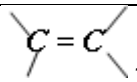
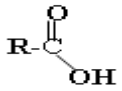
Observations	Inferences
Yellow bromine water not decolurised / yellow colour of bromine water persist(1mk)	 *-C ≡C- /unsaturated organic compound absent* or saturated organic substance present (1mks)

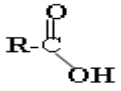
b. Add about $1cm^3$ of acidified potassium dichromate (VI). Warm the mixture

Observations	Inferences
Yellow colour of acidified $K_2Cr_2O_7$ persist/does not turn green	*R-OH absent*

c. add about $1cm^3$ of solution D ,aqueous sodium carbonate provided

Observations	Inferences
effervescence of colourless odourless gas /bubbles of colourless odourless gas that puts off a burning splint(1mk)	 H_3O^+ ,H^+ , present (1mks) accept L is acidic

d. Add the piece of magnesium ribbon provided.

Observations	Inferences
effervescence of colourless gas/bubbles of colourless gas that that ***extinguishes/puts off a burning splint*** with a pop sound 2mkk)	 H_3O^+ ,H^+ , present (1mks) accept L is acidic

KSCE 2016

1. You are provided with the following:
   - Aqueous potassium iodide, solution A_1
   - Aqueous sodium thiosulphate, solution A_2
   - Acidic solution, solution A_3
   - starch solution, solution A_4
   - dilute hydrogen peroxide, solution B
   - distilled water

   You are required to determine the rate of reaction between acidified potassium iodide and hydrogen peroxide.

   Procedure

   Step 1

Using a 10ml measuring cylinder, place 2 cm^3 of solution A_1 into 100 ml beaker. Add 2 cm^3 of solution A_2 followed by 2 cm^3 of solution A_3. Add 5 drops of solution A_4. Finally, add 12 cm^3 of distilled water and shake the mixture.

Step 2

Using a burette, place 6 cm^3 of solution B into a test tube. Pour the measured 6 cm^3 of solution B into the beaker in step 1 above and immediately start a stopwatch/clock. Swirl the mixture and place on a white paper. Observe the mixture and immediately stop the stopwatch/clock when a blue colour appears.

Record the time taken in table 2. Measure the temperature of the mixture and record in table 2. These are the results of the experiment1.

Step 3

Repeat the steps 1 and 2 using the volumes of solutions given in table 1 for experiments 2, 3, 4, 5 and 6 and record in table 2.

Table 1

Experiment number	Volume of solutions (cm^3)				Distilled water (cm^3)
	A_1	A_2	A_3	A_4	
1	2	2	2	5 drops	12
2	4	2	2	5 drops	10
3	6	2	2	5 drops	8
4	8	2	2	5 drops	4
5	10	2	2	5 drops	4
6	12	2	2	5 drops	2

a) Calculate the rate of reaction 1/time S^{-1} for each experiment and fill table 2.

Expected results

Table 2

Experiment number	Volume of solution A_1 Acidified potassium iodide	Temperature (^OC)	Time (sec) t	Rate1/t S^{-1}
1	2	21	294	3.4×10^{-3}
2	4	21	147	6.8×10^{-3}
3	6	21	100	10×10^{-3}
4	8	21	73	13.9×10^{-3}
5	10	21	69	14.5×10^{-3}
6	12	21	50	20×10^{-3}

Complete table 5mks
Decimal…….1mk
Accuracy……1mk
Trend …….1mk
Total 8mks

(8 marks)

A. COMPLETE TABLE……5MKS

Marks distribution for the table ,the marks were distributed using the conditions shown in Table below.

1. Complete table with 18 entries (6 temperature,6 time and 6 correct rates ……..…5mks
2. Incomplete table with 6 temperature, 6 time and 4 or 5 correct rates……..4$\frac{1}{2}$mks
3. Incomplete table with 6 temperature, 6 time and 3 correct rates……4mks
4. Incomplete table with 6 temperature, 6 time and 4 or 5 correct rates……3$\frac{1}{2}$mks
5. incomplete table with 4 or 5 temperature, 4 or 5 time and 4 or 5 correct rates……..3mks
6. incomplete table with 4 or 5 temperature, 4 or 5 time and less than 3 correct rates...2$\frac{1}{2}$mks
7. incomplete table with 4 or 5 temperature, 4 or 5 time and 3 correct rates……...2$\frac{1}{2}$mks
8. incomplete table with 3 temperature, 3 time and 3 correct rates……..2$\frac{1}{2}$mks
9. incomplete table with 3 temperature, 3 time and less than 3 correct rates……..$2mks$
10. incomplete table with 2 temperature, 2 with or without correct rates…….1mk
11. incomplete table with 1 temperature, 1 time and with or without correct rates……$\frac{1}{2}$mks
12. incomplete table with only one entry award ……0 mk
13. incomplete table with only time column mark out of 2$\frac{1}{2}$mks and penalize $\frac{1}{2}$mk for each space not .filledon the time column

