CHEMISTRY PAPER 233/1 K.C.S.E 2001
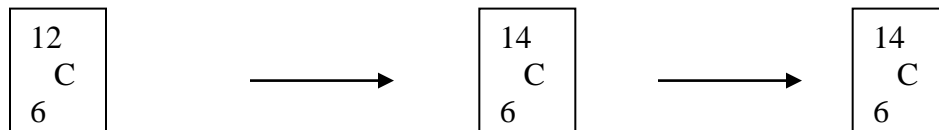## QUESTIONS

1. Study the nuclear reaction given below and answer the questions that follow.

$$\boxed{^{12}_{6}\text{C}} \longrightarrow \boxed{^{14}_{6}\text{C}} \longrightarrow \boxed{^{14}_{6}\text{C}}$$

(a) 12 and 14 are isotopes. What does the term isotopes. What does the term isotope mean?
$^{12}_{6}\text{C} \quad ^{14}_{6}\text{C}$

(b) Write an equation for the nuclear reaction in step II

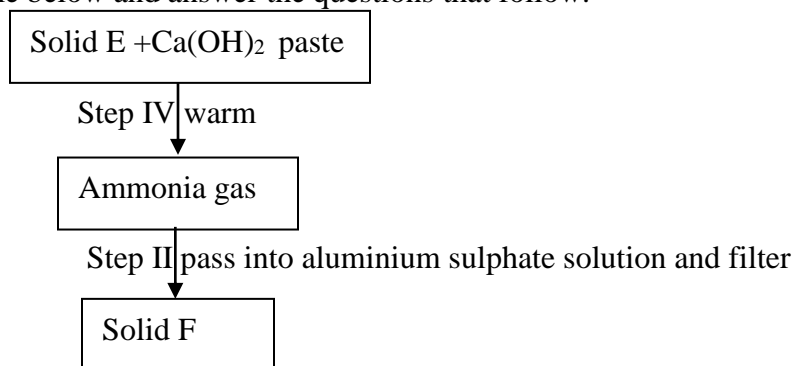$^{14}_{6}\text{C} \quad ^{14}_{7}\text{N} \quad ^{0}_{I}\text{e} \quad$ or $\quad ^{14}_{6}\text{C} \quad ^{14}_{7}\text{N} \quad ^{0}_{i}\text{e}$

(c) Give one use of $^{14}_{6}\text{C}$

2. In an experiment, 0.8gm of magnesium of powder were reacted with excess dilute sulphuric acid at 25^0C. The time for the reaction to come to completion was recorded. The experiment was repeated at 40^0C. In which experiment was the time taken shorter? Explain your answer.

3. The electronic structures for elements represented by letters A,B,C,D are
A=2 .8.6   B 2.8.2 C 2. 8. 1   D 2. 8. 8.
   a) Select the element which forms:
      (i) a double charged cation
      (ii) A soluble carbonate
   b) Which element has the shortest atomic radius?

4. Study the scheme below and answer the questions that follow.

$$\boxed{\text{Solid E} + \text{Ca(OH)}_2 \text{ paste}}$$
Step IV warm
$$\downarrow$$
$$\boxed{\text{Ammonia gas}}$$
Step II pass into aluminium sulphate solution and filter
$$\downarrow$$
$$\boxed{\text{Solid F}}$$

   a) Identify solid E.
   b) Write an ionic equation for the reaction in step II that produces solid F.

5. Give a reason why phosphorus is stored under water.

6. At 298K and 1 atmosphere, graphite changes into diamond according to the equation:
   C (graphite) $\longrightarrow$ C(diamond); $\triangle$=2.9 kJmo^{-1}
   In the space provided, sketch a simple energy level diagram for the above change.

7. How would you obtain a sample of pure iodine from a mixture of iodine and lead sulphate?

8. 10gm of sodium hydrogen carbonate were dissolved in 20cm^3 of water in a boiling tube. Lemon juice was then added drop wise with shaking until there was no further observable change.
    a) Explain the observation, which was made in the boiling tube when the reaction was in progress
    b) What observation would have been made if the lemon juice had been added to copper turnings in a boiling tube? Give reason?

