KENYA NATIONAL EXAMINATION COUNCIL
KCSE, 2014

CHEMISTRY PAPER 1
ANALYSIS

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3.5 CHEMISTRY (233)

In 2014, chemistry (233) was tested using two theory papers , 233/1, 233/2 and a practical paper (233/3). The two theory papers are marked out of 80 marks each while the practical paper is marked out of 40 marks.

Table 13: Performance of Chemistry in the Years 2010, 2011, 2012, 2013 and 2014

Year	Paper	Candidature	Maximum Score	Mean Score	Standard Deviation
2010	1	**347,364**	80	18.78	14.48
	2		80	16.19	13.25
	3		40	14.87	5.60
	Overall		**200**	**49.79**	**31.57**
2011	1	**403,070**	80	18.43	14.86
	2		80	16.99	13.95
	3		40	11.91	6.30
	Overall		**200**	**47.31**	**33.51**
2012	1	427,190	80	22.36	14.17
	2	427,212	80	17.18	14.50
	3	427,167	40	16.34	6.73
	Overall	**427,386**	**200**	**55.86**	**34.10**
2013	1	439,787	80	16.68	13.89
	2	439,770	80	18.31	14.25
	3	439,765	40	14.67	5.68
	Overall	**439,847**	**200**	**49.00**	**32.10**
2014	1		80	25.44	15.79
	2	**476,582**	80	21.33	13.46
	3		40	17.57	6.19
	Overall		**200**	**64.31**	**35.63**

From the table it can be observed that:-

(i) Performance in all the three papers went up.

(ii) Paper 1 (233/1) went up from a mean of 16.68 in 2013 to 25.44 in 2014.

(iii) Paper 2 (233/2) went up from a mean of 18.31 in 2013 to 21.33 in2014.

(iv) Paper 3 (233/3) went up from a mean of 14.67 2013 to 17.57 in 2014.

(v) Overall performance in chemistry (233) went up from a mean score of 49.00 to 64.

The candidature for the subject has continued to increase. In 2014 it increased by 5%.

The improved performance could be attributed to improved quality of setting and more important to improved quality of marking.

Questions which were performed poorly discussed bellow.

3.5.1 Chemistry Paper 1 (233/1)

Question 2

When dilute hydrochloric acid was reacted with solid B, a colourless gas which extinguished a burning splint was produced. When an aqueous solution of solid B was tested with a blue litmus paper, the paper turned red/ pink.

(a) Identify the anion present in solid B. (1 mark)

(b) Write an ionic equation for the reaction between solid B and dilute hydrochloric acid. (1 mark)

The question required candidates to;
1 identify an ion present in a solution which turns a blue litmus paper pink.
2 write an ionic equation for the reaction which would occur when the named ion reacts with a dilute acid.

Weaknesses
Candidates could not correctly identify the ion present in the solution. They also could not write the correct ionic equation. Many other candidates identified the ions as either hydrogen carbonate or as carbonate. Solutions containing these ions have a PH of 8 and therefore cannot be acidic. The weaknesses shown indicate that the topic on acids and normal salts is not practically taught in schools. Teachers are advised to cover all topics fully. All topics can be tested any time.

Expected response

(a) HSO_3^- (1)

(b) $HSO_{3(aq)}^{-1} + H^+_{(aq)} \longrightarrow H_2O_{(l)} + SO_{2(g)}$

or

$NaHSO_{3(s)} + H^+_{(aq)} \longrightarrow Na^+_{(aq)} + H_2O_{(l)} + SO_{2(g)}$

Question 4

Starting with zinc sulphate solution, describe how a sample of zinc oxide can be obtained. (3 marks)

Candidates were expected give a brief and concise description on the preparation of Zinc oxide from a solution of Zinc sulphate.

Weaknesses
Candidates did not know the effect of heat on Zinc sulphate and also how to convert Zinc sulphate solution to another Zinc salt that can easily be decomposed to Zinc oxide. In order to obtain Zinc oxide, Zinc sulphate can be reacted with a soluble solution of a group one element for example Sodium carbonate. This way, Zinc carbonate is formed which can now be decomposed to form Zinc oxide. Expose candidates to numerous methods of preparation of salts. Concepts are best learnt if some kind of discovery is made in the process of teaching . All efforts should be made to avoid theoretical teaching.

