# JUNIOR LYCEUM AND SECONDARY SCHOOL
# ANNUAL EXAMINATIONS 2009

Directorate for Quality and Standards in Education
Educational Assessment Unit

**FORM 3** **CHEMISTRY** **TIME: 1h 30min**

**Name: _____** **Class: _____**

Useful Data: A copy of the Periodic Table is printed below.
Relative atomic mass may be taken as: H=1, O=16, Mg=24, S=32.

PERIODIC TABLE

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 H 1 | | | | | | | | | | 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: *a* **X** *b* — relative atomic mass / symbol / atomic number

**Marks Grid [ For Examiners use only ]**

| **Question N°.** | **Section A** | | | | | | **Section B** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | |
| **Max Mark** | 10 | 10 | 10 | 10 | 10 | 10 | 20 | 20 | 20 | **Theory Total** |
| **Actual Mark** | | | | | | | | | | |

| 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. a. Fill in with the words: **solvent**, **solute**, **solution**.

When crystals of copper sulfate are dissolved in water, the mixture formed is called a _____. Water is the _____ while copper sulfate is the _____. **[3]**

b. Solids melt into liquids while liquids boil to become gases.
The temperature at which:

(i) a solid melts is called _____ _____

(ii) a liquid becomes a gas is called _____ _____ **[2]**

c. Some mixtures can be separated by filtration. Underline which of the mixtures below can be separated by **filtration:**

(i) sand and water
(ii) sand and marble chips
(iii) alcohol and water
(iv) sugar and table salt. **[2]**

d. Sea water is a mixture of salts and water. When sea water is boiled, the water is turned into _____. This can be _____ back into water and collected as _____ water. **[3]**

2. a. Most elements are either metals or non-metals. Give one example of each.

Metal: _____ Non-metal _____ **[2]**

b. Fill in the space with the word **metals** or **non-metals**.

(i) Elements that conduct both heat and electricity are usually _____.

(ii) Most elements with a low melting point are _____.

(iii) Most _____ can be hammered to produce thin sheets.

(iv) Most _____ are shiny when freshly cut.

(v) Most solid _____ are brittle and break easily. **[5]**

c. Write down the name of :

(i) a metallic element that reacts with water _____.
(ii) a non-metallic element present in the air _____.
(iii) a non-metallic element that reacts with hydrogen to form an acid _____. **[3]**

3. a. An atom of the element potassium, symbol K, contains 19 protons and 20 neutrons.

Write down its:

(i) atomic number _____ (ii) mass number _____ **[2]**

b. Atoms of the **same** element always contain the same number of _____

and the same number of electrons, but not necessarily the same number of _____. **[2]**

c. A normal sample of chlorine includes amounts of two different atoms with symbols $^{35}_{17}Cl$ and $^{37}_{17}Cl$. Fill in the table below:

| | $^{35}_{17}Cl$ | $^{37}_{17}Cl$ |
|---|---|---|
| Number of protons | | |
| Number of electrons | | |
| Number of neutrons | | |

**[3]**

d. (i) Atoms of the same element with different mass numbers are called _____.

(ii) Chlorine is an example of such an element.

Another example is _____.

**[2]**

e. In a book of chemical data, the mass number of chlorine is given as 35.5. Use this data to state which of the two atoms of chlorine in question c. is more abundant.

_____. **[1]**

4. a. Atoms of two or more elements chemically bonded together form a _____ **[1]**

b. The element neon has an atomic number of 10.

(i) The electron configuration of a neon atom is _____.

(ii) Neon has a noble gas election configuration. This means that its outermost election shell is _____. **[2]**

c. (i) An atom of lithium, symbol Li, **loses** one electron to become an ion. The symbol of a lithium ion is _____.

(ii) An atom of chlorine, symbol Cl, **gains** one electron to become an ion. The symbol of a chlorine ion is _____.

(iii) An ion of a metal, such as lithium, formed by electron loss, is known as a _____ while an atom of a non-metal, such as chlorine, formed by electron gain, is known as an _____. **[4]**

d. The atomic numbers of lithium and chlorine are 3 and 17 respectively. Use this information to draw a dot/cross diagram that illustrates the electron transfer in the formation of lithium chloride.

