

JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2001

Educational Assessment Unit - Education Division

FORM 3

CHEMISTRY

TIME : 1hr 30min

Name: _____

Class: _____

Useful Data: A copy of the Periodic Table is provided with this paper.
Relative atomic masses. C = 12, H = 1, Mg = 24, O = 16
Avogadro constant (L) = 6×10^{23}

Section A: Answer **All** questions in this section, using the spaces provided.
This section carries 60 marks.

1. a) Give the name of the process which occurs when:
- i) liquid water is obtained from water vapour _____.
 - ii) iodine solid is changed directly to iodine vapour _____.
 - iii) crystals of salt are obtained from salt solution _____.
- (3 marks)
- b) i) Complete these statements by giving the terms which describe the solid/liquid mixtures.
- Copper (II) sulphate dissolves in water to form a solution. Copper (II) sulphate is called the _____ while water is called the _____.
- Copper (II) oxide is an insoluble black solid, so when added to water it forms a cloudy _____.
- (3 marks)
- ii) Draw a fully labelled diagram of the apparatus used to separate a mixture of insoluble copper (II) oxide and copper (II) sulphate solution. (4 marks)

2. a) Complete this passage which describes the sub-atomic particles.
An atom contains an equal number of positively charged _____ and negatively charged _____.
The protons and _____ are packed together in the nucleus. The _____ move rapidly around the nucleus in _____.
- (5 marks)

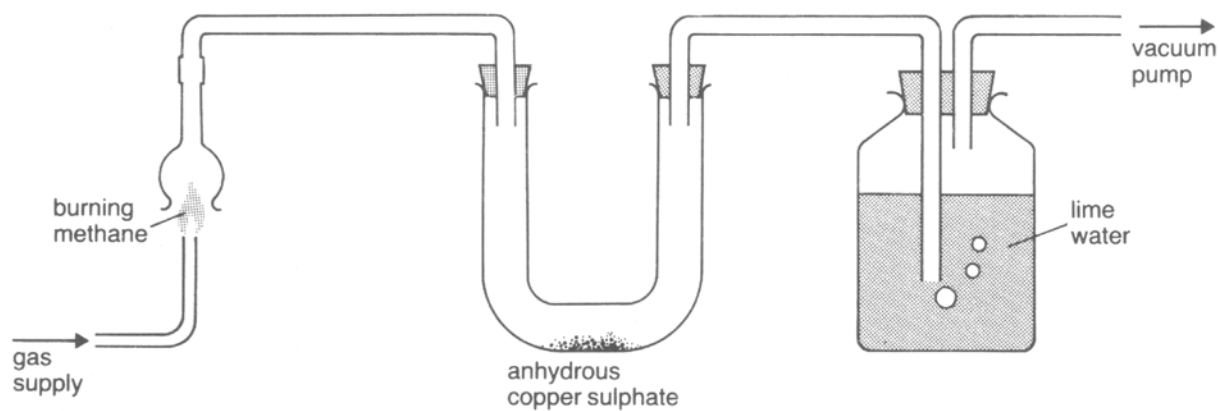
- b) The element Neon, Ne, has different types of atoms.
Two of these atoms are ${}_{10}^{20}\text{Ne}$ and ${}_{10}^{22}\text{Ne}$.
- i) What term is used to describe such atoms? _____.
- ii) How do these two atoms differ from each other?
_____.
- (3 marks)
- iii) Neon in the air consists mainly of 90% of ${}^{20}\text{Ne}$ and 10% of ${}^{22}\text{Ne}$. Use this information to calculate the relative atomic mass of neon in the air. (3 marks)

3. a) From the following list of pH values.
1, 3, 7, 10, 13.
Select the approximate pH value of the following substances:

sodium hydroxide solution	_____
aqueous sodium nitrate	_____
dilute hydrochloric acid	_____
lemon juice	_____
lime water (calcium hydroxide solution)	_____

- b) Give the **name** of
- i) the weak acid present in vinegar _____.
- ii) a base that is used to reduce acidity in soil _____.
- (7 marks)

4. a) Methane (natural gas) and butane (cylinder gas) are fuels, so that they are burned to provide _____.
- Combustion of fuels uses up _____ gas. (2 marks)
- b) The apparatus shown below was used to investigate the products formed when methane gas, (a hydrocarbon of formula CH_4), was burned in air



The paragraph below describes the result of this experiment.

Fill in the blanks.

A colourless liquid condensed in the U-tube. This liquid turned the anhydrous copper (II) sulphate from _____ to _____.

This test shows that the liquid formed was _____.

It can be shown that there is a **pure** sample of this liquid by testing its _____.

