233/3
CHEMISTRY
PRACTICAL
PAPER 3
May/June 2014

EKSIKA JOINT EVALUATION TEST

Kenya Certificate of Secondary Education

INSTRUCTIONS TO SCHOOLS

The information contained in this paper is to enable the head of the school and the teacher in charge of Chemistry to make adequate preparations for this year's chemistry practical examination. **NO ONE ELSE** should have access to this paper or acquire of its contents. Great care **MUST** be taken to ensure that the information here in does not reach the candidates either directly or indirectly. The teacher in charge of chemistry should **NOT** perform any of the experiments in the same room as the candidate nor make the results of the experiments available to the candidates or given any other information related to the experiments to the candidates. Doing so will constitute an examination irregularity which is punishable.

In addition to the apparatus and the fittings found in a chemistry Laboratory, each candidate will require the following;

1. About $50cm^3$ of solution V
2. About $50cm^3$ of solution K
3. 1.89g of solid P accurately weighed and placed in a stopped container.
4. Thermometer (one)
5. Red and blue litmus
6. 5 dry test tubes in a test tube rack
7. Spatula
8. Bunsen burner
9. Solid P is oxalic acid
10. Solid S is ferrous ammonium sulphate; about 2g of solid S placed in a stopped container.
11. About $120cm^3$ of solution M
12. About $90cm^3$ of solution F

Access to;

a) Bunsen burner
b) 2M aqueous ammonia with a dropper
c) 2M sodium hydroxide with a dropper
d) 2M Barium chloride with a dropper
e) 2M Lead (II) nitrate with a dropper
f) Hydrogen peroxide with a dropper
g) Methyl orange with a dropper.

Notes

1. Solution V is a prepared by dissolving 63g of oxalic acid to make one litre of solution.
2. Solution K is prepared by dissolving 16g of sodium hydroxide pellets to make one litre of solution.
3. Solution M is prepared by dissolving $17cm^3$ of concentrated hydrochloric acid to make one litre of solution.
4. Solution F is prepared by dissolving 15.3g of hydrated sodium hydrogen carbonate to make one litre of solution.
5. Solid P is Oxalic acid
6. Solid S is furious ammonium Sulphate

NAME……INDEX NO……

CANDIDATE'S SIGNATURE……DATE…….

SCHOOL…….

233/3
CHEMISTRY
PAPER 3
PRACTICALS
MAY/JUNE 2014
TIME: 2 ¼ HOURS

EKSIKA JOINT EVALUATION TEST.

Kenya Certificate of Secondary Education (K.C.S.E)

233/3
CHEMISTRY
PAPER 3
PRACTICALS
MAY/JUNE 2014
TIME: 1 ¼ HOURS

INSTRUCTIONS TO CANDIDATES.

a) Write your name and index number in the spaces provided above.
b) Sign and write the date of examination in the spaces provided above.
c) Answer **ALL** questions in the spaces provided above.
d) All workings **MUST** be clearly shown where necessary.
e) You are not allowed to work with the apparatus for the first 15minutes of the 2 ¼ Hours allowed for this paper.This time is to enable you read the question paper and make sure you have all the chemicals and the apparatus that you may need.
f) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINERS' USE ONLY.

Question	Maximum Score	Candidates' Score
1	12	
2	40	
3	14	
	40	

This paper consists of 4 printed pages.
Candidates should check the questions paper to ascertain that all pages are printed as indicated and no questions are missing.

1 You are provided with:

Solution M 0.2M hydrochloric acid,

Solution F containing 15.3g per litre of basic compound $G_2X.H_2O$.

You are required to determine the relative atomic mass of G.

PRECEDURE:

Place solution M in a burette ,pipette 25cm^3 of solution F into a 250cm^3 conical flask. Add two drops of methyl orange indicator and titrate. Record your results in the table below. Repeat the procedure two more times and complete table I.

Table I

a) i)

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

(4mks)

ii) What is the average volume of solution M.? (1mk)

……

……

b) Given that one mole of F reacts with 2moles of M. Calculate the;

i) number of moles the basic compound,G_2X, $10H_2O$ in the volume of solution F used. (2mks)

……

……

……

……...

ii) Concentration of solution F in mole per litre. (2mks)

……

……

……

……

iii) Relative formula mass of the basic compound, $G_2X.10H_2O$. (1 ½ mks)

……

……

……

iv) relative atomic mass of G (Relative formula Mass of X=60 , atomic mass of H=1.0 , O=16.0). (1 ½ mks)

……

……

……

2 You are provided with:

1 1.899g of solid P, solid P is adiabatic acid H_2X.

