BURETI SUB-COUNTY JOINT EVALUATION TEST
233/1
CHEMISTRY
PAPER 1

1. a) What name is given to the process by which alcohol is formed from a carbohydrate. (1 mark)
b) Explain why the solubility of ethane in water is lower than that of ethanol. (2 marks)

2. When solid A was heated strongly, it gave off water and a solid residue. When water was added to the solid residue, the original solid A was formed.
a) What name is given to the process described. (1 mark)
b) Give **one** example of solid A. (1 mark)

3. The table below gives some properties of three elements in group VII of the periodic table. Study it and answer the questions that follow.

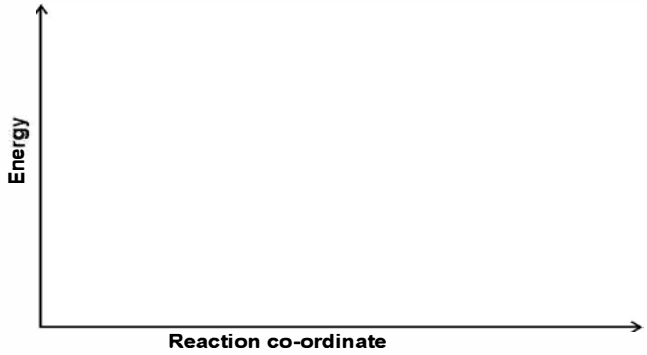
Element	Atomic No.	Melting point (°C)	Boiling point (°C)
Chlorine	17	-101	-34.7
Bromine	35	-7	58.8
Iodine	53	114	184

a) Which element is in liquid form at room temperature ? Give a reason. (1 mark)
b) Explain why the boiling point of Iodine is much higher than that of chlorine. (2 marks)

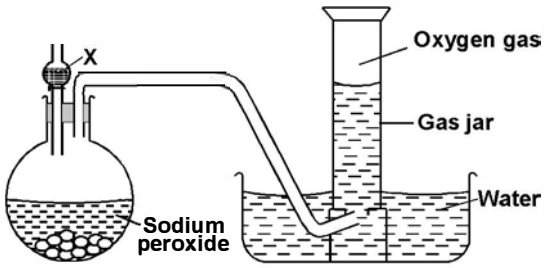
4. The thermochemcial reaction between carbon and sulphur is as shown by the equation below.

$$C_{(S)} + 2S_{(S)} \rightarrow CS_{2(l)} \quad \Delta H = +117kJmol^{-1}$$

On the grid below, sketch and label the energy level diagram for the reaction. (2 marks)



5. The set-up below can be used to prepare oxygen gas. Study it and answer the questions that follow.



a) Identify X ..... (1 mark)
b) What property of oxygen makes it possible for it to be collected as shown in the above set-up? (1 mark)
c) State **two** uses of oxygen (1 mark)

6. Describe an experimental procedure that can be used to extract oil from nut seeds. (2 marks)

7. A beaker contained 75.0cm^3 of aqueous copper (II) sulphate at 23.7°C. When scrap Iron metal was added to the solution, the temperature rose to 29.3°C
a) Write an equation for the reaction that took place. (1 mark)
b) Given that the mass of copper deposited was 5.83g, calculate the molar enthalpy change in kJmol^{-1} (specific heat capacity of solution = 4.2Jg^{-1}k^{-1}, density of solution = 1.0g/cm^3, Cu=63.5) (2 marks)

8. Analysis of a compound showed that it had the following composition:
69.42%, carbon, 4.13%, Hydrogen and the rest oxygen.
a) Determine the empirical formula of the compound. (C=12.0, H=1, O=16) (2 marks)

b) If the mass of one mole of the compound is 242, determine its molecular formula. (1 mark)