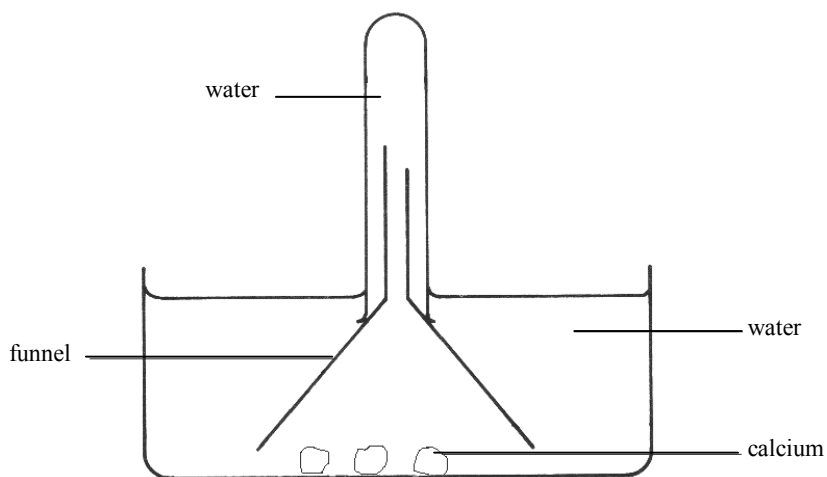
After a short time, the lime water turned _____, showing that the gas _____ was also liberated. (6 marks)

- c) If cylinder gas (butane, C_4H_{10}) is burned in a limited supply of air, there is incomplete combustion. Name the pollutant gas that is formed and say why it is harmful.

_____ (2 marks)

5. This question is about some chemical properties of water.

- a) The diagram below shows the apparatus which might be used to investigate the reaction of calcium with water.



During the reaction, hydrogen gas is given off. Calcium hydroxide is also formed, but it is only slightly soluble in water.

- (i) Use this information to give **two** observations you would expect to **see**.

_____ (2 marks)

- (ii) Complete the equation for the reaction.



- b) Magnesium reacts with steam to form a white solid and hydrogen. Complete the equation for this reaction.



- c) The non-metal carbon also reacts with steam forming hydrogen and another gas, which is a neutral oxide of carbon.

Complete the equation for this reaction.



6. The method selected to prepare a particular salt will depend on whether it is soluble or not. There are other chemical, practical or safety factors to be considered.

a) Match the method which is most suited to prepare each of the salts given, by writing the letter of the method next to the salt.

- | | | | |
|-------------------------------|---------------------|-------|-----------|
| A. acid + alkali (titration) | iron (III) chloride | _____ | |
| B. acid + insoluble carbonate | lead sulphate | _____ | |
| C. precipitation | potassium nitrate | _____ | |
| D. synthesis | copper(II) sulphate | _____ | (4 marks) |

b) Suggest a reason why

(i) the preparation of sodium chloride would not be attempted by adding sodium to dilute hydrochloric acid.

_____.

(ii) copper (II) sulphate cannot be prepared by adding copper to dilute sulphuric acid. _____ (2 marks)

c) Salts are very useful substances. Briefly explain why –

(i) sodium hydrogencarbonate (NaHCO_3) is used in baking soda.

_____ (2 marks)

(ii) washing soda ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) can be used to remove hardness of water.

_____ (2 marks)

7. a) What is the number of.

(i) moles of atoms in 48g of magnesium (1 mark)

(ii) atoms in 12g of magnesium (2 marks)

b) (i) Calculate the relative molecular mass of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$ (2 marks)

(ii) the percentage by mass of carbon in glucose. (2 marks)

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

- 8 a) As part of your practical work, you are asked to solve the following problem:
'Is the green pigment in carnation leaves a single substance?'
Describe in detail how you would.
- i) extract the colouring matter from some carnation leaves, (4 marks)
 - ii) use the method of paper chromatography to solve the problem.
Include a diagram of the experiment set up and the result. (10 marks)
- b) A mixture of nitrogen dioxide and oxygen can be separated by passing the gaseous mixture through a suitable cooling apparatus. The nitrogen dioxide is easily liquified while the oxygen passes on and can be collected separately.
Draw a labelled diagram showing a suitable method of liquifying the nitrogen dioxide **and** collecting the oxygen (which need not be dry). (6 marks)
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- 9 a) The elements sodium, $_{11}\text{Na}$, and chlorine, $_{17}\text{Cl}$, react together to form the electrovalent compound sodium chloride.
- i) Write the electron configuration for the neutral **atoms** of each element. (2 marks)
 - ii) State how the atoms become stable and draw diagrams, showing ALL electron shells, to show the electron configuration and the charge for the sodium **ion** and chloride **ion**. (6 marks)
 - iii) Give two properties that are expected of electrovalent compounds. (2 marks)
- b) The elements nitrogen, $_{7}\text{N}$, and hydrogen, $_{1}\text{H}$, react together to form the covalent compound ammonia.
- i) Write the electron configuration for one **atom** of each element. (2 marks)
 - ii) State the number of electrons that the atoms of each element needs to become stable and draw a diagram, showing OUTER shell electrons only, to show the bonding in a **molecule** of ammonia. (6 marks)
 - iii) Give two properties that are expected of covalent compounds. (2 marks)
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- 10 a) i) Describe, with the aid of a labelled diagram, how you would prepare and collect **dry** hydrogen in the laboratory. Give a balanced equation for the reaction.
ii) How would you test for the presence of hydrogen. (12 marks)
- b) Give balanced equations for the following reactions involving hydrogen.
- i) hydrogen burns in air to form water;
 - ii) hydrogen combines with chlorine to form hydrogen chloride;
 - iii) when hydrogen is passed over hot copper oxide, the products are copper and steam. (6 marks)
- c) Give two uses of hydrogen. (2 marks)