NAME: …………………………….…… INDEX NO: ………………………….

SIGNATURE: ………………….………… DATE : …………………………….

233/2
CHEMISTRY
PAPER 2
THEORY
JULY / AUGUST 2013
TIME: 2 HOURS

NANDI NORTH DISTRICT JOINT MOCK EVALUATION TEST 2013

Kenya Certificate of Secondary Education (K.C.S.E.)
CHEMISTRY
PAPER 2
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

- Write your Name and Index Number in the spaces provided above.
- Answer all the questions in the spaces provided after each question.
- Mathematical tables and non-programmable electronic calculators may be used.
- ALL working must be clearly shown where necessary.

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDITATE'S SCORE
1	13	
2	13	
3	10	
4	13	
5	11	
6	10	
7	10	
TOTAL	**80**	

1. Air was passed through several reagents as shown in the flow chart below.
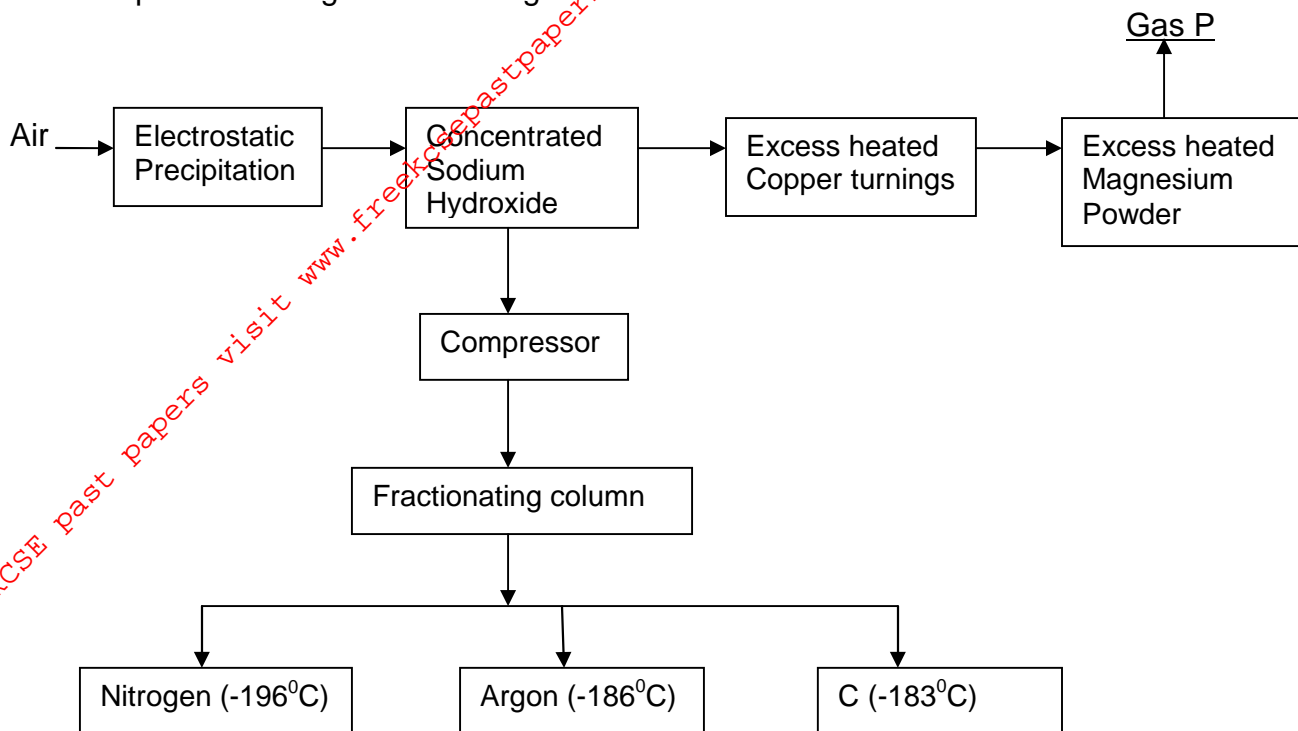
(a) Name the major components of air. (2mks)

    ………

    ………

(b) Write an equation for the reaction which takes place in the chamber with:
    (i)   Concentrated sodium hydroxide. (1mk)

    (ii) Excess heated copper turnings. (1mk)

    (iii) Excess heated magnesium powder. (1mk)

(c) Name **one** gas which escapes from the chamber containing magnesium powder.