9. Sample solutions of salt were labeled as I,II, III and IV. The actual solutions, not in that order are lead nitrate, zinc sulphate potassium chloride and calcium chloride.
    a) When aqueous sodium carbonate was added to each sample separately, a white precipitate was formed in I, III and IV only. Identify solution II.
    b) When excess sodium hydroxide was added to each sample separately, a white precipitate was formed in solutions III and I only.
        Identify solution I

10. A weighed sample of crystalline sodium carbonate ($Na_2CO_3 . H_2O$) was heated in a crucible until there was no further change in mass.
    Calculate the number of moles (n) of the water of crystallization

11. A certain matchstick head contains potassium chlorate and sulphure.
    On striking the two substances react to produce sulphure dioxide and potassium chloride.
    Explain the environmental effect of using such matches in large numbers.

12. Describe a simple laboratory experiment that can be sued to distinguish between sodium and sulphide and sodium carbonate.

13. The information in the table below relates to elements in the same group of the periodic table. Study it and answer the question that follows:

 | Element | Atomic size |
    |---------|-------------|
    | G1 | 0.19 |
    | G2 | 0.23 |
    | G3 | 0.15 |

    Which element has the highest ionization energy? Give reason.

14. When the oxide of element H was heated with powdered carbon the mixture glowed and carbon dioxide was formed. When the experiment was repeated using the oxide of element J, there was no apparent reaction.
    a) Suggest one method that can be used to extract element J from its oxide
    b) Arrange the elements H, J and carbon in the order of their decreasing creactivity.

15. When a sample of concentrated sulphuric acid was left in an open beaker in a room for two days, the volume was found to have increased slightly
    a) What property of concentrated sulphuric acid was left in an open beaker in a room for two days, the volume was found to have increased slightly.
    b) State one use of concentrated sulphuric acid that depends on the property named above.

16. The diagram below shows an iron bar, which supports a bridge. The Iron bar is connected to a piece of magnesium metal.

Iron bar
Connecting wire
Soil
Magnesium metal
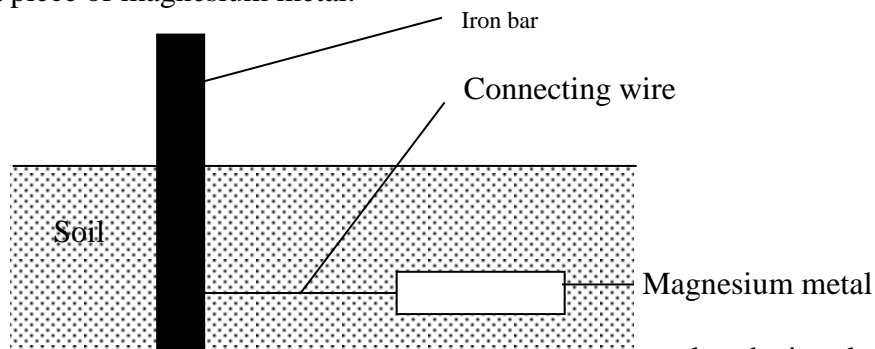
Explain why it is necessary to connect the piece of magnesium metal to the iron bar.

17. a) State one cause of temporary hardness in water.
    b) How does distillation remove hardness from water?

18. In the presence of U.V light, ethane gas undergoes substitution reaction with chlorine.
    (a) What is meant by the term?
        Substitution reaction:
    (b) Give the structural formula and the name of the organic product formed when equal volumes of ethane and chlorine react together.

19. Explain why burning magnesium continues to burn a gas was Magnesium metal

20. a)what observation would be made if hydrogen sulphide gas v solution of zinc nitrate?
    b) write an equation for the reaction that takes place in (a) above
       $Zn(NO_3)_2 (aq) + H2S (g) \longrightarrow ZnS + 2 HNO_3 (aq)$

