Name .....

School .....……

Roll Number.....……

Republic of Somaliland

Somaliland National Examination Board

Form 4 Chemistry Examination

June 2006

2 hours

PLUS 10 MINUTES before the exam for reading through the paper

TOTAL TIME 2 hours 10 minutes

INSTRUCTIONS TO CANDIDATES

This paper consists of 15 PRINTED pages.
Count them now. Inform the invigilator if there are any missing.

PART ONE- Multiple Choice Questions: 10 marks
PART TWO- Structured Questions: 90 marks
TOTAL 100 marks

- **Answer ALL questions.**
- **All answers must be written on this paper in the spaces provided immediately after each question. ONLY WRITE ON THIS EXAM PAPER.**
- **ALL WORKING SHOULD BE CLEARLY SHOWN IN THE SPACE AFTER THE QUESTION.**
- **Rough work can be done on page 2. This will not be marked**
- **NO extra paper is allowed.**
- **NO CALCULATORS are allowed.**
- **If you make a mistake cross out the incorrect answer clearly and write your correct answer.**

USE THIS PAPER FOR ROUGH WORK. IT WILL NOT BE MARKED.

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Section A: Multiple choice questions

For each question in this section, circle the correct answer.

If you change your mind cross out the answer you have wrongly chosen and clearly circle the correct answer.
If the examiner thinks you have marked two answers you will not receive a mark for that question.
For each question there is only one correct answer. Each question is worth one mark.

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1 A **precipitate** can be separated from a solution by

A evaporation followed by filtration
B chromatography
C filtration followed by washing and drying
D fractional distillation?

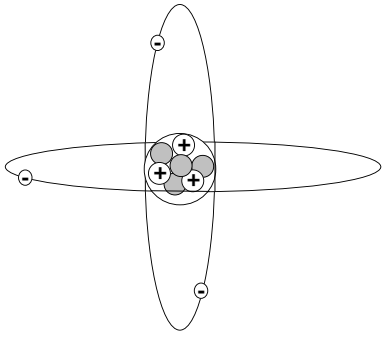
2 The pH of a **weak alkali** is between

A 0 and 4
B 7 and 10
C 4 and 7
D 11 and 14?

3 Chlorine is found in Group VII of the periodic table. The group is known as the

A Halogens
B Alkali metals
C Transition elements
D Noble gases?

4 The following diagram represents an atom of **lithium**.



Which of the following statements is **true**?

A A lithium atom has 3 neutrons
B Neutrons carry a charge of -1
C The atomic number is 4
D A lithium atom has 3 electrons

5 Which of the following two compounds belong to the same homologous series

A C_2H_4 and C_4H_6 B CH_3COOH and $HCOOCH_3$

C C_2H_3Cl and CH_4Cl_2 D C_2H_5OH and CH_3OH

6 Which of the following is the correct atomic symbol for the element Potassium?

A k B Po

C K D PO

7 The percentage of water in copper (II) sulphate crystals, $CuSO_4.5H_2O$ is
(Atomic masses Cu = 63.5, S = 32, O = 16, H = 1)

A 64% B 10% C 36% D 58%

8 Which of the following molecules is **ionic**?

A C_3H_8 B HBr C $NaNO_3$ D SiO_2

9 Organic molecules with the same molecular formula but different structural formulas are called

A allotropes B isomers

C isotopes D polymers

10 Which of the following equations is NOT correct?

A $CaCO_3 \rightarrow CaO + CO_2$

B $ZnCO_3 + H_2SO_4 \rightarrow ZnSO_4 + H_2O + CO_2$

C $MgO + 2HCl \rightarrow MgCl_2 + H_2$

D $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

Total 10 marks

Section B: Structured questions

Answer all of the questions below as fully as possible. You must write all your answers in the spaces provided on the paper.
The mark awarded for each part question is shown at the end of the space provided e.g. (2) means 2 marks.

Question 1

A strip of zinc is placed in a beaker containing copper (II) sulphate solution. It is left for a day.

(a) What colour is the solution **before** the reaction has taken place? (1)

.....

(b) What colour is the solution **after** the reaction has taken place? (1)

.....