9. The diagram below represents part of the periodic table. Use it to answer the question that follow.

M					Q			
T	V		W					

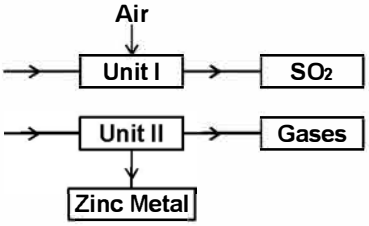
a) Write the electronic arrangement for the stable ion formed by W. (1 mark)

b) Write an equation for the reaction between V and Q (1 mark)

c) How do the ionisation energies of element M and T compare? Explain. (1 mark)

10. Distinguish between the terms deliquescent and efflorescent as used in chemistry. (2 marks)

11. The flow chart below shows some processes involved in the industrial extraction of zinc metal.



a) Name **one** ore from which zinc is extracted. (1 mark)

b) Write the equation for the reaction taking place in unit II. (1 mark)

c) Name **two** uses of zinc metal. (1 mark)

12. The use of CFCs has been linked to depletion of the ozone layer.

a) What does CFC stand for? (1 mark)

b) Explain the problem associated with the depletion of the ozone layer. (1 mark)

c) State another environmental problem caused by CFC. (1 mark)

13. The table below gives the solubilities of substances T and U at 10°C and 40°C.

Substance	Solubility g/100g water	
	10°C	40°C
T	40	65
U	15	17

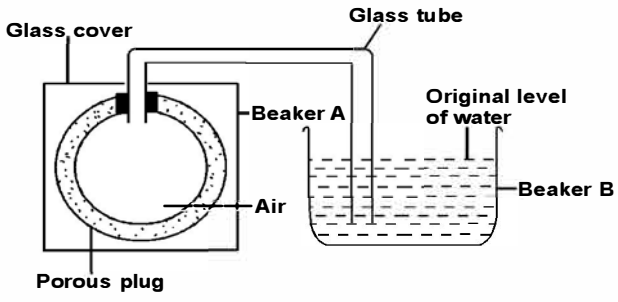
When an aqueous mixture containing 55g of T and 12g of U at 80°C was cooled to 10°C, crystals formed.

a) Identify the crystals formed. (1 mark)

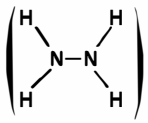
b) Determine the mass of the crystals formed. (1 mark)

c) Name the method used to obtain the crystals. (1 mark)

14. The set-up shown below was used to investigate a property of hydrogen gas.



State and explain the observation that would be made in the glass tube if beaker A was filled with hydrogen gas. (3 marks)

15. Hydrazine gas  burns in oxygen to form nitrogen gas and steam.

a) Write an equation for the reaction. (1 mark)

b) Using the bond energies given below, calculate the enthalpy change for the reaction in (a) above. (2 marks)

Bond	Bond energy (kJ per mole)
N □□N	944
N - N	163
N - H	388
O = O	496
H - O	463

16. Aqueous, hydrogen chloride gas reacts with potassium manganate (VII) to produced chlorine gas while a solution of hydrogen chloride in methylbenzene has no effect on potassium manganate (VII). Explain this observation. (2 marks)

17. a) What would be observed if sulphuric (IV) oxide is bubbled through acidified potassium manganate (VII)? (1 mark)

b) In an experiment, sulphuric (IV) oxide was dissolved in water to form solution L.

i) What would be observed if a few drops of barium nitrate solution were immediately added to solution L ? (1 mark)

ii) Write an ionic equation for the reaction that occurred between solution L and aqueous barium nitrate in b(i) above. (1 mark)

18. a) Diamond and graphite are allotropes of carbon. What is meant by an allotrope? (1 mark)

b) Explain why graphite can be used as a lubricant while diamond cannot. (2 marks)

19. A solution was made by dissolving 8.2g of calcium nitrate to give 2 litres of solution (Ca=40, N=14, O=16). Determine the concentration of nitrate ions in moles per litres. (3 marks)

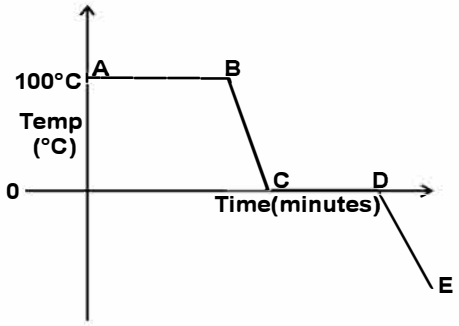
20. The atomic number of an element T is 15.