Penalties

Penalize $\frac{1}{2}$mk once for unrealistic temperature values less than $10^{o}C$ an more than $40^{0}C$

Penalize $\frac{1}{2}$mk once for unrealistic time values less than 5 seconds an more than 420 seconds

Penalize $\frac{1}{2}$mk once for time in minutes

If no temperature is given penalize 1mk once

Accept given to at least 3 decimal places , **Penalize** $\frac{1}{2}$mk once if a candidates gives rate in lesdivides s than 3dp places unless it works out exactly to a whole number.

Penalize $\frac{1}{2}$mk once for wrong arithmetic error in working out rate if the error is outside

+ or – 2 units in third decimal place

Where only temperature readings are given ,penalize fully(award 0 mark) for complete table an award accordingly for decimal place and trend.

NOTE

Reject rate in fractions and strange values and penalize $\frac{1}{2}$mk for each entry upto a maximum of 1 $\frac{1}{2}$mks

accept $\frac{1}{t}$ /rate given in standard form or powers of 10

If fractions appear followed by a decimal points ignore the fractions and mark accordingly.

Where the values are constant in time column award a maximum of $\frac{1}{2}$mk for complete table.

When two sets of values for temperature , time and rates are given award only $\frac{1}{2}$mk for complete table, for trend and accuracy each of the two values must meet the criteria.

B. USE OF DECIMALS……..……1mk

Tied to time $\frac{1}{2}$ mk and temperature $\frac{1}{2}$mk column only subject to at least two readings in each case

Conditions

Accept whole numbers ,one or 2 decimal place used for time column used consistently ,otherwise penalize $\frac{1}{2}$mk

Accept for decimals given as whole number or one decimal place of 0.0 or 0.5 or two decimal place of 0.00, 0.25, 0.50 or 0.75 used consistently **otherwise penalize** $\frac{1}{2}$mk

C. ACCURACY

……1MK

Tied to time column only for experiment number one, compare the candidate value with the school value if within the range of + or -2 seconds award 1mk

