NAME ....**INDEX NO**.....................**DATE**.............

SCHOOL...**SIGN**............................

233/1
CHEMISTRY
PAPER 1
THEORY
JULY/AUGUST 2010
2 HOURS

LAICOMET FORM IV EXAM

233/1
CHEMISTRY
PAPER 1

INSTRUCTIONS TO CANDIDATES

❖ *Write your name and index number in the space provided above*

❖ *Answer all questions in the spaces provided.*

❖ *Mathematical tables and electronic calculators may be used.*

❖ *All workings* ***MUST*** *be clearly shown where necessary.*

For examiners use only

Questions	Maximum score	Candidates score
1 – 29	80	

1. Cooking oil is a mixture of compounds which have boiling points ranging from
   230^0 to 270^0

a) What evidence is there to support the statement that cooking oil is a mixture (1mk)

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b) What experiment procedure can be used to confirm the answer in (a) above (1mk)

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2. Dilute Sulphuric acid was added to a compound P of Magnesium. The solid reacted with the acid to form a colourless solution Q and a colourless gas R which forms a white precipitate when bubbled through lime water.

a) Name compound P…………………………………….. (1mk)

b) Comment on the expected observation if a similar compound of Calcium was used instead of that of Magnesium (2mks)

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3. In an experiment to study the effect of burning substances in air on their mass, 2g of Magnesium ribbon was polished and then heated in a crucible as shown below. Occasionally the lid was lifted and then returned. When there was no further change in mass of the crucible and its contents, heating was stopped as the reaction was complete.

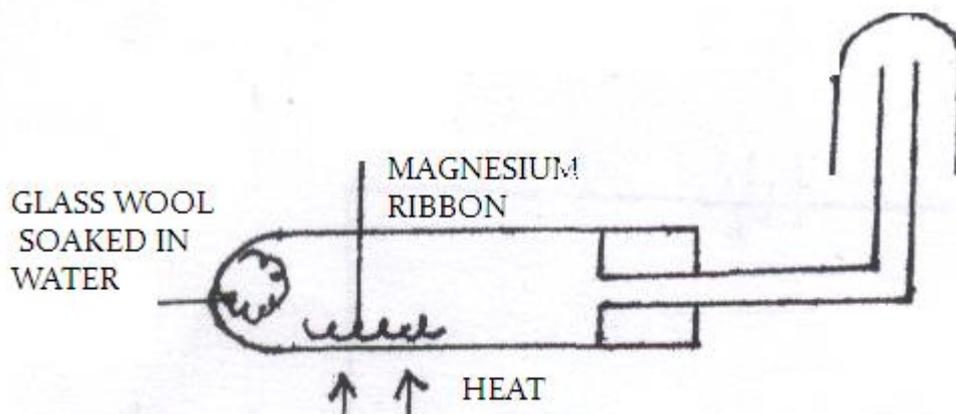The experiment was repeated but with 2 g of sulphur.
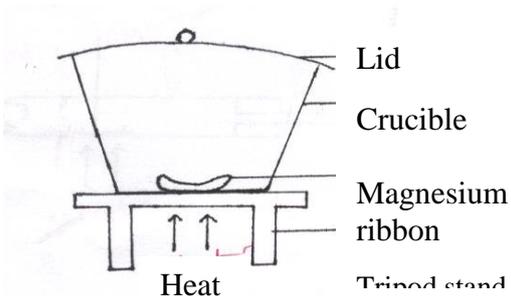
With aid of a chemical equation, explain what happens to the mass of

   i Crucible with Magnesium ribbon (1mk)

   ii Crucible with Sulphur (1mk)

4. When Magnesium is reacted with steam, it reacts rapidly forming a white solid and Hydrogen gas.

GLASS WOOL SOAKED IN WATER | MAGNESIUM RIBBON

HEAT

a) What property of Hydrogen gas makes it be collected as shown above

(1mk)

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b) How would you show that the gas collected is hydrogen gas.   (1 mk)

....

....

c) When copper turnings were used instead of magnesium ribbon, Hydrogen

gas was not produced. Explain   (1mk)

....

....