21. The apparatus shown below shown below was used to investigate the effect of carbon monoxide on copper (II)oxide.

Copper (II) oxide
Dry CO(g)
Tube K
Combustion tube
Heat
Lime water
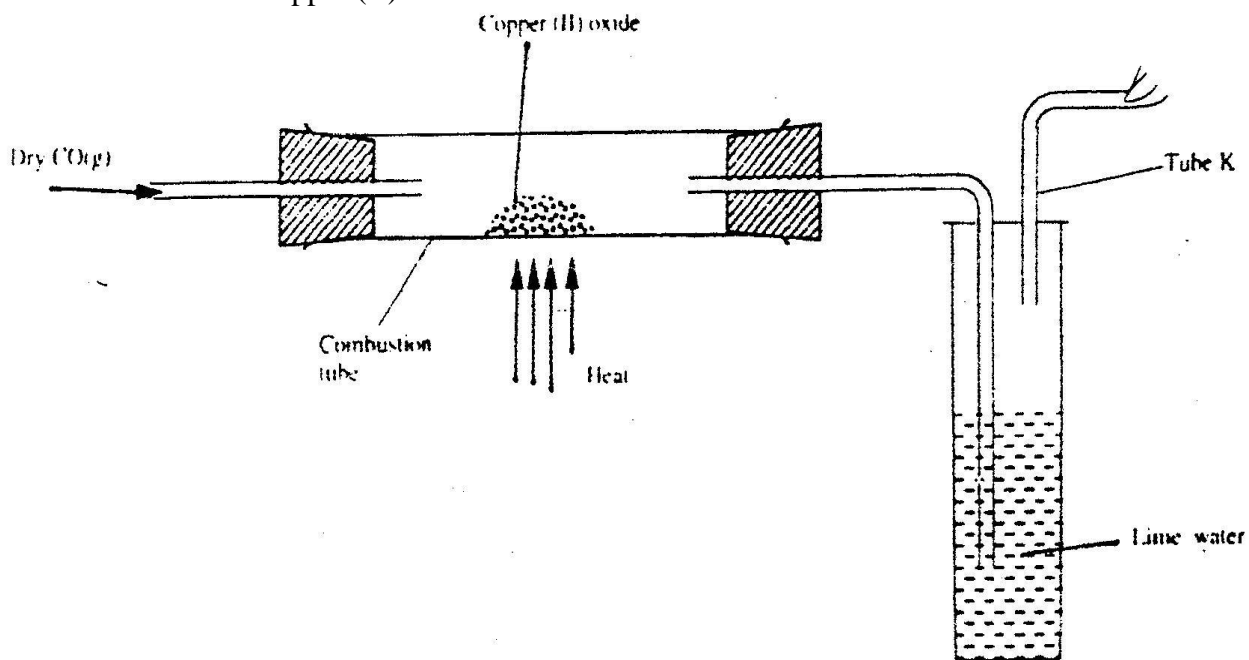
    a) State the observation that was made in the combustion tube at the end of the experiment.

b)   Write an equation for the reaction that took place in the combustion tube

C)   Why is it necessary to burn the gas coming out of tube K?

22.   Explain why hydrogen forms compounds in which its oxidation state is either + 1 or -1 (Atomic number of hydrogen is 1)

23.   The table below shows the properties of substances K,L,M and N

Substances	Reaction with oxygen at 25°C	Melting point	Conductivity Solid	Molten
K	Uncreative	Low	Poor	Good
L	Reactive			
M	Uncreative	High	Good	Good
N	Uncreative	Low	Good	Good

Select the substances which are likely to be:

a)   Copper metal

b)   Magnesium chloride

24.   An element P has a relative atomic mass of 88. When a current of 0.5 amperes was passed through the fused chloride of P for 32 minutes and 10 seconds, 0.44g of P were deposited at the cathode. Determine the charge on an ion of P. (1 faraday = 96500 Coulombs).

25.   The melting point of phosphorous dichloride is – 91°C. While that of magnesium chloride is 715°C.In terms of structure and bonding, explain the difference in their melting points.

26.   The Ph of a sample of soil was found to be 5.0.An agricultural office recommended the addition of calcium oxide in the soil. State two functions of the calcium oxide in the soil.

27.   Hydrogen peroxide decomposes according to the equation below:

$H_2O_2(l) \longrightarrow H_2O(l) + \frac{1}{2} O_{2(g)}$; $\triangle H = - 98kJ$

8.5 gm of hydrogen peroxide contained in $100cm^3$ of solution with water were completely decomposed. Determine the rise in temperature due to the reaction. Specific density of water = $1g/cm^3$ O =16, H = 1,).

CHEMISTRY PAPER 233/2 K.C.S.E 2001
QUESTIONS

1. In an experiment to study the rate for reaction between duralumin (an alloy of aluminium, magnesium and copper) and hydrochloric acid, 0.5g of the alloy were reacted with excess 4M hydrochloric acid. The data in the table below was recoded.
    Use it to answer the questions that follow.