(c) What colour is the metal strip **before** the reaction has taken place? (1)

.....

(d) What colour is the metal strip **after** the reaction has taken place? (1)

.....

(e) Write a *half equation* to show what has happened to the copper (II) *ions* (1)

.....

(f) Write a *half equation* to show what has happened to the zinc *atoms* (1)

.....

(g) Which *half equation* shows **reduction**? (1)

.....

(h) Which *half equation* shows **oxidation**? (1)

.....

(i) How has the *oxidation number* of the copper changed? (1)

.....

(j) How has the *oxidation number* of the zinc changed? (1)

.....

(k) Which ions were the *spectator ions* during the reaction? (1)

Total 11 marks

Question 2

Given:- Relative Atomic Masses of Na = 23, O = 16 and C = 12

(a) How many grams of sodium carbonate are contained in:

[i] 500 cm^3 of 1M solution? (3)

.....

.....

[ii] 1500 cm^3 of 0.25M solution? (2)

.....

.....

(b) How many **moles** of sodium carbonate are contained in:-

[i] 1060 g of the solid? (2)

.....

[ii] 1000 cm^3 of 1M solution? (1)

.....

[iii] 1000 cm^3 of 0.55M solution? (1)

.....

.....

[iv] 285 cm^3 of 0.55M solution? **(Give answer to 3 decimal places)** (2)

.....

.....

Total 11 marks

Question 3

(a) Write a **molecular equation** to show magnesium ribbon burning in oxygen gas to form magnesium oxide. (2)

.....

(b) [i] Name the products of the following *complete* hydrocarbon combustion reaction: (2)

Propane (g) + oxygen (g) → .....

[ii] Complete and balance the **molecular equation**: (2)

C_3H_8 (g) + O_2 (g) → .....

(c) [i] Complete & balance the **molecular equation** for the following precipitation reaction: (2)

$Pb(NO_3)_2$(aq) + NaI(aq) → .....

[ii] Write an **ionic equation** for this reaction. (2)
(No need to show spectator ions)

Don't forget to show state symbols for all equations
Total 10 marks

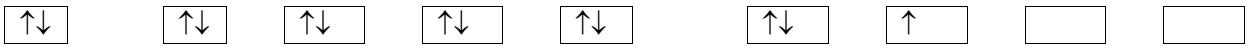
Question 4

The *electronic configuration* of aluminium (atomic number 13) can be shown as:-

Electronic structure 2,8,3 *or*

spdf notation $1s^2$, $2s^2 2p^6$, $3s^2 3p^1$ *or*

Electrons in boxes notation



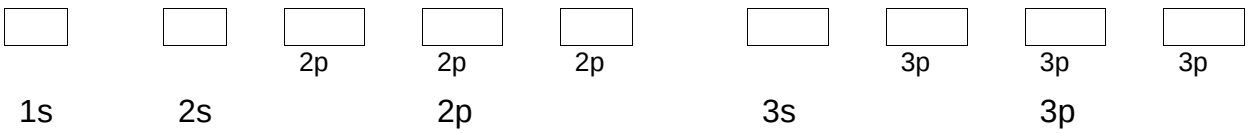
Give the *electronic*, *spdf notation* and *electrons in boxes notation* to show the electronic configurations of the following elements:-

(a) Silicon (atomic number 14) (3)

Electronic structure .....

spdf notation .....

Electrons in boxes notation

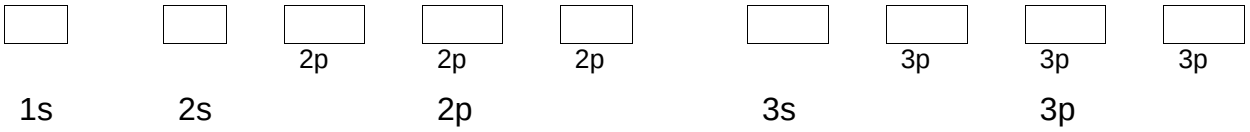


(b) Sulphur (atomic number 16) (3)

Electronic structure .....

spdf notation .....