5. Determine the relative atomic mass of element K whose isotopic mixture occur
   in the proportions;

   $^{39}_{19} K(93.1\%)$, $^{40}_{19} K(0.01\%)$ and $^{41}_{19} K(6.89\%)$ (2mks)
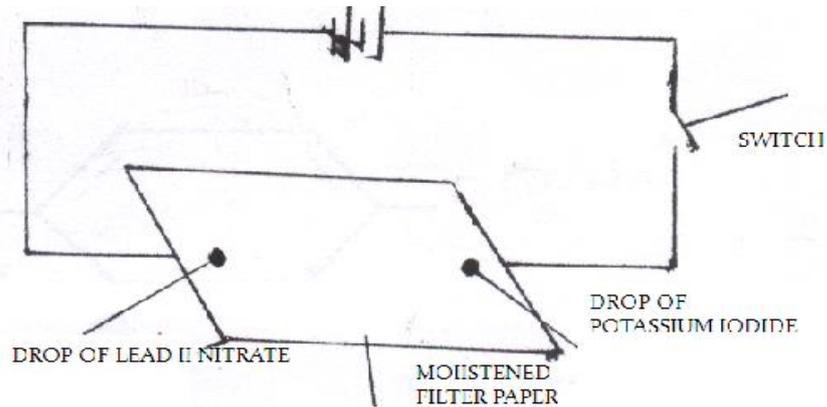
6. Using dots ($\cdot$) and crosses (x) to represent electrons .Show the bonding in
   compounds formed when the following elements react,

   $(si = 14, Na = 11, Ci = 17$

   a) Sodium and Chlorine   (1mk)

   b) Silicon and Chlorine   (1mk)

7. The apparatus below were setup by students to show the movement of ions during electrolysis

a) On the diagram indicate the anode and the cathode. (1mk)

b) State and explain the observation made when the switch is closed (2mks)

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8.   a Amorphous carbon is the impure form of Carbon . Name two examples of this form of Carbon (1mk)

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

   b State two uses of Amorphous carbon (2mks)

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

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9.   a State Graham's Laws of diffusion (1mk)

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   b A certain volume of gas A diffuses through a porous plug in 41 seconds and the same   volume of air diffuses through the plug in 155 seconds.
   Calculate the density of gas A.   (Density of air is $1.0g/cm^3$)   (2mk)

10. A student weighed 1.0g of egg shells. He reacted this mass with 15 cm³ of 2M Hydrochloric acid. After the shells completely dissolved, the resulting solution was all transferred into a volumetric flask and the volume made up is100 cm³ of distilled with water added. The solution was labelled P. 20cm³ of this solution required 25cm³ of 0.1 M Sodium hydroxide for complete neutralization.

    i   Find the quantity of the excess Hydrochloric acid in moles. (2mks)

    ii   Calculate the percentage of Calcium carbonate in the egg shell. (2mks)
$(Ca = 40, C = 12, O = 16)$

11. The structures below represents two cleansing agents, A and B.

   <u>A</u>

                                                       <u>B</u>

$R - COO^- Na^+$ $R - \langle\text{benzene ring}\rangle - OSO_3^- Na^+$
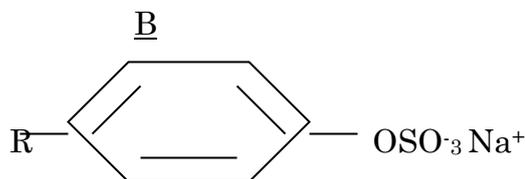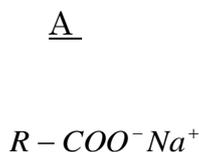
Which cleansing agent would be suitable for washing in water with dissolved Magnesium sulphate. Give a reason   (2mks)

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....

12. The diagram below shows apparatus arrangement when preparing ammonia gas.
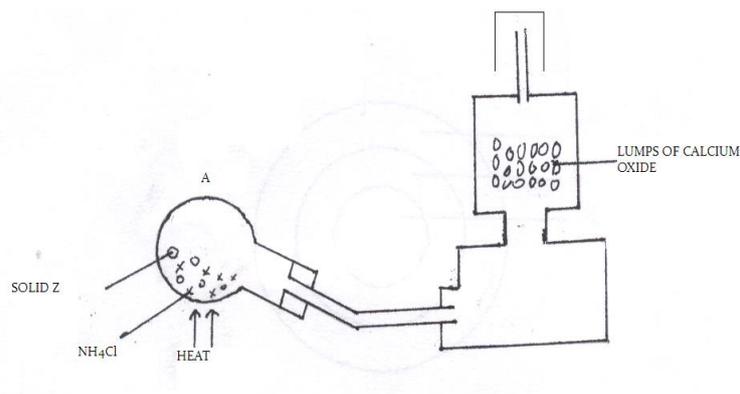
   i Write equation for the reaction that took place in flask labelled A. (2mks)

ii What is the purpose of the lumps of Calcium oxide?　　　　(1 mk)

....