Time (minutes)	Total volume of gas (cm3)
1	0
2	220
3	410
4	540
5	620
6	640
7	640

a) i) On the grid provided, plot a graph of total volume of gas produced (vertical axis) again time.

    ii) From the graph, determine the volume of gas produced at the end of 2 ½ minutes.

b) Determine the rate of reaction between the 3rd and 4th minute.

c) Give a reason why some solid remained at the end of the experiment

d) Given that $2.5cm^3$ of the total volume of the gas was from the reaction between magnesium and aqueous hydrochloric acid, calculate the percentage mass of aluminium present in 0.5g of the alloy.
    (Al = 27.0 and Molar gas volume = $24,000cm^3$ at 298k)

e) State two properties of duralumin that make it more suitable than aluminium in aeroplane construction.

2. a) In which homologous series do the following compounds belong
        i) CH_3CC
        ii) CH_3CH_2COO

    b) Raw rubber is heated with sulphur in the manufacture of natural rubber.
        i)   What is the name given to the process
        ii)   Why is the process necessary?

c)   Study the scheme given below and answer the questions that follow.
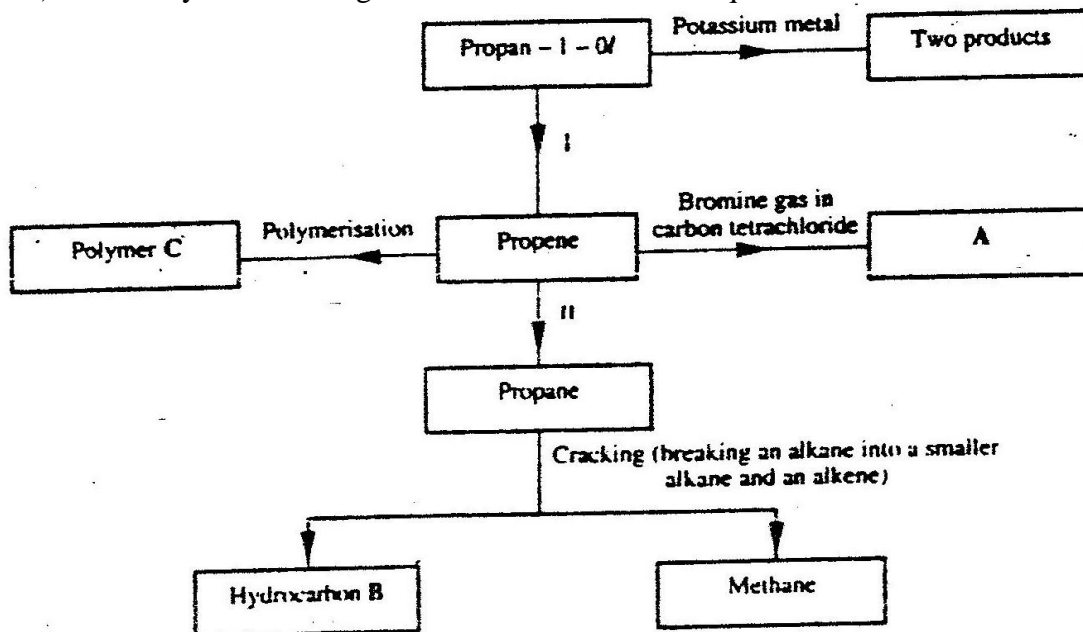
i)   Write an equation for the reaction between propane – 1 – 0 / and potassium metal.

ii)   Name processes I and II
      I
      II

iii) Identify the products A and B

iv)   Name one catalyst used in process II

v)   Draw the structural formular of the repeating unit in the polymer C.

d)   State two industrial uses of methane.

3.   a)   Study the standard electrode potentials do the half – cells given below and answer the questions that follow.(The letters do nor represent the actual symbols of the elements.)

                                                          E°volts

N^+_{aq} + e-   ⇄   N(s);   -2.92

$J^+_{(aq)}$ + e-   ⇄   J(s);   +0.52

$K^+_{(aq)}$ + e-   ⇄   ½ K2(g)   0.00

½ G2$_{(g)}$ + e-   ⇄   G(aq);   +1.36

$M^{2+}_{(aq)}$ + 2e- ⇄   M(s);   -0.44

i)   Identify the strongest oxidizing agent. Give a reason for your answer.

ii)   Which two half – cells would produce the highest potential difference when combined?