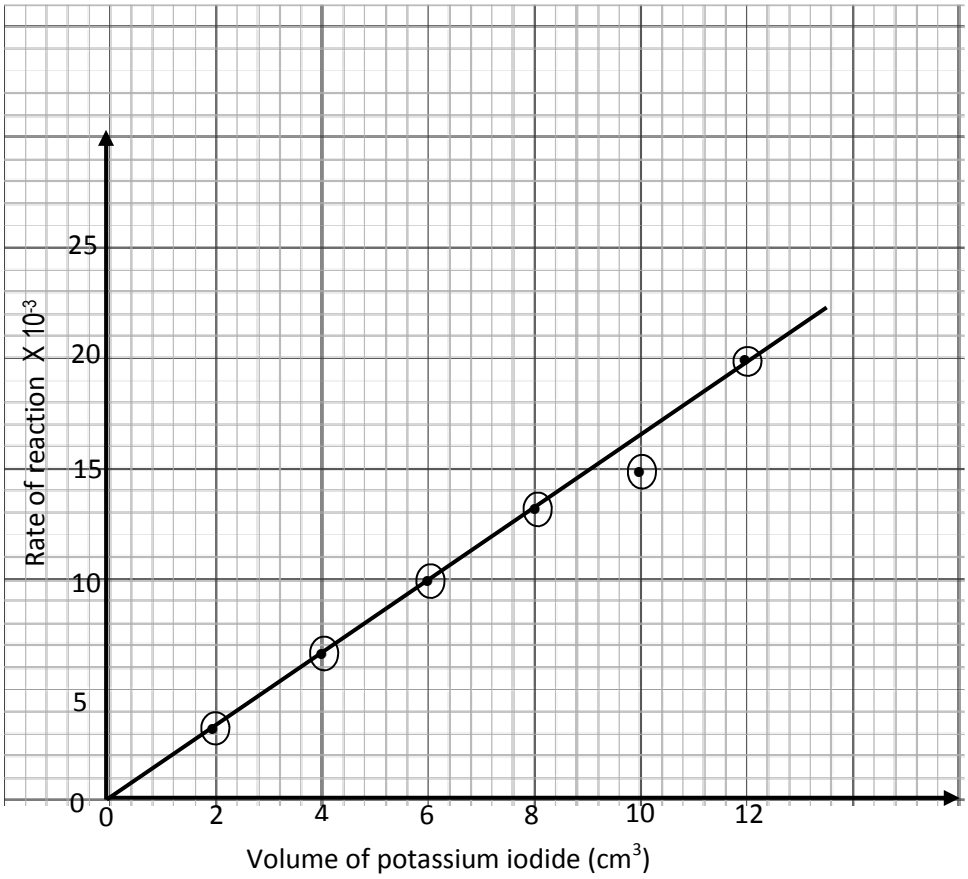
D . TREND

……1MK

Tied to time and temperature column only ,award $\frac{1}{2}$mk if the time reading decrease continuously **otherwise penalize** $\frac{1}{2}$mk **,** and $\frac{1}{2}$mk if temperature is constant **otherwise penalize** $\frac{1}{2}$mk

Graph 3mks
Labeled axis with units shown or not shown 1/2mks
Scale .must cover half of the grid 1/2mk
Plots…all points less one correctly plotted 1mk, if only half of the points are plotted penalize half a mark
Shape of the curve –straight line passing through at least two correctly plotted points plus the origin on extrapolation ward 1mk
If a student values of $\frac{1}{t}$ is strange or missing award $\frac{1}{2}$mk for correct labeling of axis and penalize fully for the other marking points

a) Plot a graph of rate of reaction 1/time vertical axis against volume of potassium iodide.
(3 marks)



b) Explain why it is necessary to record the temperature for each experiment. (1 mark)
Because rate of reaction also depends of temperature which remains constant

c) If the experiment was repeated using 7 cm^3 of acidified potassium iodide, solution A_1, determine:

(i) The volume of distilled water that would be used. (1mark)

14-7 = 7cm^3

(ii) The time taken for the blue colour to appear. (2marks)

Correct showing ……..$\frac{1}{2}$mk Correct reading ……..$\frac{1}{2}$mk

Expression $\frac{1}{time}$ $\frac{1}{2}$mk ,correct answer$\frac{1}{2}$mk

d) Explain how the rate of reaction is affected by the volume of acidified potassium iodide. (1mark)

Rate of reaction increases with increase in volume of potassium iodide $\frac{1}{2}$mk , this is because increase in volume leads to corresponding increase in concentration.

2. You are provided with solution **G.** carry out the following tests and record your observations and inferences in the spaces provided.

a) Make the pH of the solution using 2 cm^3 of solution **G** and universal indicator paper.

observations	Inferences
pH 10	Weakly alkaline/basic ***reject weak base /alkali***
pH 11 or 12	Strongly alkaline/basic ***reject strong base /alkali***

(1mark) (mark)

b) To about 2 cm^3 of **G** in a test tube, add drop wise dilute nitric (v) acid until no further change. Retain the mixture for use in tests (c)(i) and (c)(ii)

observations	Inferences
Effervescence /bubbles of a gas /fizzing reject ; fizzling, hissing , colourless gas on its own (1mark)	HCO_3^-, CO_3^{2-}, SO_3^{2-} 3-ions 1mk, 2-ions $\frac{1}{2}$*mk ,1-ion (0 mark)* (1mark)

c) Divide the mixture obtained in (b) above into two portions.

(i) To the first portion, add 3 drops of lead (II) nitrate.

Observations	inferences
White precipitate	SO_4^{2-}, Cl^- ***penalize 1 mark for each contradictory ion to a maximum of 2mks***

(1mark) (2marks)

(ii) To the second portion, add 3 drops of aqueous barium nitrate.