....

iii Why is it important to place the flask in a slanting manner? (1 mk)

....

....

13. The diagram below is a cross section of three pipes used for extraction of Sulphur by Frasch　　process

Y

W

X
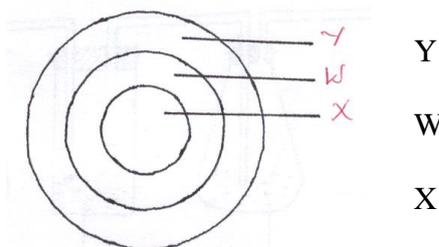
i　　Name and state the purpose of the substance that passes through tube X

(2mks)

....

....

ii　　One main use of Sulphur is vulcanization of rubber. State one advantage of vulcanization　　　　　　　　　　　　　　　　　　　　　　　(1mk)

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14.　　The diagram below shows how Chlorine gas can be prepared in the laboratory

Conc. HCl

MnO_2

Heat　　　　Water　　　　Liquid L　　　　Dry chlorine gas
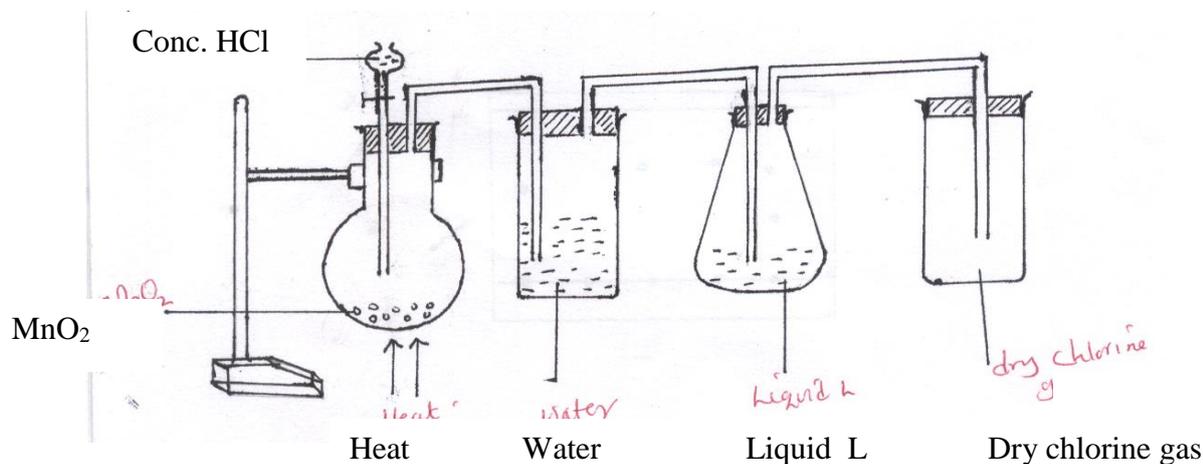
a) Name another chemical that would have been heated with conc. Hydrochloric acid to form Chlorine gas instead of Manganese IV oxide .　　　(1mk)

....

b) If the chemical you have named in (a) above was used , which other changes

would be necessary during experiment   (1mk)

....

....

c) Name one precaution necessary when preparing Chlorine gas   (1mk)

....

15.   The lattice and Hydration energies for Lithium chloride and Potassium

chloride are given   below.

SALT	Lattice energy $(KJmol^{-1})$	Hydration energy $(KJmol^{-1})$
LiCl	-891	-884
KC1	-791	-695

a) Write down equations for the following

i) Lattice energy for LiCl.   (1 mk)

ii) Hydration energy for KCl   (1mk)

b) Calculate the enthalpy of solution for LiCl   (1mk)

16. Given the equation's

$$N_2(g) + 3H_2(g) \underset{\leftarrow}{\rightarrow} 2NH_3(g), \Delta H = -92 KJMol^{-1}$$

What happens to the position of equilibrium when

a) More hydrogen is introduced to the system   (1mk)

....

....

b) The pressure of they system is reduced   (1mk)

....