2 0.5M Solution of the dibasic acid , H_2X , Solution V.

3 Sodium hydroxide, Solution K.

You are required to determine:

a) i) the molar heat of solid P.

ii) the heat of reaction of one mole of the dibasic acid with sodium hydroxide.

b) Calculate the heat of reaction of solid H_2X with aqueous sodium hydroxide.

PROCEDURE I.

Place $30cm^3$ of distilled water into a 100ml beaker. Measure the initial temperature of the water and record it in the table II below. Add all the solid P at once; stir the mixture carefully with the thermometer until all the solid dissolves. Measure the final temperature reached and records it in the table II

Table II

Final temperature (^oc)	
Initial temperature (^oc)	

a) Determine the change in temperature ΔT_1 (1½mks)

……

b) Calculate the:

i) heat change when H_2X dissolves in water, (Assuming the heat capacity of the solution is $4.2Jg^oK^{-1}$ and density is $1g/cm^3$) (2mks)

ii) number of moles of the acid that were used. (Relative formula mass of H_2X is 126) (1mk)

……

……

……..

iii) molar heat of solution ΔH_1 solution of the acid H_2X. (1mk)

……..

……..

……..

PROCEDURE II.

Place $30cm^3$ of solution V into a $100cm^3$ beaker. Measure the initial temperature and record it in table III below. Measure $30cm^3$ of sodium hydroxide, solution K.Add all of the $30cm^3$ of t of solution K at once to V in the beaker. Stir the mixture with the thermometer. Measure the final temperature reached and record it in table III.

Table III.

a)

Final temperature (^oC)	
Initial temperature (^oC)	

(1 ½ mks)

b) Determine the change in temperature, ΔT_2. (½ mk)

……

c) Determine the:

i) heat change for the reaction (Assume the heat capacity of the solution is $4.2Jg\text{-}1^{-1}{}_k{}^{+1}$ and density is $1g/cm^3$ (2mks)

……

……

ii) Number of moles of the acid used (H_2X). (1mk)

……..

……

……

iii) Heat of reaction , ΔH_2 of one mole of the acid H_2X with sodium hydroxide (1mk)

……

……..

……

……..

d) Given that,

ΔH_1 is the heat for reaction $H_2X_{(s)} \xrightarrow{\text{water}} 2H^+_{(aq)} + X^{2-}_{(aq)}$

ΔH_2 is the heat for the reaction $H^+_{(aq)}+OH^-_{(aq)} \longrightarrow H_2O_{(l)}$

Calculate ΔH_3 for the reaction $H_2X_{(s)} + 2OH^-1_{(aq)} \longrightarrow 2H_2O_{(l)} + X^{2-}_{(aq)}$(2mks)

……

……

……

……

……

3 You are provided with solid S. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Place about one third of solid S in a dry test tube. Heat the solid gently and the strongly. Test any gases produced with blue and red litmus papers.

Observations	Inferences
(2mks)	(1mk)

b) Dissolve the remaining portion of solid S in $8cm^3$ of distilled water.

i) Divide the solution into the first portions, to the first portion, add aqueous sodium hydroxide drop wise until in excess.

Observations	Inferences
(1mk)	(2mks)

ii) To the second portion , add aqueous ammonia dropwise in excess.

Observations	Inferences
(1mk)	(1mk)

iii) To the third portion , add 10cm^3 of barium chloride solution.

Observations	Inferences
(1mk)	(1mk)

iv) To the forth portion , add about 1cm^3 of Lead (II) nitrate solution.

Observations	Inferences
(1mk)	(1mk)

v) To the fifth portion, add about 2ml of hydrogen peroxide then about 1cm^3 of sodium hydroxide solution.

Observations	Inferences
(1mk)	(1mk)

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MARKING SCHEME

Question 1
Procedure 1 and procedure 2
Table 1 and table 2 5mks

A i) Complete table 1mk
ii) Complete table with 3 + titration done ½ mk
iii) Incomplete table with 1 titrations done 0mk

Penalties
i) way anthnetic/ substraction
ii) Inverted table
iii) Burette readings beyond 50 cm^3, unless explain
iv) Unrealistic titre value of acid – 0.9 cm3 or titre values in Jou's.

