

UNIVERSITY OF SWAZILAND
FACULTY OF EDUCATION
MAIN EXAMINATION PAPER 2011

B.Ed. II and PGCE

December 2011

Title of paper: Curriculum Studies: Chemistry

Course number: EDC 279

Time allowed: 3 hours

Instructions:

1. This paper contains SIX questions.
2. Question 1 is COMPULSORY. You may then choose ANY THREE questions from Questions 2, 3, 4, 5 and 6.
3. Marks for each question or sub-question are indicated at the end of the question.
4. Any piece of material or work which is not intended for marking purposes should be clearly **CROSSED OUT**.
5. Ensure that responses to questions are **NUMBERED CORRECTLY**.

Special Requirements

SGCSE Physical Science Syllabus 6888 (Chemistry section)

THIS PAPER SHOULD NOT BE OPENED UNTIL PERMISSION HAS BEEN GRANTED BY THE INVIGILATOR

QUESTION 1

This question is compulsory

- a) Part of the understanding of the nature of science reflects that
- Science is empirical
 - Scientific claims are falsifiable
 - Science values open-mindedness

What do these terms mean in terms of the nature of science?

[5]

- b) Below is a section of the Junior Certificate Science syllabus *Topic 11: Acids, Bases and Salts*

11. Acids, Bases and Salts

Learners should be able to:

- describe the properties of chemical reactions
- identify chemical reactions
- describe meaning of exothermic and endothermic reactions
- investigate the characteristic properties of acids as reactions with metals, bases, carbonates and effect on litmus
- describe neutrality and relative acidity and alkalinity in terms of pH (whole numbers only) measured using Universal Indicator paper
- describe and explain the importance of controlling the acidity in soil
- describe the preparation of soluble salts

- Formulate a sub-topic for a lesson you might teach to achieve learning outcome (d).
[1]
- Outline activities that could be carried out by the pupils and by the teacher for a lesson on the sub-topic formulated in b) (i).
[10]
- What **elements of science** might be developed through the activities presented in (ii) above. Give **two** examples from chemistry for each of the elements?
[9]

QUESTION 2

The inclusion of Science in the secondary school curriculum is justified by the view that science develops **cognitive, affective and psychomotor abilities** of the pupil as well as **language competencies** of the pupil.

Using your Chemistry section of the Physical Science Syllabus (6888) for reference and any knowledge you may have regarding the chemistry offered in the schools, **discuss** your views on the potential contributions of the chemistry offered in schools to the development of the competencies outlined above. [25]

QUESTION 3

Discuss the ways in which chemistry as a school subject and its teaching may affect the motivation of pupils studying chemistry. Use examples from chemistry to illustrate your answer.

[25]

QUESTION 4

Suppose you want to use the **lecture** and **practical work** methods of teaching to achieve the following syllabus learning outcomes with your pupils. (See Topic: *C11. Electricity and chemistry*, page 15 in Physical Science syllabus (6888) 2011/2012. You may use attached information)

All pupils should be able to

- *Predict the likely products of the electrolysis of a specified binary compound in the molten state or in aqueous solution.*
- *Construct word equations for the electrode reaction involved in the manufacture of aluminium, chlorine and sodium hydroxide.*

- a) Discuss the suitability of the **lecture** and **practical work** as methods that can provide learning experiences that may lead pupils to achieve the outcomes. [12]
- b) Describe the preparation you might make to ensure the effective use of the stated methods. [8]
- c) Construct **two** assessment items/questions you might use to ascertain attainment of the given learning outcomes. Items **must** be above the knowing level. [5]

QUESTION 5

A student teacher provided the following information in his preparation book during Teaching Practice in 2009.

a) Instructional objectives (for a 50-minute lesson):

At the end of the lesson pupils should be able to:

- i) *Describe the formation of single covalent bond in H_2 , Cl_2 , H_2O , CH_4 and HCl by sharing of electrons leading to the noble gas configuration*
- ii) *Describe the electron arrangement in more complex molecules such as N_2 , C_2H_4 , CH_3OH and CO_2 .*

Comment on the learning outcomes for the intended lesson. [6]

b) The attached test was given by the same student teacher to his class.

Study the test and then answer the questions below.