....

c) Temperature is raised   (1mk)

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17. During the electrolysis of Lead (II) bromide a current of 5 amperes was passed

through the electrolyte for 386 seconds. Calculate the volume of Bromine gas

evolved at s.t.p (molar gas volume at $s.t.p = 22.4dm^3$, (1 Faraday $= 96,500C$)

(3mks)

18. 25 g of radioactive $^{211}_{85}At$ was reduced to 3.125 g after twelve hours.

Determine the half life of **At**   (2mks)

19. Iron is extracted from its ore ; Haematite in blast furnace . The main reaction during extraction

is $Fe_2O_3(s) + 3CO(g) \rightarrow 2 Fe(s) + 3CO_2(g)$
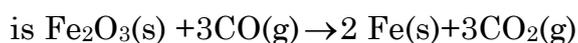
a) Name the oxide of Iron shown in the equation above.   (1mk)

………

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

b) Calculate the mass of Iron which will be produced from 320 tones of Haematite

Fe =56, O = 16   **(**1mk**)**

20. Consider the chromatogram below
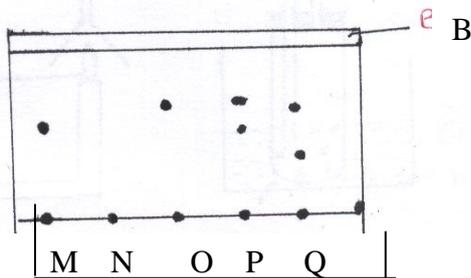
a) What does line B indicate?   (1mk)

………

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

b) State the components that make up P.   (1mk)

………

………

c) Explain why N does not separate   (1mk)

………

21. Excess Iron fillings were allowed to rust in $1dm^3$ of moist air and the volume of the remaining air measured each day.

Day	0	1	2	3	4	5	6	7	8	9
Volume of Air (cm^3)	1000	950	900	860	840	820	800	800	800	800

a) Why did the volume of the air remain constant from day six (1mk)

....

....

b) Determine the % volume of oxygen in air (1mk)

c) write the chemical formula of rust (1mk)

22. Describe how you would prepare a sample of Lead (II) chloride using the following reagents, Dilute Nitric (v) acid; dilute Hydrochloric acid and Lead (II) carbonate. (2mks)

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....

23. The flowchart below shows the scheme for extraction of Hydrogen from hydrolysis of natural gas, study it and answer the questions that follow.

Steam

Step 1

Natural gas

Water gas

H_2 CO_3 step II

Air

Step III   Separation chamber

H_2 CO_2 Step IV

Purification chamber

H_2 gas
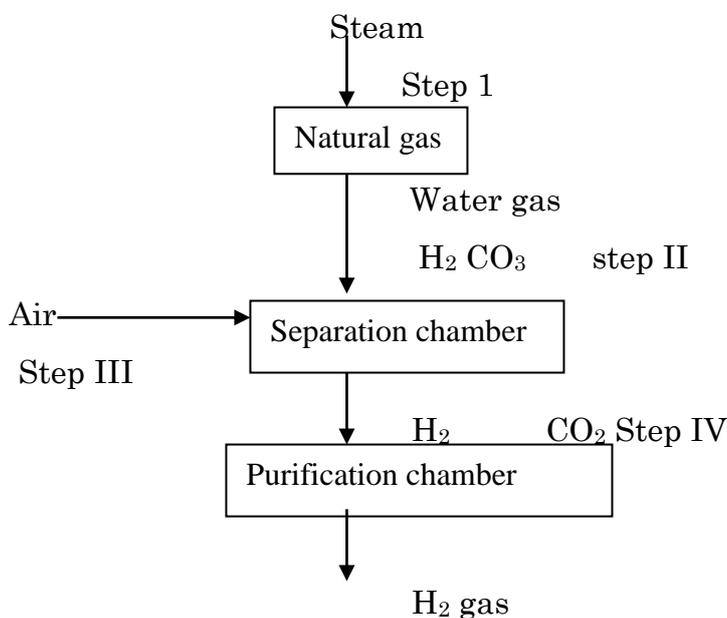
a) In step II water gas is formed. State one use of water gas. (1mk)

....

....

b) When air is added in step III CO is converted to CO_2 name one chemical substance that can be used to separate CO_2 from H_2 in step IV   (1mk)

....

....

c) State one large scale use of Hydrogen gas formed   (1mk)

....

....