a) Write the electronic configuration of the ion T^{3-}. (1 mark)

b) Write the formula of an oxide of T. (1 mark)

21. Dilute sulphuric (VI) acid was electrolysed using platinum electrodes. Name the product formed at the anode and give a reason for your answer. (2 marks)

22. The graph below is a cooling curve for water. Study it and answer the questions that follow.



a) Explain what happens to the molecules of water in the region BC in terms of kinetic theory. (2 marks)

b) In what state is the water in the region DE? (1 mark)

23. a) Describe how carbon(IV) oxide can be distinguished from carbon (II) oxide using calcium hydroxide solution. (2 marks)

b) What is the role of carbon (IV) oxide in fire extinguishing? (1 mark)

24. Study the standard electrode potentials in the table below and answer the questions that follow.

	E^{θ} volt
$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(S)}$	+ 0.34
$Mg^{2+}_{(aq)} + 2e^- \rightarrow Mg_{(S)}$	-2.38
$Ag^{+}_{(aq)} + e^- \rightarrow Ag_{(S)}$	+0.80
$Ca^{2+} + 2e^- \rightarrow Ca_{(S)}$	-2.87

a) Which of the metals is the strongest reducing agent. (1 mark)

b) What observations will be made if a silver coin was dropped into an aqueous solution of copper (II) sulphate? Explain. (2 marks)

25. a) Name the raw material from which sodium is extracted. (1 mark)

b) Give a reason why sodium is extracted using electrolysis. (1 mark)

c) Give **two** uses of sodium metal. (1 mark)

26. When magnesium carbonate is heated the equilibrium shown below is established.

$$MgCO_{3(S)} \rightleftharpoons MgO_{(S)} + CO_{2(g)}$$

How would the position of the equilibrium be affected if a small amount of dilute potassium hydroxide solution is added to the equilibrium mixture. Explain (2 marks)

27. In an experiment three separate samples of water were tested using soap solution to find out the volume of soap needed to form permanent lather with 1000cm^3 of the water sample. Each sample was boiled and again the amount of soap required was determined. The following results were obtained

	SAMPLE		
	I	II	III
Volume of soap required before boiling (cm^3)	27.0	3.0	10.6
Volume of soap required after boiling (cm^3)	27.0	3.0	3.0

a) Explain the change in the volume of soap solution in sample III. (2 marks)

b) Write down the formula of the compounds present in sample I. (1 mark)

28. Calculate the oxidation state of <u>sulphur</u> in the following compounds. (2 marks)

i) $Na_2S_2O_3$ .....

ii) H_2S .....

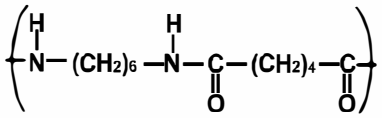
29. Aluminium oxide reacts with both dilute acids and alkalis.

Write the equation for the reaction between aluminium oxide and

i) dilute sulphuric acid. (1 mark)

ii) Sodium hydroxide solution (1 mark)

30. The following is a structure of a polymer.



a) Draw the structures of the monomers forming the above polymer. (2 marks)

b) Identify the type of polymerization represented above. (1 mark)

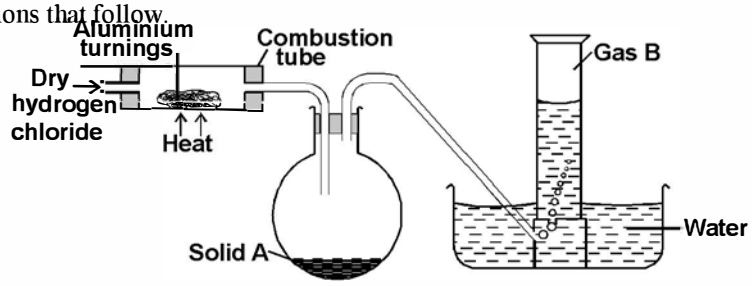
BURETI SUB-COUNTY JOINT EVALUATION TEST
233/2
CHEMISTRY
PAPER 2

1. **a)** The table below shows some elements of the periodic table and their atomic numbers (The letters do not represent the actual symbols of the elements). Study it and answer the questions that follow.

