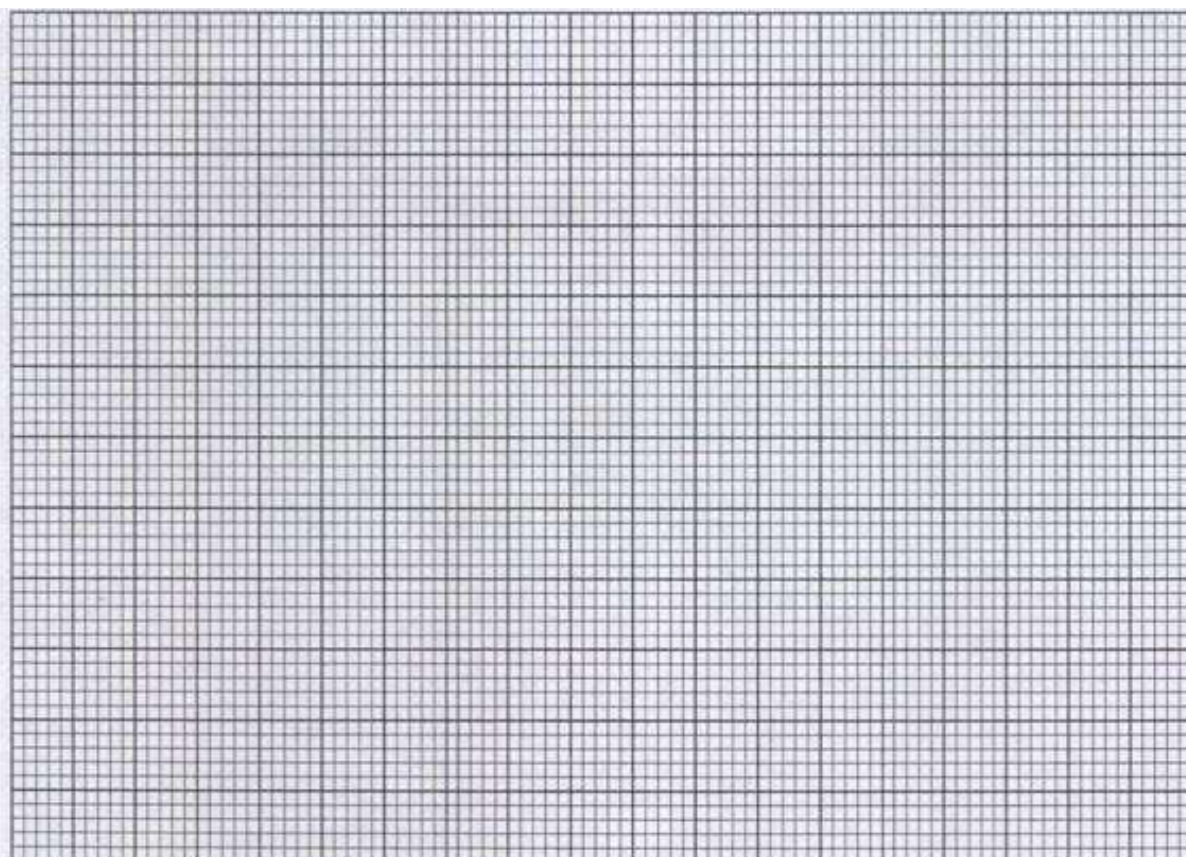
Clean the burette and fill it with solution T. Clean the pipette and use it to place 25.0 cm^3 of solution P into a 100 cm^3 beaker. Measure the initial temperature of this solution and record it in table II. From the burette, place 5 cm^3 of solution T into the beaker containing 25.0 cm^3 of solution P, stir the mixture carefully and record the highest temperature of this mixture in table II. Place another 5 cm^3 of solution T into the mixture in the beaker, stir carefully and record the highest temperature of this mixture in table II. Continue this procedure of placing 5 cm^3 portions of solution T onto 25 cm^3 of solution P and complete table II below.

TABLE II

Total volume of solution T added (cm ³)	0	5	10	15	20	25	30
Volume of solution P (cm ³)	25	25	25	25	25	25	25
Temperature (°C)							

(4marks)

a) On the grid provided, draw a graph of temperature (vertical axis) against volume of solution T used. (3 marks)



b) From the graph determine;

i. The highest temperature change, (1 mark)

ii. The volume of solution T required to react with 25cm³ of solution P. (1 mark) c)

Calculate the; i. The number of moles of solution P used. (1 mark)

ii. Molar heat of neutralization of P with sodium hydroxide labeled T. (Assume the specific heat capacity of the solution is 4.2Jg⁻¹K⁻¹ and density of solution is 1.0 g cm⁻³) (2 marks)

2. You are provided with 10 cm³ of solution H. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Add 20 cm³ of 2 M aqueous sodium hydroxide to all of solution H provided. Shake well and filter the mixture. Collect the filtrate in a conical flask. Retain the filtrate for use in tests b, c and d below. Observations

Observation (1 mark)	Inferences (1 mark)
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b) To about 2 cm³ of the filtrate, add 3 cm³ of 2M nitric acid. Retain the mixture for use in b(i) and (ii) below.

i. To about 2 cm³ of solution obtained in (b) above add 2 M aqueous sodium hydroxide drop wise until in excess.

Observation (1 mark)	inferences (1 mark)
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ii. To about 2 cm³ of another solution obtained in (b) above, add 2 M aqueous ammonia dropwise until in excess.

Observation (1 mark)	Inferences (1 mark)
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c) To 2 cm³ portion of the filtrate, add 3 drops of 2 M hydrochloric acid

Observation (1 mark)	Inferences (1 mark)
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d) To 2 cm³ portion of the filtrate, add 3 drops of acidified barium chloride.

Observation (1 mark)	Inferences (1 mark)
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3. You are provided with solid J. Carry out the tests below. Write your observations and inferences in the spaces provided.

a) Using a clean spatula heat about a half of solid J in a Bunsen burner flame.

Observation (1 mark)	Inferences (1 mark)
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b) Dissolve the remaining portion of solid J into about 10 cm³ of distilled water and divide the solution into 3 portions.

i. To the first portion, add two drops of acidified potassium manganate (vii) solution

Observation (1 mark)	Inferences (1 mark)
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ii. Determine the pH of the second portion using universal indicator paper.

Observation	Inferences
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(1 mark)

(1 mark)

iii. To the third portion, add a small amount of solid sodium hydrogen carbonate.

Observation

(1 mark)

Inferences

(1 mark)