24. Given that element G has an electronic arrangement of 2.8.18.7 and element H has an atomic number 17.

a) To which period of the periodic table does element G belong? Explain   (1mk)

....

....

b) How would the reaction of Sodium metal with G compare to its reaction with H ?   Explain   (2mks)

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....

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The table below shows, some properties of alkali and alkaline earth metals.

Table 1

Elements	Atomic number	Atomic radius	Melting point (^0C)	Ionization Energy KJmol^{-1}
Li	3	0.133	180	520
Na	11	0.157	98	496

Table 2

Element	Atomic	Atomic Radius	Melting point	1st 1.E	2nd 1.E
	Number	(nm)	(^0C)	Kjmol^{-1}	Kjmol^{-1}
Be	4	0.089	1280	900	1800
Mg	12	0.136	650	736	1450

ii Explain why the melting point values for alkaline earth metals are higher than for the corresponding alkali metals.   (1mk)

....

....

iii   Why the 2nd 1.E of alkaline earth metals are much larger than the first 1.E   (1mk)

....

....

iv   In both chemical families, the melting point values decrease down the

group. Explain   (1mk)

....

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25. Study the flow chart below and answer the questions, that follow.

Carbondioxide (iv) oxide $\rightleftarrows$ Acid A

Burning magnesium

Water solid B +black specks

+ Water

Alkaline solutions
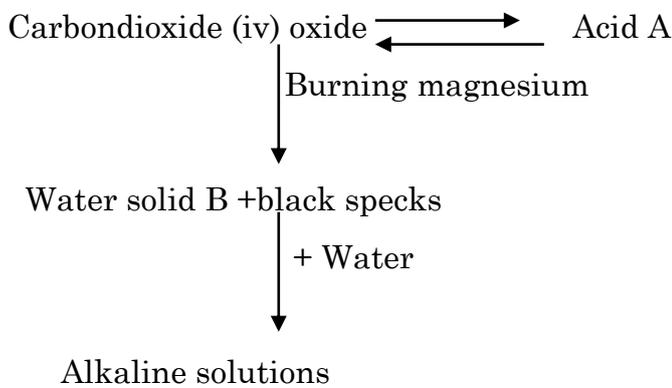
Write the formula of substances A, B, and C

A -   (1mk)
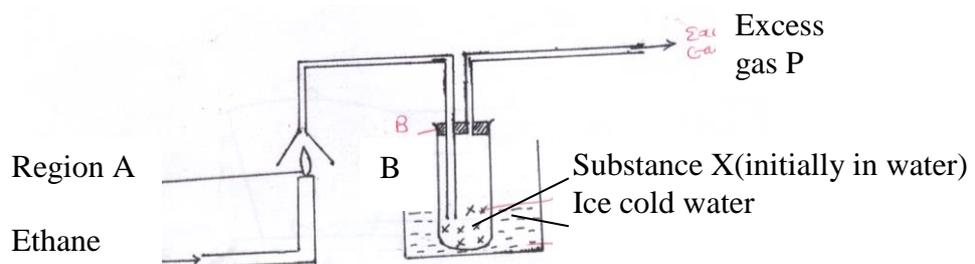
B -   (1mk)

C –   (1mk)

26. Calculate the number of electrons that will be required to convert 1.6g of

Sulphur to Sulphide ions (S^{2-}) (S = 32, L 6.0 X 10^{23})   (3mks)

27. The diagram below shows apparatus arrangement during combustion of

Ethane gas.

Excess
gas P

Region A   B   Substance X(initially in water)
                                                Ice cold water

Ethane

i   Write down the equation for the reaction occurring at region A .   (1mk)

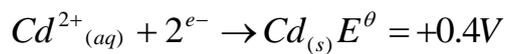ii What is expected to be the PH of substance X.   (1mk)

....

....

iii   Identify excess gas P   (1mk)

....

....

28. The following electrochemical cell was setup at 25^0C and one atmosphere.

$$Cr_{(s)} / Cr^{3+}_{(aq)} // Cd^{2+}_{(aq)} / Cd_{(s)}$$

Given the following standard electrode potentials

Cr^{3+} (aq) + 3 e $\longrightarrow$ Cr (s) E ^{0}= - 0.74V

$$Cd^{2+}_{(aq)} + 2^{e-} \rightarrow Cd_{(s)} E^{\theta} = +0.4V$$

a)   Write the cell reaction for the cell above   (1mk)

b)   Calculate the e.m.f for the cell   (1mk)