Penalise ½ mrk each to a natinum of ½ mrk is penalize ½ mrk once.

B. Use of decimal (OP)
- Tied to 1st and 2nd rows only…….1mk
(i) Accept 1 or 2 dps used consistently, otherwise penalize fully i.e either 1 mk or 0.
(ii) If 2 dp are used, 2nd dp place must be a zeroes or a fire (5) otherwise penalize fully.
(iii) Ignore inconsistency in values of initial burette reading as 0,0.0,0.00.

C. Accuracy..(1mk)
- Compare candidates correct titre value with school value (S.V) and tick the particular value choosen if it earns a mark.

Conditions
i) If atleast 1 titre value is within ± 0.1 of school value (SV) then a ward (1mk). E.g if SV = 16.8, then score 16.8, 16.9, or 16.7.
ii) If there is no value within ± 0.1 of SV but there is atleast 1 value within ± 0.2, award. ½ mk.
iii) If no titre value is within ± 0.2 of SV, award 0mk
NOTE
If there was wrong arithmetic or substraction, compare the SV with the correct work for value and award according e.g.
iv) If no SV value is given or SV cannot be worked out. As the candidates average titre values are written down then the close further session.
b) However if candidates average titre values are too varied, ignore and use councils value as SV.
c) Principle of average……91mk)

i) If 3 consistent value are average…..(1mk)
i.e largest…. Smallest ≤ 0.2

ii) If 3 titrations done but only 2 are consistent and are averaged….(1mk) e.g 19.6,19.0,19.0- averagable.

iii) But if only two titrations done but are consistent and averaged…..(1mk)

iv) If 3 titrations done but are inconsistent and are averaged..0mk

v) If 3 titrations are averaging but only 2 averaged award.0mk.

vi) If only 2 titrations are done and are inconsistent or are averaged award..0mk

vi) If only one titration done ….award 0mk

- The working must be shown to give ½ and ½ for answer but transfer the mark to the table for PA.

Penalise

i) Penalise ½ mk for wrong arithmetic if error is our side ± 2 only in the 2nd dp of average value expected.

ii) Penalise ½ mk if no working is shown but answer given is correct.

iii) If no working is shown and given answer is shown then PA attracts-0mk.

iv) Accept rounding off or 21.67, otherwise penalize fully, if rounded off to 1 dp or whole number e.g 21.70.

NOTE - Accept answer if it works out exactly to 1 dp or whole number and credit accordingly.

E. Final accuracy FA…1mk

Compare the candidates correct average titre with SV

i) If within ± 0.1 of SV, award 1mk

ii) If not within ± 0.1 but within ± 0.2 of SV, award ½ mk

iii) If beyond ± 0.2, award 0mk

NOTE - i) When there are 2 possible correct averagable titre values, use the one which is closer to the SV and credit accordingly.

Eg 16.6,16.4,16.2 ,SV = 16.5

So $\frac{16.6+16.4}{2}=16.5$

And not $\frac{16.4+16.2}{2}=16.3$

- Make a hek on the table value ,use to SV

ii) If wrong titre values were average pick the correct values, if any following the principle of averaging, average and award accordingly.

a) i)

Table 1	1	11	111
Final burette reading (cm^3)	28.0	28.0	
Initial burette reading (cm^3)	0.0	0.0	0.0
Volume solution K (used) (cm^3)	28.0	28.0	28.0

ii) Average volume of solution = $\frac{28+28+28}{3}=28cm^3$

b) i) Moles of solution K = $\frac{0.2 \times 28}{1000} = 0.0056 moles$ $\frac{0.2 \times titre\,value}{1000}$

mole ratio F : K = 1 : 2 = answer

mole % F = $\frac{1}{2} \times moles\ of\ K$ mole ration = ½ x

$\frac{1}{2} \times 0.0056 = 0.0028 moles$ answer 1

ii) Concentration of F concentration of F

25 cm^3 of F = 0.0028 moles $= \frac{1000 \times answer}{25 cm^3}$

$\therefore 1000 cm^3\ if\ = ?$ = answer.

$\frac{1000 \times 0.0028}{25} = 0.112 M$

iii) Molarity = $\frac{gl - 1}{RMF}$ RFM = $\frac{15.3}{answer\ in\ bii)}$

$0.112 = \frac{15.3}{RFM}$ = amswer.

$RFM = \frac{15.3}{0.112} = 136.6$

iv) 2G+60+18 = 136.6 2G+60+18 =

2G+78= 136.6 answer biii).