Electrons in boxes notation

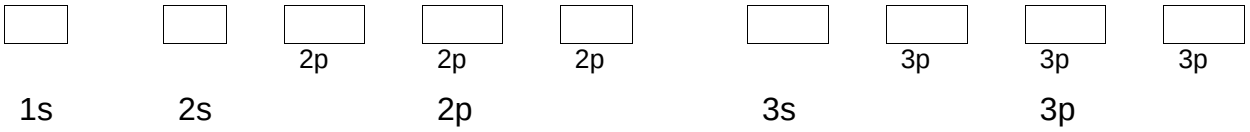


(c) Sodium (atomic number 11) (3)

Electronic structure .....

spdf notation .....

Electrons in boxes notation



(d) Fill in the table below to show equations for the 2nd, 3rd & 4th Ionization energies of aluminium:-

Ionization Energy	**Equation**	**Value in kJ mol^{-1}**
1st	$Al\ (g) \rightarrow Al^{+}(g) + e^{-}$ 2,8,3 2,8,2	578
2nd	$Al^{+}\ (g) \rightarrow Al^{2+}(g) + e^{-}$	1817
3rd	$Al^{2+}(g) \rightarrow Al^{3+}(g) + e^{-}$	2745
4th	$Al^{3+}(g) \rightarrow Al^{4+}(g) + e^{-}$	11575

[i] For each ion put the *electronic structure* in the table. (4)

[ii] In the table circle the *electronic configurations* that are the same as a *Noble gas*. (2)

[iii] The values from 1st to 2nd to 3rd increase gradually, but there is a huge increase from 3rd to 4th. Explain why. (3)

.....

.....

Total 18 marks

Question 5

The table below shows part of the Periodic Table, including the symbols of some elements

1																	2
3	4											5	6	7	8	F 9	Ne 10
Na 11	Mg 12											13	14	15	S 16	17	Ar 18
K 19	Ca 20	21	22	23	24	25	Fe 26	27	28	29	30	31	32	33	34	Br 35	36

Answer the questions below using **ONLY** the symbols given

(a) Give the symbols of 2 elements that are in the same period. (1)

.....

(b) Give the symbols of 2 elements that are in the same group. (1)

.....

(c) Give the symbols of 2 elements that can show the +3 oxidation state. (1)

.....

(d) Give the symbol of 1 element that can show more than one oxidation state. (1)

.....

(e) Give the symbol of the most reactive element shown. (1)

.....

(f) What type of bond would be shown between calcium and fluorine. (1)

.....

Total 6 marks

Question 6

Ethane burns in air according to the following equation:

$$2C_2H_6\,(g) + 7O_2\,(g) \rightarrow 4CO_2(g) + 6H_2O(l) \qquad \Delta H = \text{negative}$$

(a) What name is given to reactions in which ΔH is negative? (1)

.....

(b) The following tables show the energy changes that take place when bonds are broken and formed.

Energy used (taken in) to break bonds:

Bond	Number of the bonds	Bond dissociation energy kJ $mole^{-1}$	Energy needed in kJ
C – H	12	413	
C – C	2	330	
O = O		497	3479
		Total energy used (take in)	

Energy given out when new bonds are formed:

Bond	Number of the bonds	Bond dissociation energy kJ $mole^{-1}$	Energy needed in kJ
C = O	8	740	
H – O		463	5556
		Total energy given out	

[i] Complete the tables to find the total energy taken in and the total energy given out.

(7)

[ii] Use your answers to calculate the energy **given out** by the complete combustion of **1 mole** of ethane. (2)

.....

.....

.....

