

JUNIOR LYCEUM ANNUAL EXAMINATIONS 2008
 DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION
 Educational Assessment Unit

FORM III

CHEMISTRY

TIME: 1h 30min

Name: _____

Class: _____

Useful Data: A copy of the Periodic Table is printed below.
 Relative atomic mass may be taken as: Cl = 35.5, Cu = 63.5, F = 19, Pb = 207,
 Mg = 24, O = 16, S = 32

PERIODIC TABLE

1	2											3	4	5	6	7	0	
																		4 He 2
7 Li 3	9 Be 4											11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10	
23 Na 11	24 Mg 12											27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18	
39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	63.5 Cu 29	65 Zn 30	70 Ga 31	73 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36	
85 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	99 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54	
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	210 Po 84	210 At 85	222 Rn 86	

Key

$\frac{a}{X} \frac{b}{}$	relative atomic mass
$\frac{a}{X} \frac{b}{}$	symbol
$\frac{a}{X} \frac{b}{}$	atomic number

Marks Grid [For Examiners use only]

Question N ^o .	Section A							Section B			
	1	2	3	4	5	6	7	8	9	10	
Max Mark	8	8	8	12	10	10	4	20	20	20	
Actual Mark											Theory Total

85% of Theory Paper	15% Practical	100% Final Score

SECTION A: Answer ALL questions in this section, using the spaces provided.
This section carries 60 marks.

1. The statements below refer to experiments that you may have observed.
- a) State whether the following are **physical** or **chemical** changes, giving a convincing reason.
- (i) A small amount of sulfur powder was put in a combustion spoon and was heated **strongly** until it caught fire.
This is a _____ change, because _____

- (ii) A piece of platinum wire was heated in a Bunsen flame till it was red hot and was then taken out of the flame and allowed to cool.
This is a _____ change, because _____

- (4 marks)

- b) Platinum is a metal while sulfur is a non-metal. Complete the table below to show the results of testing for **differences** in properties between metals and non-metals.

Test	Result / Property	
	Metals e.g. platinum	Non-metals e.g. sulfur
(i) Appearance	Shiny / silvery	Dull / yellow
(ii) Hit a small sample of the element with a hammer		
(iii) Connect a piece of the element in a circuit containing a battery, wire and a lamp		

(4 marks)

2. A supply of 'pure' water is very important both at home and in the laboratory. It is necessary to treat water before use because it contains different impurities.
- a) (i) Which type of impurities can be removed by filtration?

- (ii) Name the process used in Malta to obtain water from sea water.

- (iii) Name a process that is used to obtain pure water from impure water in the laboratory.

- (iv) How can water be sterilised (to kill bacteria)?

- (4 marks)

b) In most households water is usually boiled in a kettle. If the water is 'hard', after a time a deposit known as 'fur' appears on the bottom and sides of the kettle.

(i) Which type of hardness causes this 'fur' to build up?

(ii) Give the name of the compound present in this 'fur'.

(iii) Write an equation to show the formation of this fur from the type of hardness that you mentioned in your answer to b) (i).

(4 marks)

3. This question refers to the presence of nitrogen, oxygen and their compounds in air.

a) Fill in the blanks in these sentences.

The two main gases in air are nitrogen and oxygen. They are present in air in the approximate percentage of oxygen _____% and nitrogen _____%.

These two gases can be isolated from liquid air in industry by the method of

_____.
(3 marks)

b) Read the following passage, then answer the questions that follow.

At high temperatures, e.g. inside car engines, nitrogen and oxygen can combine to form the colourless gas nitrogen monoxide. Once it comes in contact with air, nitrogen monoxide normally reacts with more oxygen to form the brown gas nitrogen dioxide which is both toxic and acidic. Nitrogen dioxide therefore contributes to making rain water more acidic.

(i) What type of oxide is nitrogen monoxide? _____

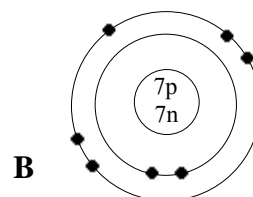
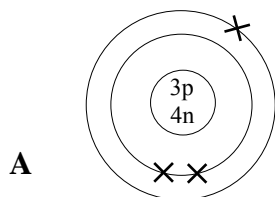
(ii) Suggest the name or formula of an acid that could be formed when nitrogen dioxide dissolves in rain water. _____

(iii) Name another gas, apart from nitrogen dioxide, which is toxic and is usually present in car exhaust fumes. _____

(iv) Nowadays, all new cars are fitted with a catalytic converter. Briefly explain why the catalytic converter helps in reducing atmospheric pollution by gases such as the oxides of nitrogen in the car's exhaust.

(5 marks)

4. a) Consider the atoms A and B shown below.