    Give a reason for your answer. (2mks)

    ………

    ………

    ………

(d) Name the substance that was eliminated by electrostatic precipitation. (1mk)

    ……….

(e) Name a reagent that can be used in place of concentrated sodium hydroxide.

    (1mk)

    ………

(f) Name substance C. (1mk)

....

(g) State **three** uses of gas C. (3mks)

....

....

....

2. The figure below shows parts of Le'Clanche cell (dry cell).
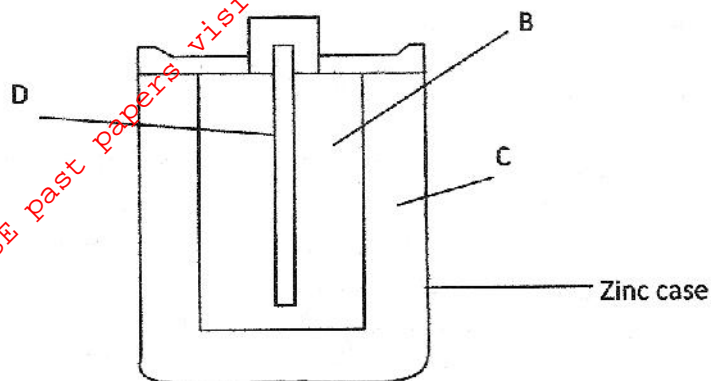
(a) Name:

(i) Substance D (1mk)

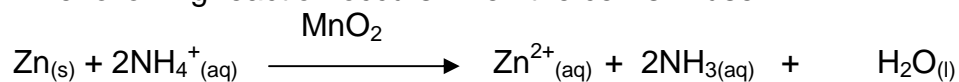...

(ii) Mixture B (1mk)

....

(iii) Electrolyte C (1mk)

....

(b) In the cell, the electrolyte is a paste. Explain. (1mk)

....

....

(c) The following reaction occurs when the cell is in use.

$$Zn_{(s)} + 2NH_4^+{}_{(aq)} \xrightarrow{MnO_2} Zn^{2+}{}_{(aq)} + 2NH_{3(aq)} + H_2O_{(l)}$$

Given that:

$$Zn^{2+}{}_{(aq)} + 2e^- \longrightarrow Zn(s) \qquad E = -0.76V$$

$$2NH^+{}_{(aq)} + 2e^- \xrightarrow{MnO_2} 2NH_{3(g)} + H_2O_{(l)} \qquad E = +0.74V$$
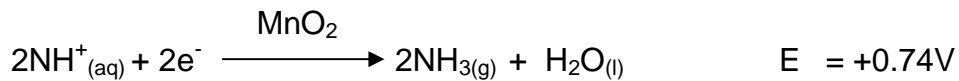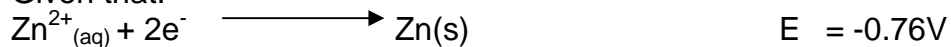
Calculate the e.m.f. of the cell. (1mk)

....

....

....

....

(d) Use the standard reduction electrode potentials given below to answer the questions that follow.

$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn(s) \qquad E = -0.76V$

$Pb^{2+}_{(aq)} + 2e^- \longrightarrow Pb(s) \qquad E = -0.13V$

$Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu(s) \qquad E = +0.34V$

$Ag^{2+}_{(aq)} + 2e^- \longrightarrow Ag(s) \qquad E = +0.80V$
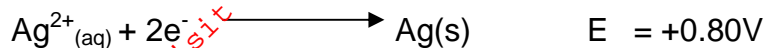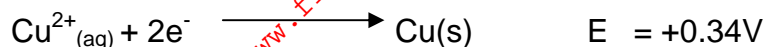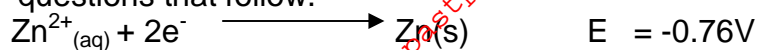
The metal copper, zinc, silver and lead were placed in different solutions as shown:-

Metal	Metal ion	Reaction / No reaction
Cu	$Ag^{2+}_{(aq}$	
Zn	$Cu^{2+}_{(aq)}$	
Ag	$Pb^{2+}_{(aq)}$	
Pb	$Zn^{2+}_{(aq)}$	