Observations	inferences
White precipitate Reject white precipitate dissolves,white precipitate soluble, white solution	SO_4^{2-},***penalize 1 mark for each contradictory ion to a maximum of 1mk***

(1mark) (1mark)

d) Describe a test that you would carry out to find out if Zn^{2+} ions are present in solution **G**.

Observations	inferences
Add aqueous ammonia 1mk, dropwiswe till in excess	White precitate $\frac{1}{2}$*mk* solube in excess $\frac{1}{2}$*mk* ammonia confirms presence of Zn^{2+} Ignore soluble in excess if test was not complete
(2marks)	(1mark)

e) Carry out the test described in (d) above.

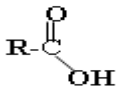
Observations	inferences
No white precipitate	Zn^{2+} absent
(1mark)	(1mark)

3. You are provided with solid **H**. carry out the following tests and record your observations and inferences in the spaces provided.

a) Place all of solid **H** in a boiling tube. Add about 10 cm^3 of distilled water and shake the mixture thoroughly.

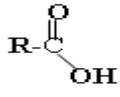
observations	inferences
dissolves $\frac{1}{2}$*mk to form a colourless solution* $\frac{1}{2}$*mk accept colourless solution formed* (1mark)	Polar compound/salt present Accept soluble salt present(1mark)

b) To about 2 cm^3 of the mixture in a test tube, add about half of the solid sodium hydrogen carbonate.

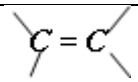
Observations	inferences
No effervesce /no bubbles of a gas (1mark)	 H_3O^+ ,H^+ , absent (1mks)

c) To the remaining amount of the mixture of **H** in the boiling tube and about 10 cm^3 of dilute hydrochloric acid. Shake thoroughly then filter the mixture. Wash the residue with distilled water. Dry the residue using filter papers. Use the residue for tests (i), (ii) and (iii) below.

(i) Place about one third of the residue a test tube. Add about 10 cm^3 of distilled water and warm the mixture. To the warm mixture, add the remaining amount of solid sodium hydrogen carbonate.

observations	inferences
effervesce /bubbles of a gas reject fizzling,sizzling hissing or colourless gas (1mark)	 H_3O^+ ,H^+ , present (1mks) Any of them 1mk, penalize fully for contradictory ion

(ii) To about one third of the residue in a test tube, add about 5 cm^3 of distilled water, shake the mixture and then add 3 drops of bromine water.

Observations	Inferences
orange /yellow/red bromine water not decolurised (1mk) accept yellow colour of bromine water persists/retained reject orange/red colour of bromine retained reject brown or red brown as colour of bromine (1mark)	 -C ≡C- *absent* (1mks)

(iii) To the remaining of the residue in the boiling tube, add about 10 cm^3 of distilled water, about 5 cm^3 of distilled sulphuric (VI) acid and then about 5 cm^3 of ethanol. Warm the mixture.

observations	inferences
Pleasant smell /fruity smell ***Reject sweet smell/fruity sweet smell***(1mark)	RCOOH/-COOH present **reject COOH present**(1mark)

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KCSE 2000

- Burette
- Pipette
- conical flask
- About 120mls of solution L (L is made by dissolving 5.6g of sodium carbonate in 500cm^3 of distillled water and diluting to one litre)
- About 80mls of solution M (0.176MHCl)

Q2

- ;solid G 3g of KNO_3
- Thermometer,stopwatch, plasic beaker

Q3.

- P is (0.5g $CUSO_4$ +0.5g Al_2SO_4)
- 2M NaOH
- 2M NH_4OH
- 2M HCl
- Acidiefied $BaCl_2$
- filter paper
- 2M HNO_3

KCSE 2001

Q1.

- Burette
- Pipette
- conical flask
- SOLUTION B 0.128MHCl
- About 80mls of Solution C (0.5M ethanoic acid)
- Solution D (0.082 M NaOH)
- Thermometer
- Measuring cylinder
- Boiling tube
- About 80mls of solution A (0.5MNaOH)
- Q2.solid E is $CaCl_2$
- Bunsen buener
- 2M H_2SO_4
- 2M$Pb(NO_3)_2$
- Q3. Solid F (0.5g tartaric acid)
- Red and blue litmus papers
- Bromine water
- Acidified $KMnO_4$
- 0.5g of solid G (0.5 $NaHCO_3$)