iii) Explain whether the reaction represented below can take place.
      $2N^+_{(aq)}$ + M$_{(s)}$ ⟶ $2N_{(s)}$ + M^{2+}(aq)

b)   100cm3 of 2M sulphuric acid was electrolysed using the set – up represented by the diagram below.
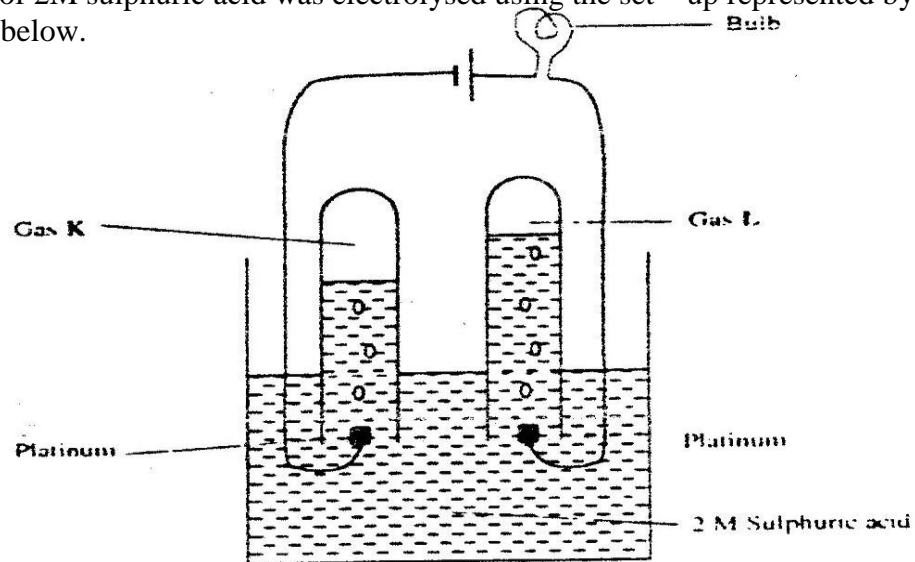

i)   Write an equation for the reaction that produces gas L.
ii)   Describe how gas K can be identified
iii)   Explain the difference in :
    I   The volume of the gases produced at the electrodes.
    II   Brightness of the bulb if 100cm3 of 2M ethanoic acid was used in place of sulphuric acid.

4.   a)   Fraction distillation of liquid air usually produces nitrogen and oxygen as the major products.
i)   Name one substance that is used to remove carbon dioxide from the air before it is changed into liquid.
ii)   Describe how nitrogen gas is obtained from the liquid air.
(Boiling points nitrogen = - 196oC, oxygen = -183oC

b)   Study the flow chart below and answer the questions that follow.
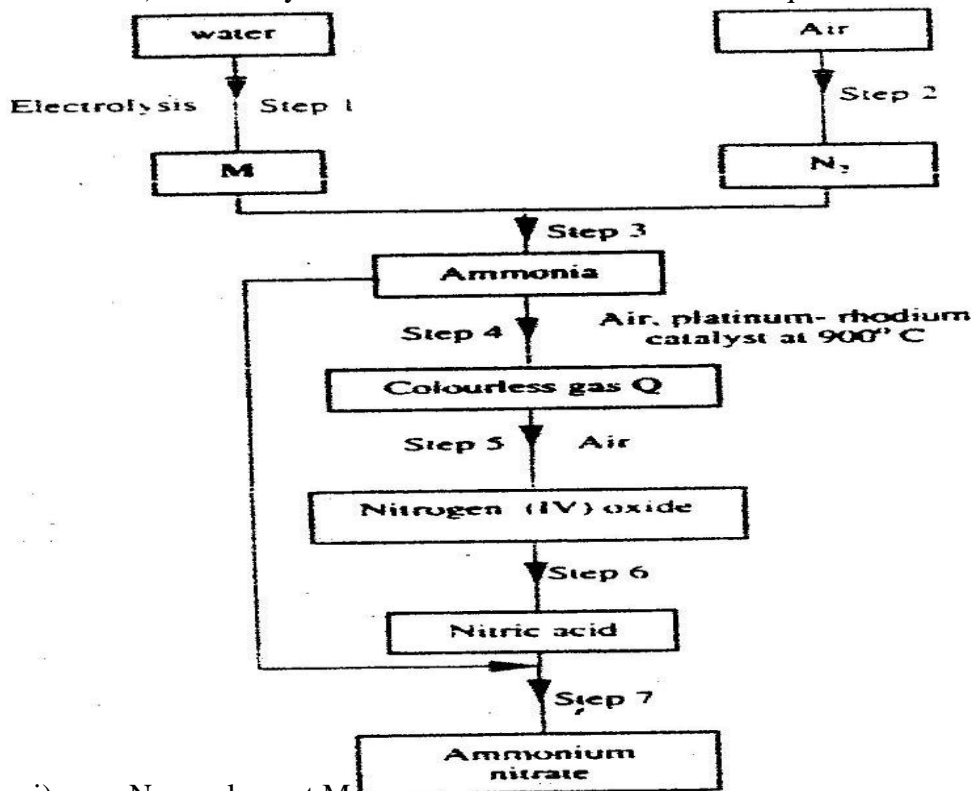
i)   Name element M.
ii)   Why is it necessary to use excess air in step 4?
iii) Identify gas Q.
iv)   Write an equation for the reaction in step 7
v)   Give one use of ammonia nitrate.
c)   State and explain the observations that would be made if a sampler of sulphur is heated with concentrated nitric acid.