**[3]**

5. a. Air is a mixture of gases. Which two gases are the most abundant in a sample of clean air?

_____ _____ **[2]**

b. Samples of air taken at random from industrial or urban areas show that air is heavily polluted with acidic gases that are not normally present in air.

(i) Name two such air-polluting gases.

_____ _____

(ii) Name one effect these polluting gases have on the environment.

_____ **[3]**

c. One of the gases you named in question a. is necessary for the rusting of iron.

(i) Give the name of another substance that must be present for iron to rust.

_____

(ii) Give one simple method that can be used to prevent iron from rusting.

_____ **[2]**

d. Global warming is a phenomenon that may have serious effects.

(i) Which atmospheric gas is mostly responsible for global warming when present in excess?

_____

(ii) Name two effects global warming may have on the environment.

_____ _____ **[3]**

6. a. Dilute hydrochloric acid reacts with zinc granules to liberate hydrogen.

(i) Write down an equation for this reaction. (Include state symbols)

_____

(ii) Give a simple test that shows that hydrogen is present.

_____ **[3]**

b. Dilute hydrochloric acid also reacts with sodium hydroxide solution.

(i) Such a reaction between an acid and an alkali is known as a _____ because neutral molecules of _____ are formed.

(ii) Write down an equation for the reaction between dilute hydrochloric acid and sodium hydroxide solution. (Include state symbols).

_____

(iii) Which **technique of separation** would you use to collect the salt produced during the reaction in question b.

_____ **[5]**

c. (i) What **colour change** takes place when blue litmus paper is placed in dilute hydrochloric acid?

_____

(ii) Use your answer to question c.(i) to show that polluted rain is acidic.

_____ **[2]**

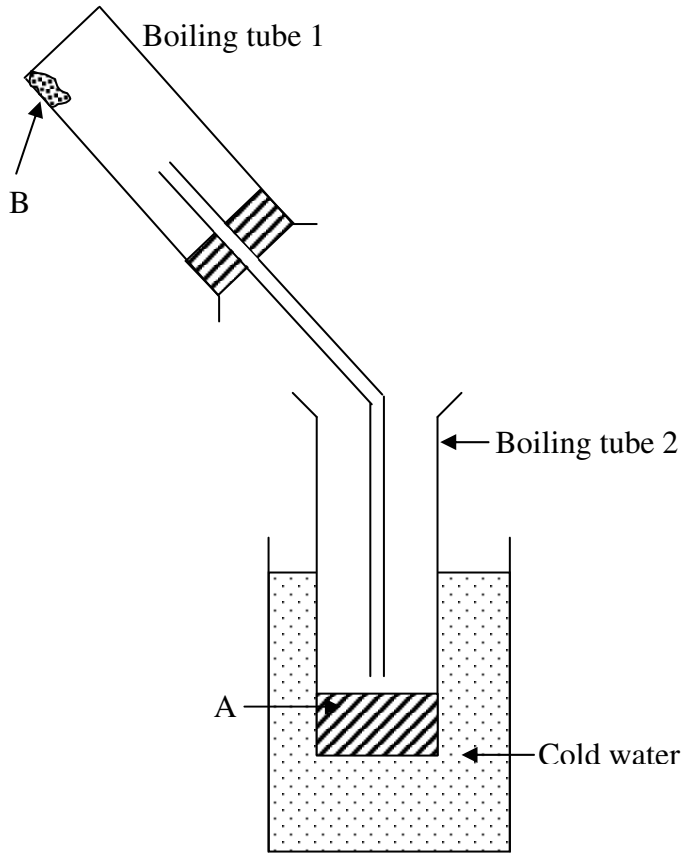
**Section B:** Answer **TWO** questions from this section on the separate sheets provided. Each question carries 20 marks.

7. This question is concerned with the hydrated salt magnesium sulfate, $MgSO_4$, $7H_2O$.

a. Work out the molar mass of:
   (i) 1 mole of water
   (ii) 7 moles of water
   (iii) 1 mole of anhydrous magnesium sulfate
   (iv) 1 mole of hydrated magnesium sulfate. **[8]**

b. Use your answer to question a. to calculate the percentage composition by mass of water of crystallization in hydrated magnesium sulfate. **[4]**

c.




