

Name Index Number.....

233/1

Class

CHEMISTRY

Adm Number.....

Paper 1

Date.....

March/April 2017

2 hours

FORM FOUR JOINT EVALUATION 2017

Kenya Certificate of Secondary Education

Chemistry

Paper 1

(THEORY)

2 hours

INSTRUCTIONS TO CANDIDATES

- (a) Write your name and index number in the spaces provided above.
- (b) Answer **all** the questions in the spaces provided.
- (c) KNEC mathematical tables and silent non-programmable calculators may be used.
- (d) **All** working **must** be clearly shown where necessary.
- (e) **This paper consists of 12 printed pages.**
- (f) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
- (g) **Candidates should answer the questions in English.**

For Examiner's use only

Questions	Maximum Score	Candidate's Score
1-27	80	

1 Part of a process to separate the gases in air is to cool air down to very low temperatures.

(a) The three main gases in air are nitrogen, oxygen and argon. Study the table below and use it the questions that follow.

Gas	Approximate percentage (%)	Boiling point (°C)
Nitrogen	78	-196
Oxygen	21	-183
Argon	0.9	-186

(a) Place the gases in order in which they would become liquids on cooling. ($1\frac{1}{2}$ marks)

First

Second

Third

(b) What is the name given to the process used to separate the gases in air? ($\frac{1}{2}$ marks)

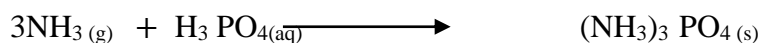
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(c) The test for oxygen is that it relights a glowing splint.

Why do glowing splints **not** relight in air? (1 mark)

.....

2 Ammonia, a weak base, can be used to make the fertilizer ammonium phosphate.



(i) What is meant by a weak base? (1 mark)

(ii) Calculate the mass of ammonium phosphate that would be produced from 510 g of ammonia. (2 marks)

3 Vinegar is an aqueous solution of ethanoic acid .

(a) A Solution of vinegar contains 6 g of ethanoic acid, CH_3COOH , in a 100 cm^3 of solution. Calculate the concentration in moles per litre of this solution. (C=12, O=16, H=1) (3 marks)

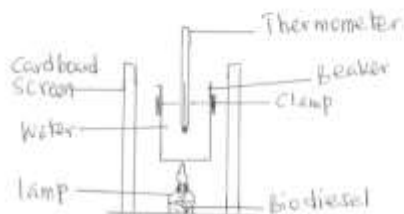
4 A student compared some properties of ethanoic acid with hydrochloric acid

	0.1 M Hydrochloric acid solution	0.1 M ethanoic acid solution
Reaction with Magnesium	fast	
Current Conductivity	high	

(a) Complete the table to show how the properties of ethanoic acid compare with hydrochloric acid. (2marks)

(b) Explain the answers in part (a) above. (1mark)

5 The energy produced by biodiesel fuel can measured using the following arrangement.



- (a) Calculate the energy absorbed by the water when 0.1kg of water is heated from 18 °C to 26°C using 5g of biodiesel. (Specific Heat Capacity of water = $4.2 \text{ kJ kg}^{-1} \text{ K}^{-1}$) (1 mark)

- (b) Calculate the molar heat of combustion of biodiesel. (molar mass of biodiesel = 270g)

(2 marks)

- 6 Professional road racing bikes are made from carbon fibre containing Kevlar.

The monomers from which Kevlar is made have the structures below



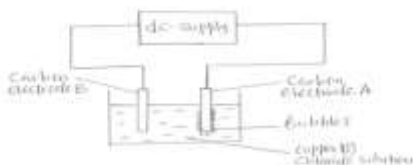
- (a) State **one** advantage of using synthetic polymers.

(1 mark)

(b) Draw the structural formula of the polymer. (1mark)

7 Describe how magnesium sulphate crystals can be prepared by using excess magnesium with dilute acid. (3marks)

8 Study the diagram below which shows the electrolysis of copper (II) chloride using carbon electrodes and answer the questions that follow.



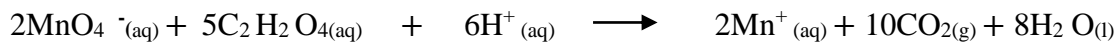
(a) What is meant by electrolysis?. (1mark)

(b) Complete the table below by adding the name of each electrode. (2marks)

Observation at Electrode A	Observation at Electrode B
Bubbles	Brown solid formed
Name of electrode A	Name of electrode B
.....