2G = 136.6- 78 G = answer.

2G = 58.6

G= 29.3

Procedure II

Q2. Table II

1. Complete table…..2 readings recorded…. ½ mk

Penalties.

i) penalize fully for any space not filled.

2. Use of decimal…… ½ mk

Accept temperature readings for ½ mk of consistently given either.

- Compare candidates temperature reading at initial temperature reading to school value atherwise penalize fully, indicate on the SV on the

Questions

a) $DT_1 = 21.5\text{-}18.5 = 3^0C$

Penalties

- Ignore formular for working DH1 but if given dh must be correct otherwise penalise ½ mk when formular is wrong.
- Penalise ½ mark for wrong units or omission of unity on the answer.
- Accept correct transfer of DT, even if rejected in (a) above.
- Penalise 1 mk for wrong arithmetic error.

ii) Number of moles $- \frac{g}{RFM} = \frac{1.89}{1.26} = 0.015$

Penalties

- Penalise ½ mk for wrong units used otherwise ignore if omitted.

iii) Molar heat of solution.

$$DH_1 = \frac{378}{0.015} \; or \; \frac{answer\ in\ (b)(i)}{answer\ in\ b(ii)}$$

$= + 25200 J\ mole^{-1}$

Or 25.2 KJ mol^{-1} = answers

Penalties

- Penalise ½ mk for transfer of either b(i) or b(ii), otherwise penalize fully for strange values.

Table III

1. Complete table ½ mk

Penalties

i) Penalise fully for any space not filled

2. Use of decimal….. ½

- Accept temperature readings for ½ mk if constantly given either as whole numbers or 1 decimal place of either (0) or S1 otherwise penalize fully.

3. Accuracy…. ½ mk

- Compare candidates temperature reading of initial temperature reading to the school value (SV)- award ½ mk, if the reading is within ± 2^0C of school value otherwise penalize fully.

Questions

b) $DT_2 = 24.5-21.0=3.5\ ^0C$

Pena;ties

- Penalise ½ mark for strange values substance
- Penalies ½ mark for wrong units

NB- ½ mark to be penalized once.

c) i) $DH_2 = MCDT_2$

$60g \times 4.25\ g^{-1}\ ^0C \times 3.5\ ^0C$

$= 882\ J$

$DH_2 = MCDT_2$

$60\ g \times 4.2\ Jg^{-1}\ ^0C^{-1} \times$ answer2

Penalties

- Ignore formular for DH_2 but if given DH_1 must be correct otherwise penalize ½ mk when formular is wrong.
- Penalise ½ mark for wrong unit or omission of unity on the answer.
- Accept correct transfer of DT1 even if rejected in (a) above
- Penalise 1mk for wrong arithmetic error.

ii) No of moles = $\frac{0.5 \times 30}{1000} = 0.015$

Penalties

- Penalise ½ mark for wrong unity used otherwise ignore if omitted.

iii) Molar heat of solution

$$\Delta H_{2}so\ln = \frac{882}{0.015}$$

$$= 58{,}800 KJmol^{-1}$$

$$= -58{,}8 KJmol^{-1}$$

$$= \frac{Answer\ in\ c(i)}{Answer\ in\ c(ii)} = answer$$

Pending:-

- Penalise ½ mark for wrong transfer of either c(i) or c(ii); otherwise penalize fully for storage values.

d)

$$\Delta H_{3} = \Delta H_{1} + \Delta H_{2}$$

$$= +25.2 + -58.8$$

$$= -33.6 KJmole^{-1}$$

OR

DH3 = answer in b(iii) + answer c(iii)= answer.

Penalties

- Penalise ½ mark for wrong transfer of either b(iii) or c(iii), otherwise penalize fully for storage figure.
- Penaliser ½ mark in the correct answer if either correct sign (-ve) or correct unit are missing or both are wrong missing.

Q3. a)

Observations	Inferences
- Red litmus changes blue - Blue litmus remains blue b) i) observation	NH^{+}_{4} present
Green ppt formed ii) observation	Fe^{2+} present Inference
Green ppt formed iii) observation	Fe^{2+} present Inference
White ppt formed iv) Observation	$SO_4{}^{2-}$presen`t
white ppt formed v) observation	$SO_4{}^{2-}$ present Inference
- Light green solution to yellow solution - Brown ppt formed	Fe^{3+} present