- i) Which syllabus topic is the test targeting? [1]
- ii) With the help of a table of specification, critique the test-identifying its strengths and weakness in terms of its **content related validity** and **construct related validity** as required by the Physical science syllabus. (See attached copy of syllabus). [18]

QUESTION 6

Show the significance of the following for (chemistry) teaching and learning:

- a) Scheme of work [5]
- b) Learning outcomes [5]
- c) Lesson introduction [5]
- d) Lesson conclusion [5]
- e) Assessment [5]

19.3 Passing electricity through electrolytes

Fig 19.3 shows an apparatus suitable for passing electricity through an electrolyte.

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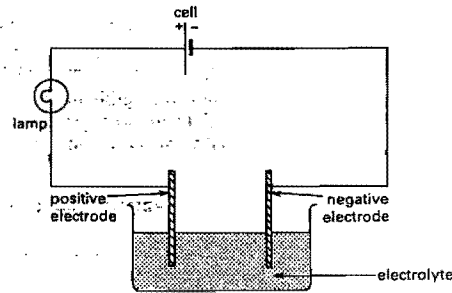


Fig 19.3

When electricity is passed through an electrolyte, the electricity enters and leaves the electrolyte via electrical contacts. These contacts are known as *electrodes*.

The positive electrode is known as the *anode*. The negative electrode is known as the *cathode*.

The ions in the electrolyte are attracted towards the electrodes.

Negative ions (called *anions*) are attracted towards the anode.

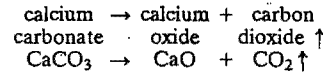
Positive ions (called *cations*) are attracted towards the cathode.

When electricity is passed through an electrolyte, chemical reactions take place at the electrodes, and the electrolyte is broken down. This process is known as *electrolysis*.

Electrolysis is the process in which a substance conducts electricity and is decomposed by it.

Many substances can be broken down or decomposed by heating. You may remember that limestone (calcium carbonate) can be changed into quicklime (calcium oxide) in this way:

Question 4



Electrolysis is also a way of breaking down substances. It uses electrical energy instead of heat energy. Consider some of the ways in which electrolysis can be used.

1. Electrolysis of molten lead bromide

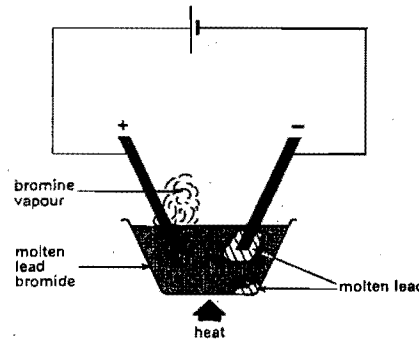
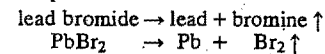


Fig 19.4

When electricity is passed through molten lead bromide, it is broken down to form lead metal and bromine vapour:



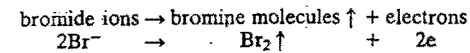
The lead is formed at the cathode and the bromine is formed at the anode.

We can consider the reactions at the anode and at the cathode separately.

At the anode

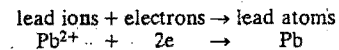
Negative bromide ions are attracted towards the

positive anode. At the anode they lose electrons and form bromine molecules:



At the cathode

Positive lead ions are attracted towards the negative cathode. At the cathode they gain electrons and form lead atoms:



2. Electrolysis of copper (II) sulphate solution

The way in which copper (II) sulphate solution conducts electricity depends on the electrode material.

(i) *With platinum electrodes*

Copper metal is formed at the cathode and oxygen gas is formed at the anode.

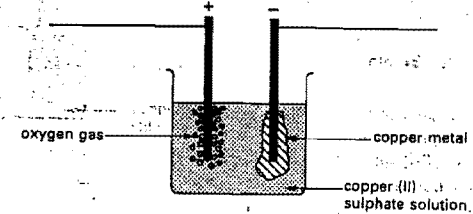


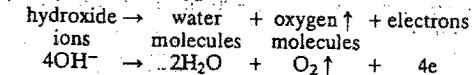
Fig 19.5

The solution contains copper (II) ions (Cu^{2+}) and sulphate ions (SO_4^{2-}) from the ionic copper (II) sulphate. It also contains some hydrogen ions (H^+) and hydroxide ions (OH^-) because water is slightly ionised.