- 9 (a) In an experiment a student carried out a reaction between oxalic acid and acidified potassium manganate (VII) in the laboratory.

The equation for the reaction is:



The student found out that when powdered oxalic acid was used the reaction was faster. Using collision theory explain why grinding to a powder increases the rate of the reaction. (2marks)

- (b) What type of reaction is represented by the equation in (a) above? (1mark)

- 10 A gold atom has atomic number of 79 and a mass number of 197.

Complete the table below to show the name and number of each sub-atomic particle in this gold atom.

Name	Number
Proton	79
Electron
.....

(3marks)

- 11 (a) Iron is extracted by heating a mixture of iron(III) oxide and carbon (II) oxide in a blast furnace.

Name this type of reaction.

(1mark)

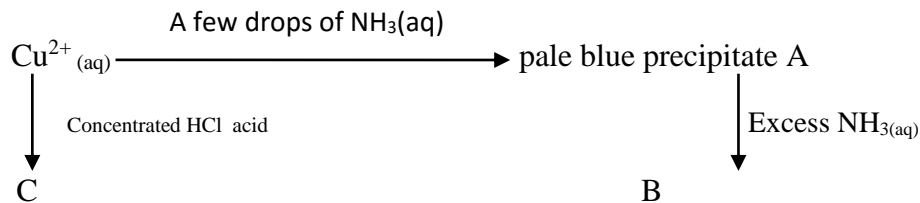
(b) Write a balanced chemical equation for this reaction

(1mark)

(c) State **one** use of wrought iron

(1mark)

12 The following scheme shows some reactions of $\text{Cu}^{2+}_{(\text{aq})}$



Write the formula of each of the following

(3marks)

A _____

B _____

C _____

13 The key step in the contact process for the manufacture of sulphuric (VI) acid is the reversible conversion of sulphur (IV) oxide to sulphur (VI) oxide in the presence of vanadium (V) oxide catalyst.



(a) What is the effect of increasing the temperature on the yield of sulphur (VI) oxide.

Explain

(2marks)

(b) Draw a dot (.) and cross(x) diagram to show bonding in oxygen molecule. (1mark)

14 (a). Define the term ionization energy

(1mark)

(b) The first seven ionization energies for an element A , in kJ/mol are:

1012 1903 2912 4957 6274 21269 25396

- (i) State the group of the Periodic Table to which A is most likely to belong.
Explain your answer. (2marks)

(ii) Complete the electronic configuration of the element in Period 2 that is in the same group as

Element A. (1mark)

15 The chlorides of elements in Period 3 of the Periodic Table show different behaviours on addition to water, depending on their structure and bonding.

- (i) Write equations to show the behaviour of sodium chloride, NaCl, and silicon chloride, SiCl₄, when separately added to excess water. (2marks)

NaCl.....

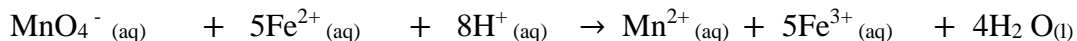
SiCl₄.....

- (ii) State the differences in the solution formed when these two chlorides are added to water in terms of their structure and bonding. (2marks)

16 A 25.0 cm³ of acidified iron (II) sulphate solution containing 3.40g of FeSO₄ .x H₂ O in 250 cm³ solution required 20.0 cm³ of 0.02M potassium manganate(VII).

(a) Explain, in terms of electron transfer the meaning of oxidation. (1mark)

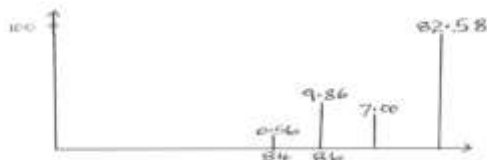
(b) Given the ionic equation for the reaction between the manganate(VII) ions and the iron (II) ions below:



Calculate the value of x in the formula $\text{FeSO}_4 \cdot x\text{H}_2\text{O}$. (Fe=56, S=32, O=16, H=1)

(2marks)

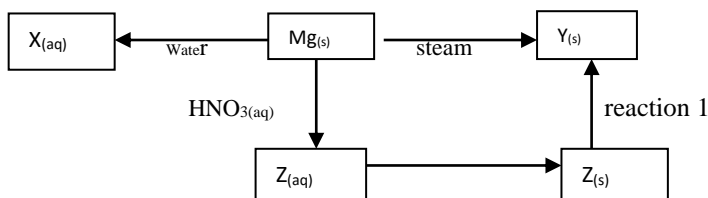
17 A sample of strontium, atomic number 38, gave the mass spectrum shown. The percentage abundances are given above each peak.