Element	A	B	C	D	E	F	G	H	I	J
Atomic number	1	7	8	19	15	2	9	6	16	20
Electronic configuration										

i) Complete the table by filling the electronic configuration for each element. (5 marks)
ii) Which letter represents:
I. The most powerful reducing agent.
Explain 1 mark)
II. The most powerful oxidizing agent
Explain. (1 mark)
iii) Select two elements with oxidation state of -2. (1 mark)
iv) Which element has the highest first ionization energy? Explain. (1 mark)
v) Select two elements which when reacted form a compound that conducts electricity both in molten and aqueous state. (1 mark)
vi) Which two elements when reacted form a compound that dissolves in water to form an acidic solution? (1 mark)
vii) Using dots (•) and cross (×) to represent electrons, show the bonding in a compound formed when A combines with B. (2 marks)

2. The diagram below shows a set up in which dry hydrogen chloride gas was reacted with aluminium turnings. Study it and answer the questions that follow.



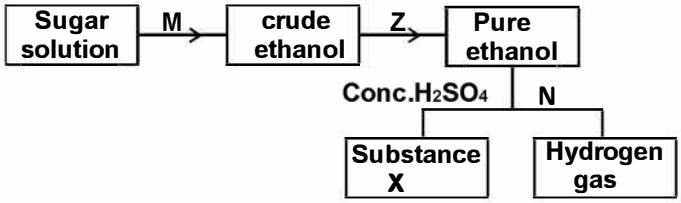
a) Name two reagents that are commonly used to prepare hydrogen chloride gas and write an equation for the reaction.
Reagents
Equation (1 mark)
b) Name two reagents that would be used to dry hydrogen chloride gas.
c) Name
Solid A ..... (½ mark)
Gas B ..... (½ mark)
d) Explain why it is possible to collect solid A using the method shown. (1 mark)
e) Give an equation for the reaction that takes place in the combustion tube. (1 mark)
f) After the reaction has gone on for some time, the water in the trough turns blue litmus paper red. Explain. (1 mark)
g) State and explain the observation that would be made if Aluminium was replaced with copper in the combustion tube. (2 marks)
h) Potassium manganate (VII) oxidizes concentrated hydrochloric acid forming chlorine gas as per the equation below.

$$2KMnO_{4(S)} + 16HCl_{(aq)} \rightarrow 2KCl_{(aq)} + 2MnCl_{2(aq)} + 8H_2O_{(l)} + 5Cl_{2(g)}$$

Calculate the maximum volume of chlorine measured at standard temperature and pressure that can be obtained when 15.8g $KMnO_4$ reacts completely with hydrochloric acid.
(K=39, Mn = 55, O=16, M.G.V at s.t.p = 22.4dm³) (3 marks)

3. a) Draw the structural formula of each of the following organic compounds.
i) Ethan-1, 2-diol (1 mark)
ii) Magnesium -2- methyl butanoate. (1 mark)
iii) Ethylbutanoate (1 mark)

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



Name

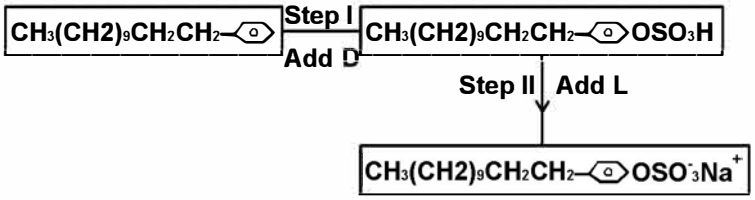
i) Substance M ..... (½ mark)

ii) Process Z ..... (½ mark)

iii) Substance N ..... (½ mark)

iv) Substance X ..... (½ mark)

c) The flow chart below shows the manufacture of a cleansing agent.