(i) Indicate in the table with a tick ( ) where a reaction occurs and a cross (x) where no reaction occurs. (2mks)

(ii) Identify the strongest reducing agent. (1mk)

……………………………………………………………………………………………

……………………………………………………………………………………………

(e) (i) Draw a well labeled diagram of the electrochemical cell when copper and magnesium half cells are connected. (3mks)

(ii) On the diagram you have drawn in e(i) above, label the anode and the cathode and also show the direction of flow of electrons. (2mks)

4

3. The scheme below shows a series of reactions starting with Propanol. Study it and answer the questions that follow:-
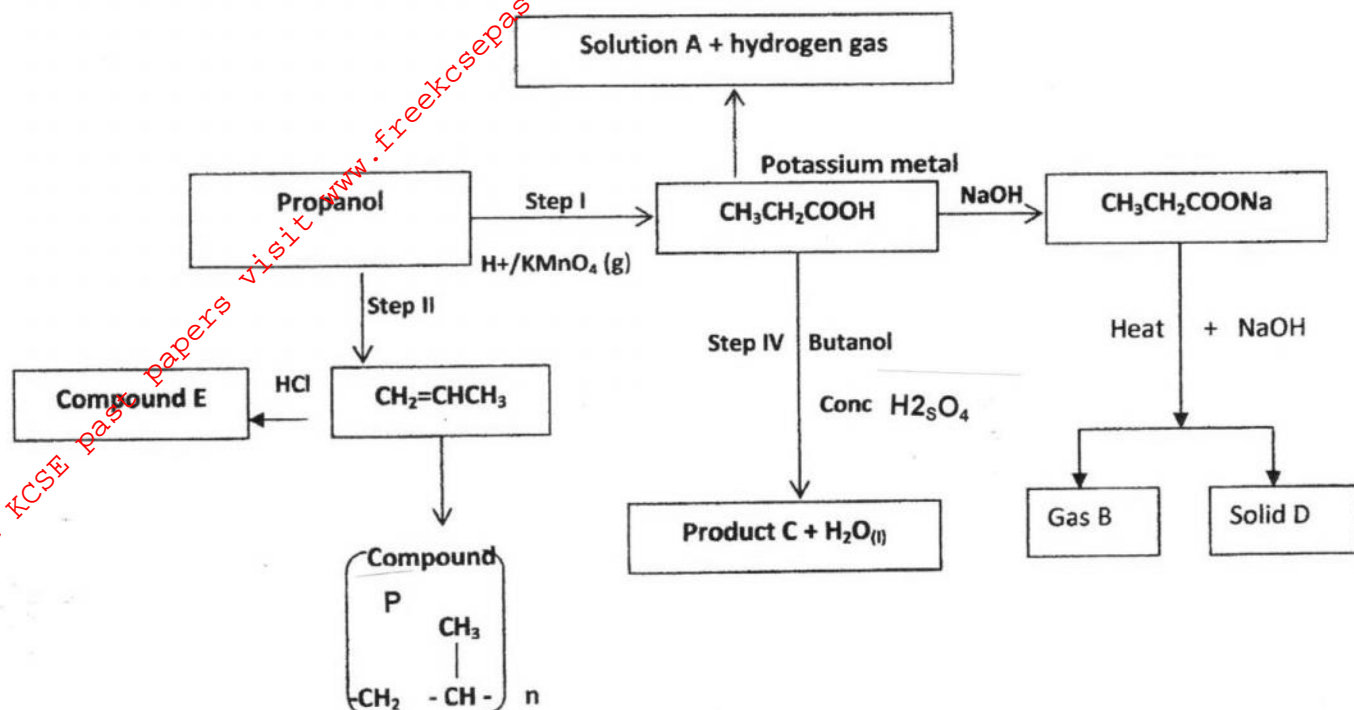
(a) Name the type of reaction in steps I and II.

Step I:………………………………………………………………………….. (1mk)

Step II:…………………………………………………………………………. (1mk)

(b) Write the formulae of gas B and solid D. (2mks)

(c) Name the substances labeled A and E. (1mk)

A:………………………………………………………………………………….

E:………………………………………………………………………………….