5.   a)   Give the name of reagent which when reacted with concentrated hydrochloric acid produce chlorine gas.
      b)   A student out to prepare iron III chloride using the apparatus shown in the diagram below.
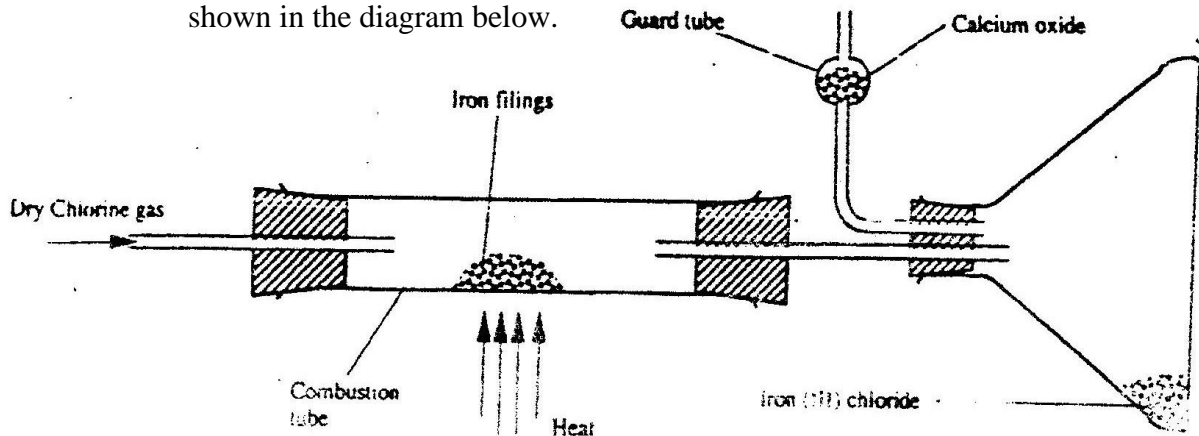
i)   Explain why:
      I.   It is necessary to pass chlorine gas through the apparatus

before heating begins.

II Calcium oxide would be preferred to calcium chloride in the guard tube.

ii) What property of iron (III) chloride makes it possible to be collected as shown in the diagram?

iii) Write an equation form one chemical reaction that took place in the guard tube.

iv) The total mass of iron (III) chloride formed was found to be 0.5g.
Calculate the volume of chlorine gas the reacted with iron.
(Fe - = 56.0,Cl = 35.5 and Molar gas volume at 298K is 24,000cm^3

C) When hydrogen sulphide gas was passed through a solution of iron (III) chloride, the following observation were made:

i) The colour of the solution changed from reddish – brown to green and (ii) a yellow solid was deposit .Explain these observations.

d) State and explain the observations that would be made if a moist blue litmus paper was placed in a gas jar full of chloride gas.

6. a) Study the information in the table below and answer the questions that follow. (The letters do not represent the actual symbols of the elements).

Ionisation Element	Electronic configuration	Energy Kj mol^{-1}
P	2.1	519
Q	2.8.1	494
R	2.8.8.1	418

i) What is the general name to the group in which elements P,Q and R belong?

ii) What is meant by ionization energy?

iii) Explain why elements has the highest ionization energy.

iv) When a piece of element Q is placed on water. It melts and a hissing sound is produced as it moves on the surface of the water.

v) Write an equation for the reaction between element Q and water.

b) Distinguish between a strong and a weak base. Give an example of each

c) Neutralization is one of the methods of preparing salts.

i) What is meant by neutralization?

ii) Describe how you would prepare crystals of sodium nitrate starting with 200cm3 of 2M sodium hydroxide.

iii) Write an equation for the reaction that takes place when a solid sample of sodium nitrate is heated.