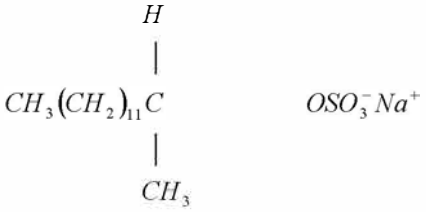
i) Name substances D,L

ii) Explain how the above cleansing agent improves the cleaning properties of water. (1 mark)

iii) Give one advantage of using this cleaning agent over ordinary soap. (1 mark)

d) The formulae below represent active ingredients of two cleansing agents A and B.

A.



B.

$$CH_3(CH_2)_{16}COO^-Na^+$$

Which one of the cleansing agents would be <u>least</u> suitable for washing in water containing magnesium hydrogen carbonate? Explain. (2 marks)

e) Dacron is a synthetic fibre formed by polymerization reaction between a dicarboxylic acid and a diol (a polyhydric alkanol)

$$HOOC–C_6H_4–COOH$$

Dicarboxlic acid

$$HO(CH_2)_2OH$$

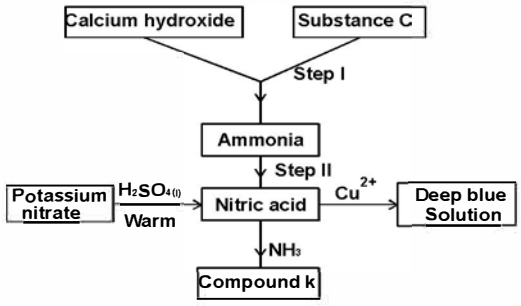
Ethanel -1, 2 - diol

i) Show how polymerization between the two occurs. (1 mark)

ii) Name the type of polymerization involved in forming <u>Dacron</u> (1 mark)

iii) Give one advantage of synthetic fibres over natural fibres. (1 mark)

4. a) Use the flow chart drawn to answer the questions that follow.



Name

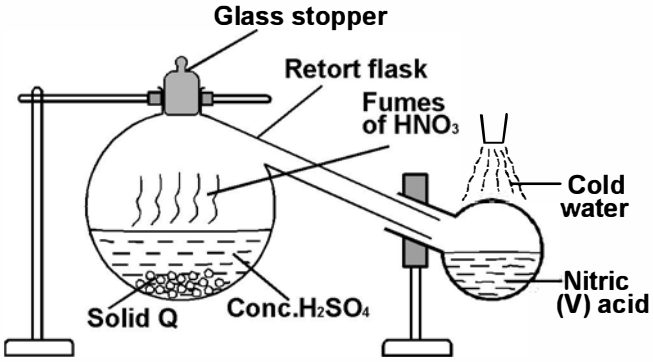
I. i) Substance C ..... (½ mark)

ii) Compound K ..... (½ mark)

iii) The deep blue solutions ..... (½ mark)

II. Write the formula of compound K. (½ mark)

b) The following set-up is used to prepare nitric (V) acid in the laboratory.



i) All the apparatus used during preparation of nitric (V) acid are made of glass. Give a reason. (1 mark)
ii) Name solid Q ..... .(1 mark)
iii) Give a reason why it is possible to separate nitric (V) acid from the sulphuric (VI) acid used as one of the reagents. (1 mark)
iv) Give two uses of nitric (V) acid. (2 marks)

c) In an experiment, 1200cm³ of ammonia gas measured at r.t.p reacted completely with copper (II) oxide. Calculate
i) The mass of copper formed. (3 marks)
ii) The volume of the nitrogen gas formed. (2 marks)

(N=14, H=1, Cu=64, O=16, M.G.V. at r.t.p = 24dm^{-3})

5. a) State Charles's law. (1 mark)
b) The table below shows the relationship between the volume of a fixed mass of a gas and its temperature (°C) at constant pressure.