(d) Draw the structural formula of product C. (1mk)

(e) Name the process in Step (IV) (1mk)

……………………………………………………………………………………

(f) Name compound P and state the type of reaction involved in its formation. (1mk)

Name of compound P:…………………………………………………………..

Type of reaction:………………………………………………………………

(g) If the relative molecular mass of P is 35,700 determine the value of n. (2mks)
(C = 12, H = 1)

……………………………………………………………………………………

……………………………………………………………………………………

…………………………………………………………………………………………………

4. A conical flask was connected to a gas syringe by means of a stopper and a delivery tube. $30cm^3$ of water and 0.5g of Manganese (IV) Oxide were placed in the flask and the $5cm^3$ of Hydrogen Peroxide were added. The flask was quickly stoppered and the readings of volume of gas in syringe were recorded after every 10 seconds. The results obtained were recorded in the table below.

Time (sec)	0	10	20	30	40	50	60	70	80
Volume (cm^3)	0	18	30	40	48	53	57	58	58

(a) (i) Draw a set-up used to carry out the above experiment. (3mks)

…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………
…………………………………………………………………………………………………

(ii) Name the gas evolved in this reaction. (1mk)

……………………………………………………………………………………………….

(b) (i) Plot a graph of volume (cm^3) shown in the syringe against time (sec). Label the curve A. (3mks)

6
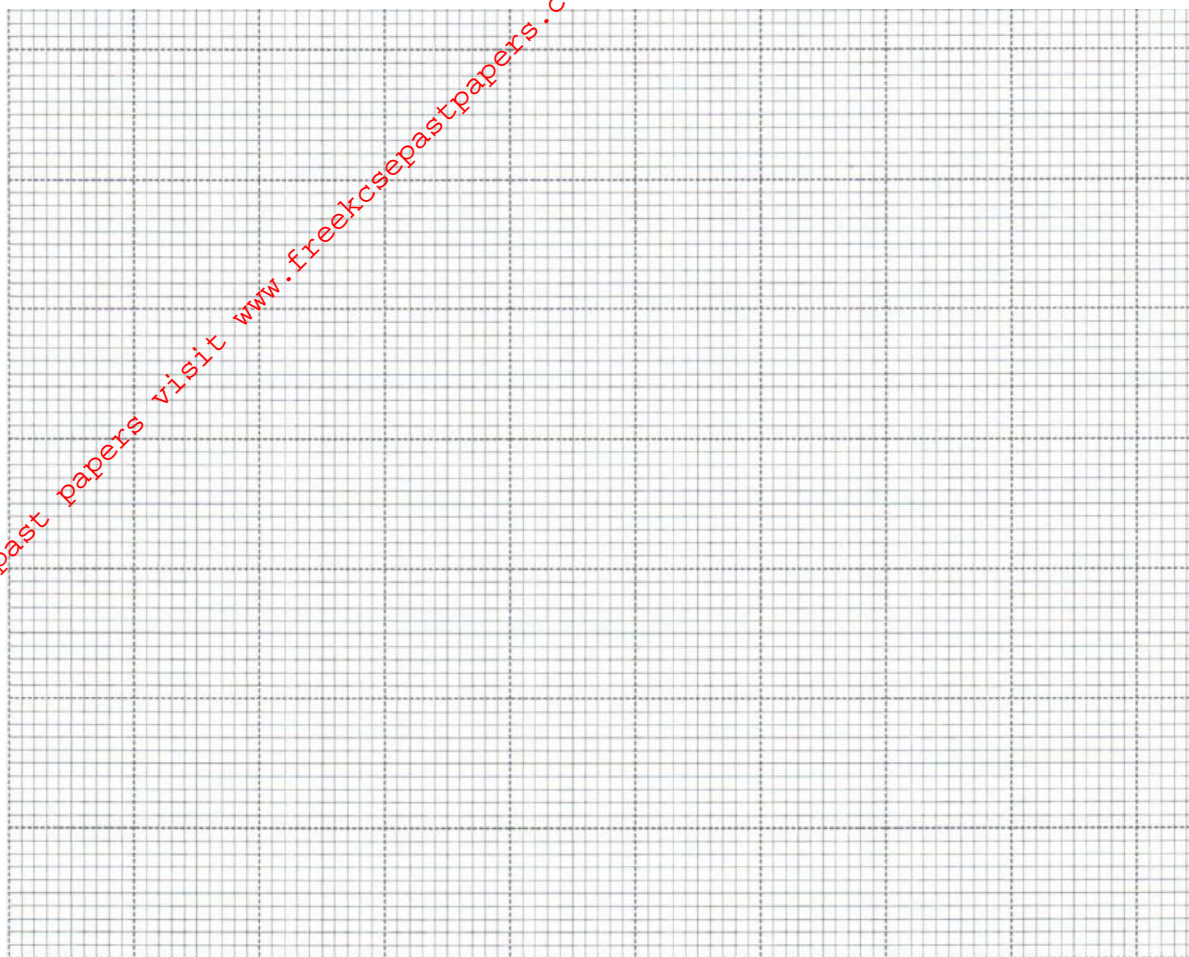
(ii) Without emptying the flask another 10cm^3 of water and 5cm^3 of Hydrogen peroxide were added and the experiment repeated exactly as above. Using the same axes as in (b) (i) above, sketch a second curve to show how volume of gas collected would vary with time. In this second experiment label the curve B. (1mk)