(i) Select, from A and B, the atom that has: an atomic number of 7 _____
a mass number of 7 _____

(ii) State the valency of: atoms of A _____
atoms of B _____

(iii) Which of the atoms, A or B, would accept or share electrons to attain a noble gas electron configuration? _____

(5 marks)

b) (i) Hydrogen, ${}_1\text{H}$, combines with chlorine, ${}_{17}\text{Cl}$, to form a covalent compound. Draw a dot / cross diagram, showing only the OUTER shell electrons, to show the bonding in a molecule of hydrogen chloride, HCl.

(2 marks)

(ii) Give one property of hydrogen chloride which is due to its being composed of molecules.

_____ (1 mark)

c) (i) Magnesium, ${}_{12}\text{Mg}$, combines with fluorine, ${}_9\text{F}$, to form the ionic compound magnesium fluoride. Draw dot / cross diagrams, showing ALL electron shells, to show the electron structure and charge of a magnesium ion and a fluoride ion.

(3 marks)

(ii) Give **one** property that you would expect magnesium fluoride to show due to its being composed of ions.

_____ (1 mark)

5. a) Classify the liquids in the table below as acidic, alkaline or neutral.

liquid	approximate pH	acidic, alkaline or neutral
sugar solution	7	
baking soda solution	8.5	
orange juice	4.5	

(3 marks)

- b) (i) Give the name **or** formula for

a weak acid _____

a dibasic acid _____

an insoluble base _____

- (ii) What term is used to describe the reaction between an alkali and an acid?

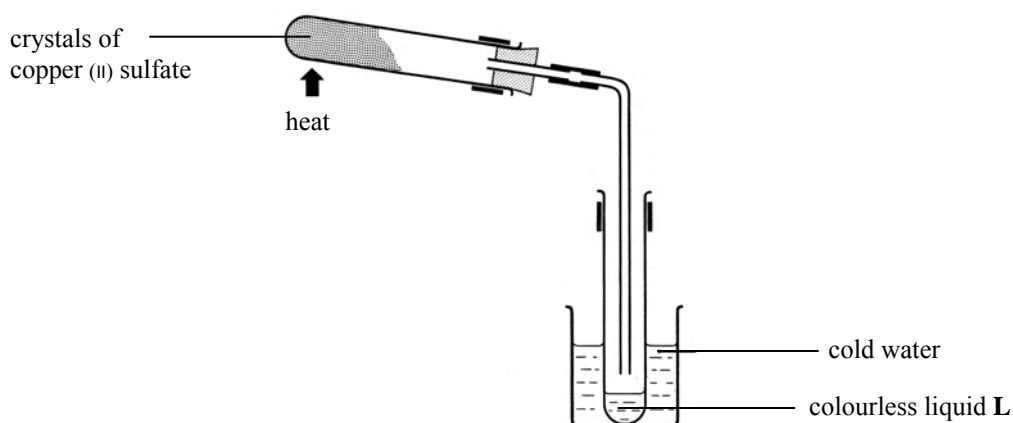
- (iii) Write a balanced equation for the reaction between an alkali and an acid.

_____ (6 marks)

- c) Give a reason why farmers sometimes add lime to soil.

_____ (1 mark)

6. a) The diagram below shows an experiment that can be carried out to show that crystals of copper (II) sulfate contain water of crystallisation.



- (i) What term is used to describe a salt that contains 'water of crystallisation'?

- (ii) Describe **two changes** that would be SEEN when the crystals are heated.

- (iii) What test can be carried out to prove that the colourless liquid L is **pure** water?

_____ (4 marks)

b) In another experiment 2.495g of copper (II) sulfate crystals, $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$, were heated to drive off the water of crystallisation. The mass of anhydrous copper (II) sulfate left was 1.595g.

(i) What is the formula mass of anhydrous copper (II) sulphate, CuSO_4 ?

_____ (2 marks)

(ii) How many moles of anhydrous copper (II) sulfate were left?

(1 mark)

(iii) If the formula mass of water is 18, how many moles of water were driven off?

(1 mark)

(iv) Use your answers to parts (ii) and (iii) to find the value of x in $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$.

(2 marks)

7. Container A contains 0.5 mole of lead (II) chloride, PbCl_2 while container B contains 2 mole of magnesium fluoride, MgF_2 .