Volume (cm³)	30	32	34	37	39	41	43
Temperature (°C)	0	20	40	60	80	100	120
Temperature (K)							

i) Complete the table by filling the corresponding temperature in Kelvin. (3½ marks)
ii) Plot a graph of volume (cm³) on the vertical axis against temperature in Celsius on the Horizontal axis using a temperature range : -300°C to 120°C (3 marks)
iii) Extrapolate the graph in (ii) above to cut the horizontal axis and read the temperature value. (1 mark)
iv) Determine from the graph, the volume of the gas when the temperature is -225°C. (1 mark)

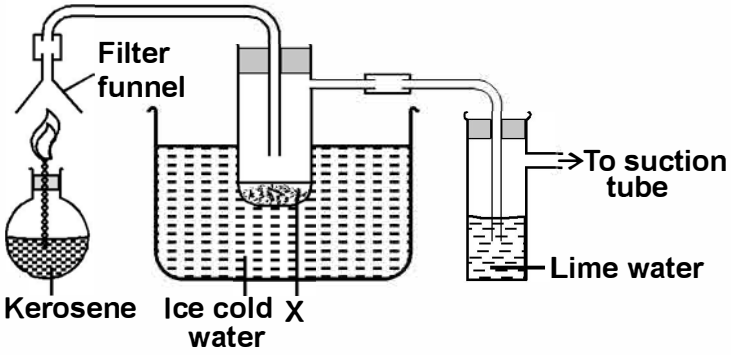
c) A balloon contains 100cm³ of air at 25°C. The balloon was put outside in the sun where the temperature was 40°C. Calculate the new volume of air. (2½ marks)

6. a) The table below shows the observation made when an electric current was passed through two substances, A and B.

Substance	Observation
Molten A	conducts an electric current and a greyish substances is deposited at the cathode
Molten B	Conducts an electric current and is not decomposed.

i) Give the type of structure and bonding that is present in substances A and B.
Substance A
Structure ..... (1 mark)
Bonding ..... (1 mark)
Substance B
Structure ..... (1 mark)
Bonding ..... (1 mark)
ii) Name the particles that are responsible for electrical conductivity in
Substance A ..... .(½ mark)
Substance B ..... (½ mark)
iii) Which of the two substances would not conduct electricity in its solid state? Explain. (2 marks)
iv) If one of the substances is metal bromide, state the observation you would expect to make at the anode (1 mark)
v) In what other state would you expect substance A to conduct electricity ? Explain. (2 marks)

7. The diagram below shows an experiment to demonstrate the products formed when an organic compound burns in air. Study it and answer the questions that follow.



a) Identify liquid X..... (½ mark)
b) Describe how liquid X would be tested to confirm its purity. (2 marks)
c) State the role of ice-cold water in the experiment. (½ mark)
d) State and explain the observation that would be made in the boiling tube containing lime water. (2 marks)
e) When a certain hydrocarbon is burnt completely in excess oxygen, 5.28 g of carbon (IV) oxide and 2.16g of water were formed. If the molecular mass of the hydrocarbon is 84, determine the molecular formula of the hydrocarbon.

BURETI SUB-COUNTY JOINT EVALUATION TEST
Paper - 233/3
CHEMISTRY PRACTICAL
PAPER 3

1. You are provided with
- 1.5g of solid P, a metal hydrogen carbonate, $MHCO_3$
- Hydrochloric acid solution Q
- Solution R, which was prepared by dissolving 10.5g of $MHCO_3$ in about 100cm³ of distilled water and topping up to 250ml Mark of the solution.

You are required to:
- Standardise solution Q using solution R
- Determine the enthalpy change for the reaction between solution Q, hydrochloric acid and solution R, $MHCO_{3(aq)}$

Procedure I
i) Pipette exactly 25cm³ of solution R into a clean 250ml. Conical flask.
ii) Add two drops of methyl orange indicator.
iii) Fill the burette with solution Q
iv) Titrate solution Q with solution R. Stop titrating when a permanent colour JUST appears, and record your results in the table below.
v) Repeat procedure (i) and (iv) and complete table 1 below.