(iii) Calculate the rate of the reaction at the 30th second. (2mks)

(c) At the end of the experiment Manganese (iv) oxide were removed from the flask, dried and re-weighed. State the observation in the change in mass. (1mk)

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

(d) Nitrogen (iv) Oxide (NO$_2$) was collected in a transparent glass jar at room temperature. The gas jar was sealed. A chemical equilibrium established in the gas jar as represented by the chemical equation below:

$$2NO_{2(g)} \rightleftharpoons N_2O_{4(g)} \qquad DH^{\varnothing}f = +9.7KJmol^{-1}$$
Red/Brown (Yellow)

7
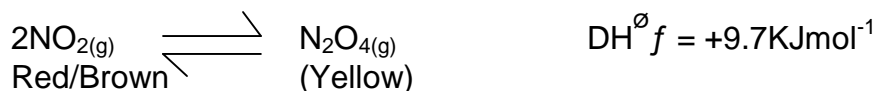
State and explain the observation made when the sealed glass jar is lowered in a trough of ice cold water. (2mks)

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

5. (a) Explain the following observation, giving an equation where necessary. When a sample of tap water is boiled for some time, a white precipitate is formed. (1mk)

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

…………………………………………………………………………………………………

(b) A sample of hard water is found to contain 0.25g of calcium chloride and 0.24g of magnesium sulphate per litre.

(i) Describe how this sample of water is softened by using anhydrous sodium carbonate. (2mks)

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

(ii) Calculate the mass of anhydrous sodium carbonate required to soften a litre of the water sample.
(Ca=40, Mg = 24, Na =23, O = 16, Cl = 35.5, S = 32 and C = 12) (3mks)

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

………………………………………………………………………………………

(iii) Give **two** reasons why it is necessary / important to soften tap water supplied for domestic use. (2mks)

………………………………………………………………………………………

………………………………………………………………………………………

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

| SOLID T | Concentrated Nitric (v) acid → | SOLUTION S | + | BROWN GAS |

Few drops of $NH_{3(aq)}$

```
┌─────────────────┐
│ BLUE            │
│ PRECIPITATE     │
└─────────────────┘
        │ Excess NH₃(aq)
        ▼
┌─────────────────┐
│ DEEP BLUE       │
│ SOLUTION Q      │
└─────────────────┘
```
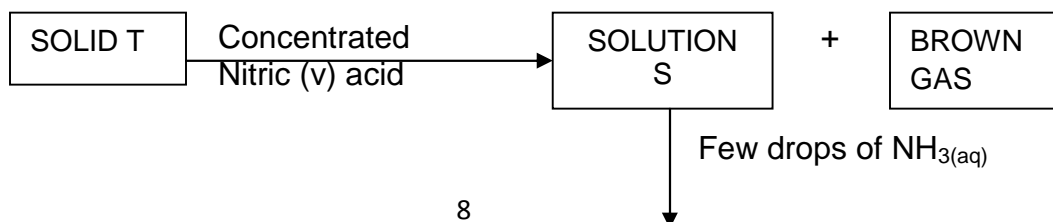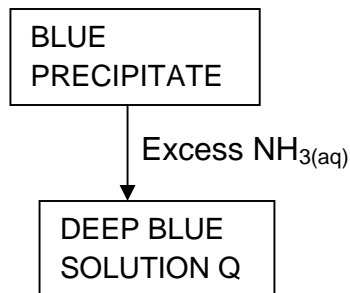
(i)   Identify solid T   (1mk)

……………………………………………………………………………………………...