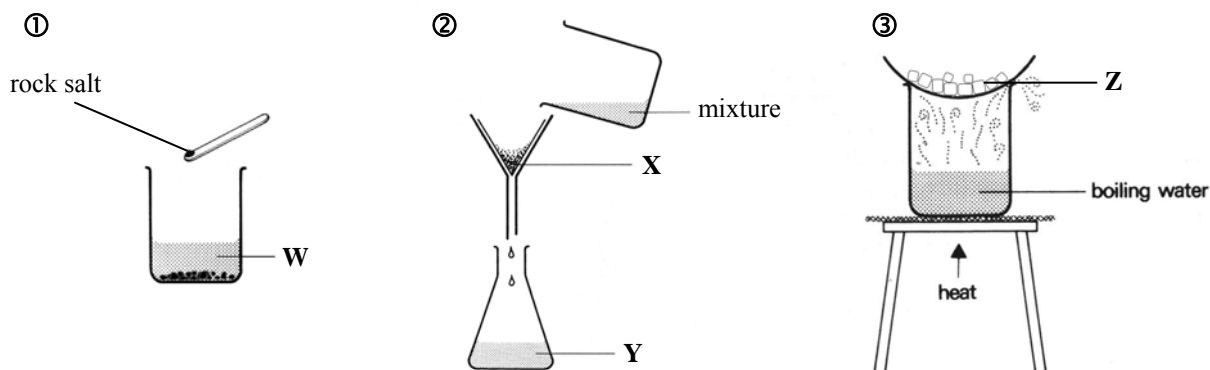
Assume that when empty, the beakers weigh exactly the same.
Which of the beakers A or B will weigh more? Show your working.

(4 marks)

SECTION B: Answer any TWO questions from this section, on the separate sheets provided. Each question carries 20 marks.

8. This question is about **methods of separation**.

a) The diagrams below show the main stages in obtaining a sample of sodium chloride from rock salt (which is mainly a solid/solid mixture of common salt and sand).



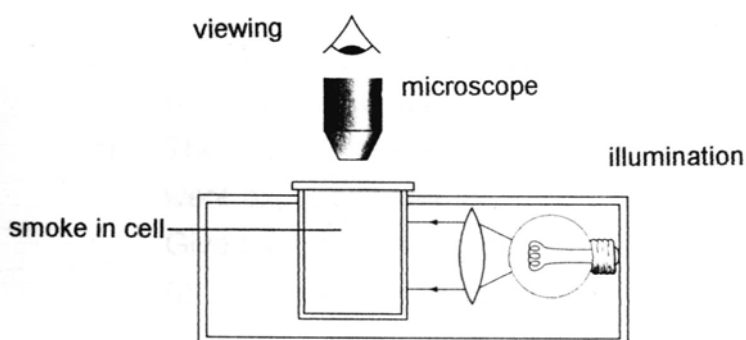
For **each** stage ① to ③:

Give the name of the process. Briefly write the **main practical steps** involved in carrying out the process. Include the **names of the apparatus** used and the **terms** used to describe the **results** (or substances) which are labelled W, X, Y and Z. (16 marks)

b) The method of **sublimation** can be used to separate a solid/solid mixture of ammonium chloride and sodium chloride. Draw a labelled diagram of this separation technique. (4 marks)

9. a) Describe an experiment that could be set up to demonstrate **diffusion** in a liquid or a gas. Draw a labelled diagram of the set up, describe what would be seen and use the kinetic particle theory (the idea of particles) to explain what happens. (8 marks)

b) The diagram below shows the apparatus that a teacher set up to demonstrate Brownian movement.



(i) State what you would **see** if you were to view the smoke cell by means of the microscope and (ii) use the idea of particles to explain the observation. (4 marks)

c) State what you understand by the underlined terms and give **two** differences between **each pair** of particles described in the two statements below.

(i) $^{12}_6\text{C}$ and $^{14}_6\text{C}$ are **isotopes**.

(ii) oxygen, O_2 , and ozone, O_3 , are **allotropes**. (8 marks)

10. This question is about the **preparation of salts** by various methods.
- a) A student is provided with zinc metal and dilute sulfuric acid in order to prepare the soluble salt, zinc sulfate.
- (i) State what the student should do to make sure the zinc reacts well with the acid and to ensure that all the acid is used up. (2 marks)
 - (ii) State **two** observations that would be made and write a balanced equation for the reaction. (4 marks)
- b)
- (i) Give the **name** and **formula** of **two compounds** of zinc that could be reacted with dilute sulfuric acid in order to prepare zinc sulfate. (4 marks)
 - (ii) Write a balanced equation for the reaction of **one** of these compounds with dilute sulfuric acid. (2 marks)
- c) A student needs to prepare a pure, dry sample of insoluble lead (II) sulfate.
- (i) Suggest the **names** of the reagents (two **solutions**) that could be used to prepare lead (II) sulfate and write a balanced equation for the reaction. (4 marks)
 - (ii) Briefly describe the experimental steps that the student would need to carry out to obtain a pure, dry, sample of lead (II) sulfate. (N.B. Diagrams are NOT required) (4 marks)