(i) Explain why there are four different peaks in the spectrum of strontium. (1mark)

(ii) Calculate the relative atomic mass R.A.M of this sample of strontium. (2marks)

- 18 Some reactions involving magnesium and its compounds are shown in the scheme below. Study it and answer the questions that follow.



- (a) Give the formulae of the compounds X and Y (2marks)

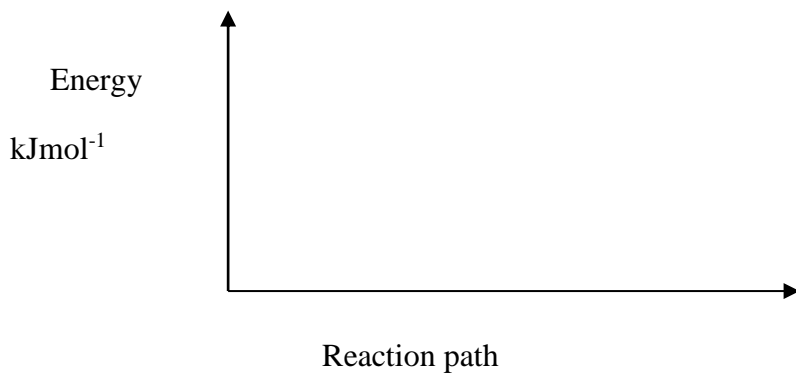
X _____

Y _____

- (b) Write an equation for the conversion of $Z_{(s)}$ to $Y_{(s)}$ in reaction (1mark)

- 19 State **two** uses of sodium carbonate. (2marks)

- 20 On the axes below sketch the diagram showing the energy changes during an exothermic Reaction. (3marks)



- 21 (a) Explain why when chlorine reacts with potassium iodide, the solution turns brown. (2marks)

(ii) State one use of chlorine other than as a bleaching agent. (1mark)

22 (i) ${}_{11}^{24}\text{Na}$ represents an atom of sodium.

How many nucleons and how many charged particles are there in one atom of sodium?

Number of nucleons..... (1mark)

Number of charged particles..... (1mark)

(ii) State **one** use of radioactive isotopes in agriculture. (1mark)

23 Describe how to separate copper powder from a mixture containing copper and zinc powders.

(3marks)

24 A compound X contains 55.85 % carbon, 6.97 % hydrogen and 37.18 % oxygen.

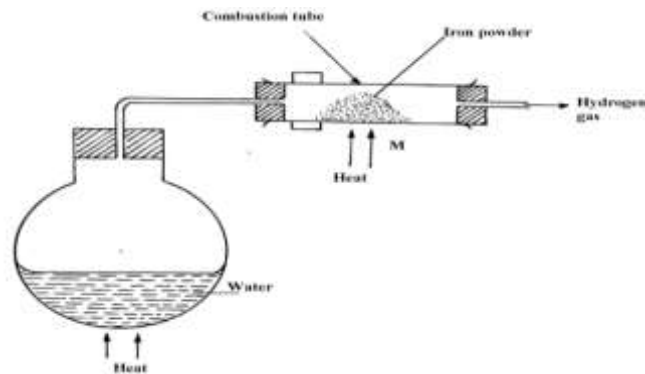
(i) How does this prove that compound X contains only carbon, hydrogen and oxygen? (1mark)

(ii) Calculate the empirical formula of compound X (2marks)

- 25 Chromatography is a method of separating components of a solution mixture by passing it through a medium where the different components move at different rates aided by a solvent.

State two factors that determine how far a given component can be spread by a solvent. (2marks)

- 26 Study the diagram below and use it to answer the questions that follow.



- (i) Between the flask and point M which part should be heated first? Explain. (2marks)

- (ii) Write a chemical equation for the reaction occurring in the combustion tube. (1mark)

- 27 (a) Define the term allotropy. (1mark)

- (b) Name two allotropes of carbon. (2marks)