(ii) Write an equation for the reaction between solid T and concentrated nitric
(v) acid.   (1mk)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

(iii) Write an equation for the reaction that produces solution Q.   (1mk)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

6. (a) The table below gives information on four elements, represented by letters P, Q,
       R and S (not the actual symbols of the elements). Study it and answer the
       questions that follow:

Element	Atomic number	Atomic radius (nm)	Tonic radius (nm)
P	12	0.136	0.065
Q	17	0.99	0.181
R	19	0.203	0.099
S	20	0.174	0.099

(i)   What **two** elements have similar chemical properties?   (1mk)

………………………………………………………………………………………………

………………………………………………………………………………………………

(ii) Which element(s) will not conduct electricity? Explain your answer. (2mks)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

(iii) Why is the atomic radius of S less than that of R?   (2mks)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

9

………………………………………………………………………………………………

(b) Below are 1st, 2nd and 3rd ionization energies (KJ mol^{-1}) of elements A, B, C, D and E (not the actual symbols of the elements).
Study the table and answer the questions that follow:

Element	1st ionization energy	2nd ionization energy	3rd ionization energy
A	500	4600	6900
B	740	1500	7700
C	630	1600	3000
D	900	1800	14800
E	580	1800	2700

(i) Which of these elements is likely to form an ion with a charge of +1? Explain your answer. (2mks)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

(ii) Select any **two** elements that are likely to belong to the same group of the periodic table. Which group do they belong? (3mks)

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

………………………………………………………………………………………………

7. The industrial extraction of lead metal from its ore is as illustrated in the flow chart below:
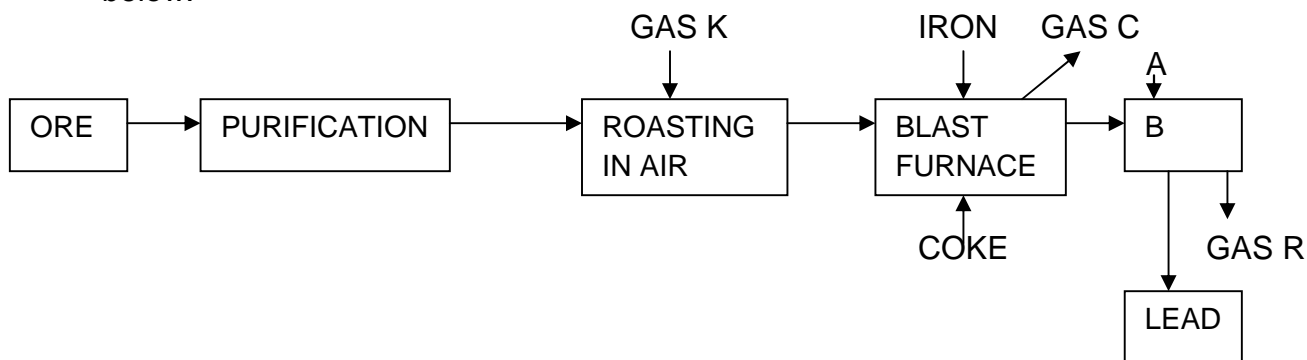
(a) Identify the chief ore used to extract lead metal. (1mk)

……………………………………………………………………………………………..

(b) What happens at purifications stage? (1mk)

……………………………………………………………………………………………..

(c) Write an equation for the reaction that takes place when the ore is roasted in air. (1mk)

………………………………………………………………………………………………

(d) Identify substances:

S:…………………………………………………………………………….. (1mk)

A:…………………………………………………………………………….. (1mk)

K:………………………………………………………………………... (1mk)

C:………………………………………………………………………... (1mk)

R:………………………………………………………………………... (1mk)

(e) Using an equation show the role of iron in the blast furnace. (1mk)

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

…………………………………………………………………………………

(f) Tetraethyl lead is an anti-knock additive that is added to petrol. This petrol additive is however being phased out. Give a reason to this. (1mk)

…………………………………………………………………………………

…………………………………………………………………………………