Table 1

Experiment Number	I	II	III
Final burette reading (cm³)			
Initial burette reading (cm³)			
Volume of solution Q used (cm³)			

(4 mar

a) Workout the average volume of solution Q used. (1 mark)
Calculate the :
b) Concentration of R in moles per litre (RFM of $MHCO_3$ = 84) (2 marks)
c) Number of moles of :
i) solution R in 25cm³ used. (1 mark)
ii) Solution Q in the averaged titre (1 mark)
d) Molarity of solution Q. (1 mark)

PROCEDURE II.
i) Fill the burette with solution Q.
ii) Measure exactly 35cm³ of solution Q from the burette and place it in a clean 250cm³ plastic beaker.
iii) Using a thermometer stir and take the temperature of solution Q every 30 seconds. Record the readings in table II below. At exactly 150 seconds add ALL solid P into the contents in the plastic beaker and stir gently. Continue taking the temperature

every 30 seconds and complete the table II below. **(5 marks)**

Time (sec)	0	30	60	90	120	150	180	210	240	270	300
Temperature (°C)											

a) On the grid provided, plot a graph of time (seconds) against temperature (Y -axis) (3 marks)
b) Using your graph determine the change in temperature. show your working. (1½ marks)
c) Calculate the
   i) enthalpy change in Joules for the reaction when 1.5g of solid P was used (specific heat capacity of the solution is $4.2Jg^{-1}k^{-1}$, density of solution is $1.0gcm^{-3}$) (2 marks)
   ii) Molar enthalpy change for the reaction in Kilojoules per mole. (1½ marks)

2. You are provided with solid F. You are required to carry out the tests, write observations and inferences in the table below.
a) Place a spatula end full of solid F into a clean dry test tube. Heat it gently followed by strong heating, while the mouth of the test tube faces away from you. Test for any gases produced (if any) with red an blue litmus papers.
b) Place another spatula end full of solid F into a clean boiling tube and shake thoroughly for about one minute. Retain and divide the result into four 2mls portions for future use in (c) to (f) below
c) To the first portion add 3 drops of sodium carbonate solution
d) To the second portion add aqueous ammonia dropwise until in excess.
e) To the third portion, add six drops of lead (II) nitrate solution. Shake the contents well and filter.
f) To the fourth portion, add three (3) drops of calcium nitrate solution followed by five drops of dilute hydrochloric acid.

3. You are provided with an organic compound solid K. You are required to carry out tests,, write the observations and the inferences in the spaces provided.
Place a spatula endfull of solid K into a clean boiling tube. Add about $15cm^3$ of distilled water and shake the mixture thoroughly.
a) Place about $2cm^3$ portion into a clean test-tube add 2 drops of acidified potassium manganate (VII) solution.
b) To another $2cm^3$ portion in a different clean test-tube add 2 drops of acidified potassium dichromate (VI) solution.
c) To the third portion add half spatula of solid sodium hydrogen carbonate.

CONFIDENTIAL INSTRUCTIONS

Each candidate should be provided with the following :
- orange / lemon
- DCPIP
- scalpel blade
- a dropper
- a 10ml measuring cylinder
- 2 test tubes
- a beaker
- bone M - lumbar vertebra
  N - cervical vertebra

BURETI SUB-COUNTY JOINT EVALUATION TEST
233/1
CHEMISTRY
Marking scheme

1.
a) Fermentation.
b) Ethane remains in molecular form while ethanol forms hydrogen bonds with water.

2.
a) Reversible reaction / temporary chemical change.
b) Hydrated copper (II) sulphate, hydrated cobalt (II) chloride, hydrated copper (II) chloride.

3.
a) Bromine : At room temperature (25°C), bromine is liquid since its melting and boiling points is below -7 and 59.
b)
- Atomic mass of iodine is higher than that of chlorine.
- Van der Waals forces are stronger in Iodine than chlorine hence iodine's boiling point is higher than that of chlorine.