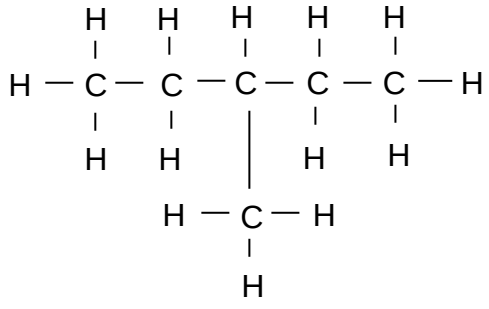
Total 10 marks

Question 7

(a) Draw the displayed structure of a hexane molecule. (1)

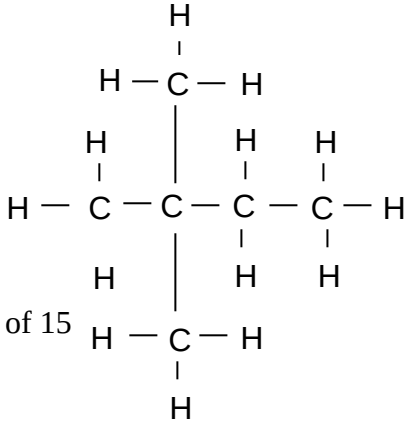
(b) Name the two isomers of hexane (given below)

A



A = ...

B



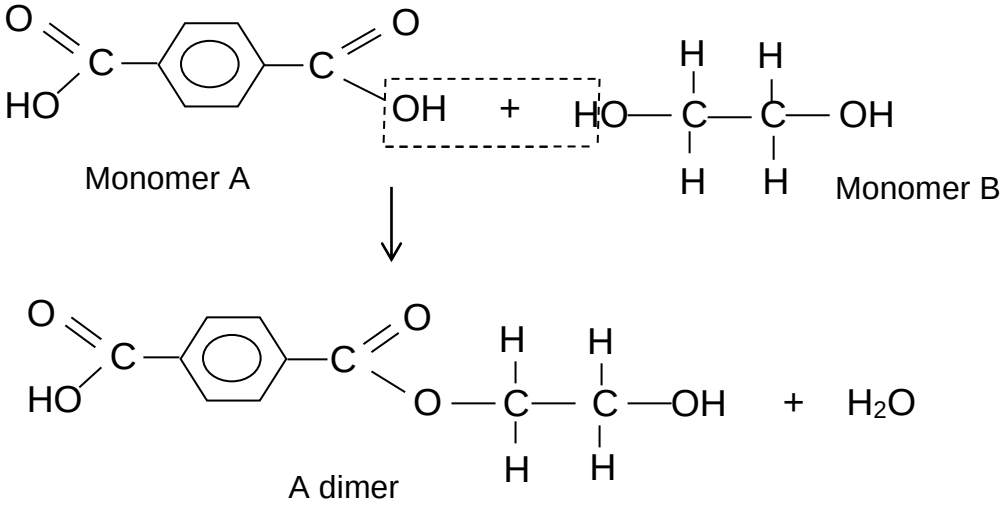
B = ...

(2)

(c) Complete the table below for each of the given hydrocarbons:- (5)

Compound:-	**Ethane**	**Ethene**	**Ethyne**
Homologous Series:-	Alkane		
Molecular Formulae:-			
Structural Formulae:-			H− C ≡ C− H
Type of Covalent Bonding:-		*Single and Double*	
Is the Carbon to Carbon bonding saturated or unsaturated?	*Saturated*		*Unsaturated*

(d) The following reaction shows the first stage in the formation of a *polyester* in which an alcohol and a carboxylic acid group combine to form an ester with the loss of water:-



(e) Which monomer is the alcohol? (A or B) (1)

.....

(f) Which monomer is the carboxylic acid? (A or B) (1)

.....

(g) What is the repeat unit of the resulting polymer? (3)

(h) What type of polymerization is taking place? (1)

.....

Total 14 marks

Question 8

Consider the reaction to produce ammonia by the Haber Process:-

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ KJ/Mol}$$

(a) What does the sign '⇌' tell you about the reaction? (1)

.....

(b) Is the reaction exothermic or endothermic? (1)

.....

(c) What temperature is used in industry for the reaction to make ammonia? (1)

.....

(d) High temperatures speed up reactions, so why is this temperature used? (2)

.....

.....

.....

.....

(e) What pressure is used in industry for the reaction to make ammonia? (1)

.....

(f) Why is this high pressure necessary? (2)

.....

(g) What catalyst is used in industry for the reaction to make ammonia? (1)

.....

(i) Why must the catalyst be powdered? (1)

.....

.....

.....

Total 10 marks