(i) Explain what happens when the boiling tube containing the hydrated salt is heated strongly. Together with your explanation, your answer should include:
- the name of the substance collected at A.
- the name of the residue left in the boiling tube at B **[6]**

(ii) Give 1 reason why:
- Boiling tube 1 must be titled with its mouth downwards.
- Boiling tube 2 is surrounded with cold water. **[2]**

8. This question is about the lab. preparation of oxygen and the formation of oxides.

   a. Describe a method that can be used for the laboratory preparation of oxygen from hydrogen peroxide.
   Your answer should include:
   - an explanation of the procedure to be adopted
   - a well-labelled diagram of the apparatus
   - the name of any other substance that is necessary for the reaction to take place. **[8]**

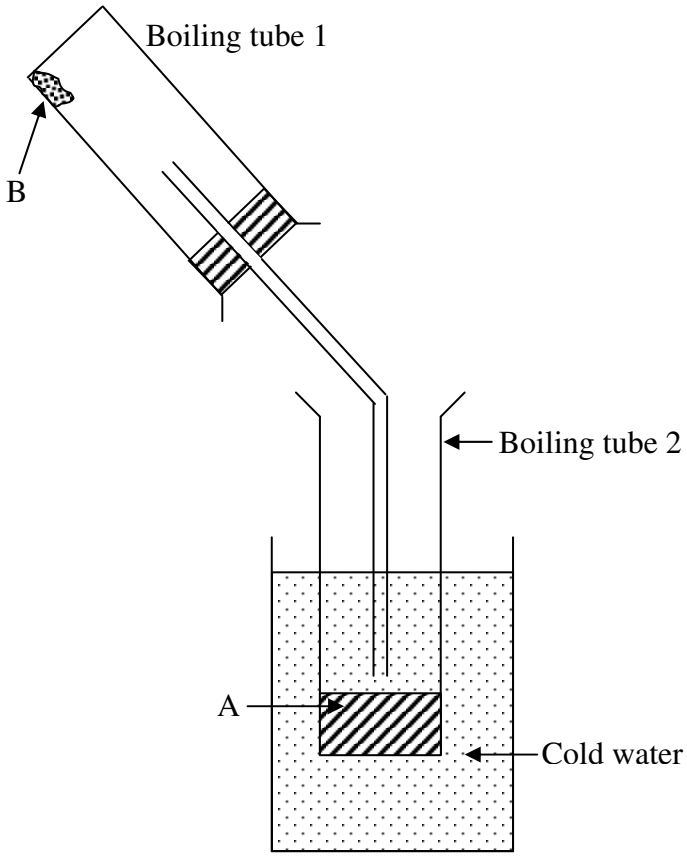
   b. Magnesium ribbon burns in air with a white flame.
   (i) Write down an equation to illustrate this reaction. Include state symbols.
   (ii) Name the product formed and describe its appearance.
   (iii) The product you named in question b.(ii) was added to some water containing universal indicator. What colour change will take place and what does this show about the product? **[6]**

   c. (i) Describe briefly what you observe when red-hot charcoal (carbon) is lowered into a gas jar containing oxygen.
   (ii) Name the gas liberated during this reaction and give a simple test to confirm the presence of the gas.
   (iii) The gas liberated is bubbled through water containing universal indicator. What colour change will take place and what does this show about this gas? **[6]**

9. a. 50 $dm^3$ of tap water required 20 $dm^3$ of soap solution to form a lather but after boiling, the same volume of water required only 8 $dm^3$ of soap solution to form a lather.
   (i) Does the water contain temporary hardness, permanent hardness or both?
   (ii) Explain why the volume of soap required to form a lather is **less** after boiling.
   (iii) Name one substance present in the original tap water responsible for causing hardness. **[4]**

   b. Write a short explanation about **each** of the following:
   (i) Hard water causes the furring of kettles.
   (ii) Hard water forms a scum with soap. **[4]**

   c. Some substances may be classified as:
   **deliquescent, effloresent or hygroscopic**
   (i) State what each term means.
   (ii) Give one example of each substance.
   (iii) What would you observe when each of the substances you chose in question c. (ii) is exposed to the air. **[12]**


Boiling tube 1
B
Boiling tube 2
A
Cold water