At the anode

Hydroxide ions lose electrons forming water

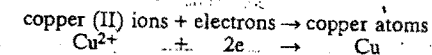
molecules and oxygen molecules:



The sulphate ions are unchanged

At the cathode

Copper (II) ions gain electrons to form copper atoms.



(ii) *With copper electrodes*

Copper is still formed on the cathode, but the reaction at the anode is different. Instead of oxygen gas being formed, the anode dissolves.

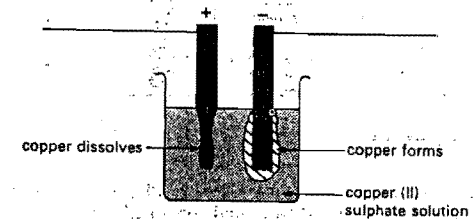
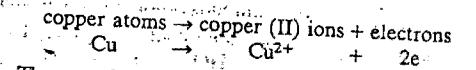


Fig 19.6

At the anode

Copper atoms from the anode lose electrons to form copper (II) ions. These ions pass into the solution.



The overall change is that copper is moved from the anode to the cathode. This makes the process suitable for copper plating. For copper plating,

the object to be plated is made the cathode and a piece of pure copper is used as the anode.

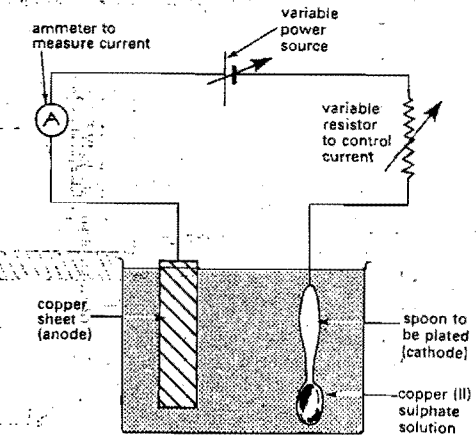


Fig 19.7 Copper plating a spoon

For successful copper plating the current, temperature and concentration of the electrolyte must be carefully controlled. The anode is sometimes arranged as a cylinder around the object to be plated. This gives a more even plating.

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Question 5(b)

FORM 4 B CHEMISTRY TEST **JUNE 2009**

TIME: 1 ½ HRS

TOTAL: 50

Answer all questions.

- What do a chloride ion and an Argon atom have in common? Why is a chloride ion not called an argon ion? (3)
- The atomic number of potassium is 19. Give 3 deductions which can be made from this statement. (3)
 - The following symbols represent atoms of elements showing their mass numbers and atomic numbers.



- What is the electronic structure of the argon atom? (2)
- How many neutrons are there in the nucleus of the Argon atom. (1)
- Explain why the Argon atom has a lower atomic number but a greater mass number than the potassium atom. (2)

- The following symbols refer to atoms of sodium, fluorine, and neon:



Using the above information, answer the following questions:

- What are the electronic structures of the sodium and fluorine atoms. (4)
- Sodium and fluorine combine to give the ionic compound Sodium Fluoride. Explain with the aid of a diagram, the changes in electronic structure. Which take place in this reaction. (5)
- Name and explain briefly, with the aid of a diagram, the type of chemical bond linking atoms of fluorine in the molecule F_2 . (2)

- Write the chemical formula for:

- Magnesium fluoride (2)
- Sodium fluoride (2)

- Draw molecular structures of the following compounds.

- CaCl_2 (3)
- H_2O (3)
- CH_3OH (5)
- NaCl (3)

- Define the following:

- Ionic bonding
- Covalent bonding
- Covalent π bond *Compound*
- Atom and ion
- Molecule (5)

- The table shows the mass numbers and atomic numbers of atoms labelled T to Z.

Atom	Mass Number	Atomic number
T	2	1
V	3	1
W	3	2
X	6	3
Y	9	4
Z	11	5

- How many protons are there in an atom of y?
- How many electrons are there in an atom of W?
- How many neutrons are there in an atom of Z?
- Which atoms are isotopes of the same element?
- Which atoms would readily form an ion with a single positive charge?
- Which is an atom of a noble gas?

(5)