Expected response

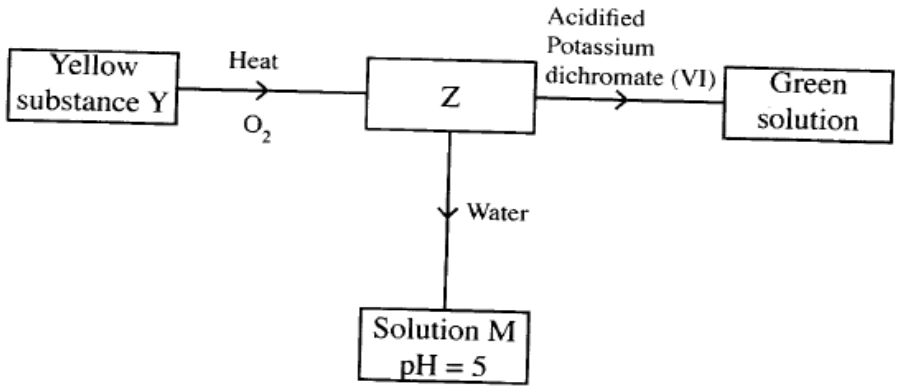
- Add soluble carbonate/Add soluble hydroxide.
- Filter out the zinc carbonate/filter the zinc hydroxide.
- Heat strongly the $ZnCO_3$ to decompose it to form ZnO/Heat strongly the $Zn(OH)_2$ to decompose it to form ZnO.

OR

- Heat to evaporate the water. (1)
- Heat $ZnSO_4$ solid to decompose (1) to form ZnO/yellow solid.

Question 11

Study the flow chart below and answer the questions that follow.



Identify Z and M. (2 marks)

Z .....

M .....

In this question candidates were expected to identify products formed when Sulphur is burnt in Oxygen, the reducing properties of sulphur dioxide and the PH values of weak acids.

Weaknesses

Majority of the candidates confused sulphur with ZnO and PbO due to its yellow colour. Others had no idea about the PH value of the weak acid formed when Sulphur(1V)oxide is dissolved in water. Once more candidates demonstrated lack of exposure to practical work. It is important for schools to embrace the practical approach method in the teaching of all science oriented subjects.

Expected response

Z is SO_2 / sulphur (IV) oxide.

M is H_2SO_3/ sulphuric (IV) acid.

Question 14

When 20 cm^3 of 1 M sodium hydroxide was mixed with 20 cm^3 of 1 M hydrochloric acid, the temperature rose by 6.7 °C. Assuming the density of the solution is 1 g/cm^3 and the specific heat capacity of the solution is 4.2 $Jg^{-1}\ k^{-1}$;

(a) calculate the molar heat of neutralisation; (2 marks)

(b) when the experiment was repeated with 1 M ethanoic acid, the temperature change was found to be lower than that with 1 M hydrochloric acid. Explain. (1 mark)

Candidates were required to calculate the molar heat of neutralization between a strong acid and a strong base They were also required to state why the molar heat of neutralization between a weak acid and a strong base is lower than that of strong acid with strong base.

Weaknesses

Many candidates did not know that the mass of the solution is the sum of the masses of the two solutions Others had no idea about the difference in the molar heats of solution. Measurement of enthalpy changes is one of the easiest and cheapest topics to teach practically as it involves cheap and easily available chemicals and equipment. Students need to see, touch ,hear etc during learning. Denying them this opportunity is unfair. There is need to embrace the 21st century approach where discovery is the norm. When experiments are used during learning the results should be thoroughly discussed.

Expected response

(a) Total volume of solution = 40 cm^3 / 40 g

$\Delta H = 40 \times 6.7 \times 4.2$

$= 1125.6/1000$

$= 1.1256$ KJ

Moles of acid $\frac{20}{1000} \times 1 = 0.02$ *moles*

0.02 moles = 0.1256

1 mole = $\frac{1.1256}{0.02}$ -56280 j/mol

= -56.28 KJ / mol

(b) Some energy is used to ionise the weak acid first before it can neutralise. So not all energy is used in neutralisation.