UNIVERSITY OF SWAZILAND

FACULTY OF EDUCATION

MAIN EXAMINATION PAPER

B. Ed. II/PGCE

December 2014

Title of paper: Curriculum Studies in Chemistry

Course number: EDC 279

Time allowed: 3 hours

Instructions:

1. This paper contains FIVE questions.
2. Question 1 is COMPULSORY. You may then choose ANY TWO questions from questions 2, 3, 4, 5.
3. Marks for each 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.
6. This paper comprises six printed pages

Special Requirements: One page information sheet: Unit 8.7 Nitrogen that is attached

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

QUESTION 1

This question is compulsory

a) Study Activity 1.2 below and then answer the two sub-questions i) and ii) below it.

> ***Activity 1.2 How to clean the kettle***
>
> *You will need: kettle, lemon juice and a heat source*
>
> *Pour enough lemon juice into the kettle so that it covers the element.*
> *Leave the juice for some time while observing what happens.*
>
> 1. *Describe your observation*
> 2. *How can you explain the observation you made?*
> 3. *Suggest a name for the substance you see being produced.*
> 4. *Describe how you could prove that your answer to Question 3 above is correct.*
>
> *Boil the lemon juice until all the deposits have been removed. Keep the resulting solution for use later.*
>
> 5. *Do you think the deposits would have been removed if the juice had been left for a longer time in the kettle without boiling?*
> 6. *Write a note to explain how to remove deposits in ironing irons used in homes.*

i) Suggest a topic for a lesson involving this activity [1]

ii) State the processes of science learners engage in while working on the activity. Indicate the step where the process occurs. [8]

b) What is the role of practical work in teaching Chemistry? [5]

c) Why is it important for a chemistry teacher to develop a specification grid when setting tests for assessing learning? [6]

d) In what ways does the teaching of Chemistry contribute to cognitive development of learners? [5]

[25]

QUESTION 2

Suppose you want to use practical work to teach learners concepts on nitrogen gas. You may refer to the attached information sheet titled **Unit 8.7 Nitrogen.**

a) Construct three learning outcomes you may wish your learners to attain from a lesson involving nitrogen gas. [9]

b) Design a worksheet for a standard practical that could be carried by your learners in a lesson. [16]

[25]

QUESTION 3

Below is an examination item that was taken from an SGCSE Physical Science Paper 3 examination paper. The relevant syllabus section is attached

Examiner's Use

12 Fig. 12.1 shows how ethene can react to form other compounds.

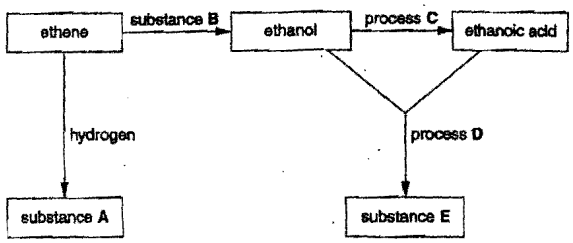

Fig. 12.1

(a) Ethene is an unsaturated hydrocarbon.

Describe a test that can be done in the laboratory to show that ethene is unsaturated.

test .....

result .....

[2]

(b) Name substances A, B and E.

A .....

B .....

E ..... [3]

(c) (i) State which type of compound is substance E.

..... [1]

(ii) Draw the structure of substance E.

[1]

a) Construct a specification grid for this item. [15]

b) Comment on the validity characteristics of the item. [10]

QUESTION 4

a) Questions that can be used with the question and answer method of teaching in chemistry can be classified in various ways. One of these ways is according to Bloom's taxonomy.

i) What is your understanding of the question and answer method of teaching? [2]

ii) What do you understand by classifying questions according to Bloom's taxonomy? [4]

iii) Construct two questions and classify them using Blooms taxonomy. [4]

iv) How might a chemistry teacher handle learner responses to questions during a chemistry lesson? [5]

b) Many learners are said not to be motivated to do science because subjects like Chemistry are difficult to understand. Discus the strategies a chemistry teacher may use to motivate learners. [10]

QUESTION 5

a) Why is it advisable for a chemistry teacher to have well stated learning outcomes for chemistry instructions? [5]

b) The following learning outcomes were designed for **a 70-minute lesson** by a student teacher during teaching practice.

By the end of Learners should able to

1. *Describe the effect of concentration, particle size, catalysts (including enzymes) and temperature on the speed of reactions*
2. *Explain the effect of concentration, particle size, catalysts (including enzymes) and temperature on the speed of reactions in terms of the collision theory*
3. *Interpret data obtained from experiments concerned with speed of reactions*

Comment on the learning outcomes stated by the student teacher for the lesson. [12]

c) Suppose you gave learners in your class the passage below to read for homework.

What chemistry concepts might the learners learn from reading the passage? [10]

Catalysts

A catalyst is a chemical substance which changes the rate at which a chemical reaction takes place. There are catalysts available that can increase the rate at which a reaction takes place as well as catalysts that can decrease the rate at which a reaction takes place. These are called **inhibitors**. Catalysts participating in reactions are chemically unchanged at the end of the reaction. However they may change physically, for example from a solid lump to a powder. Catalysts are normally either transition metals or transition metal salts. **Homogeneous** catalysts have the same phase (solid, liquid or gas) as the reactants while **heterogeneous** catalysts have a different phase from the reactants. If for example the reactants are liquids, the catalyst may be a solid.

UNIT 8.7

NITROGEN

About 80% of the earth's atmosphere is made up of the element nitrogen. Nitrogen is found in the protein material of plants and animals, and in the earth's crust as metal nitrates such as sodium nitrate and potassium nitrate.

The laboratory preparation of nitrogen

In the laboratory nitrogen is prepared by heat decomposition of ammonium nitrite. The ammonium nitrite solution decomposes gradually, even at room temperature, and cannot be stored as such. It is, therefore, prepared when it is needed by the reaction between ammonium chloride and sodium nitrite. The chemical equation representing the reaction is:

ammonium chloride + sodium nitrite → ammonium nitrite + sodium chloride

$$NH_4Cl_{(aq)} + NaNO_{2\,(aq)} \rightarrow NH_4NO_{2\,(aq)} + NaCl_{(aq)}$$

ammonium nitrite → water + nitrogen

$$NH_4NO_{2\,(aq)} \rightarrow 2H_2O_{(\ell)} + N_{2\,(g)}$$

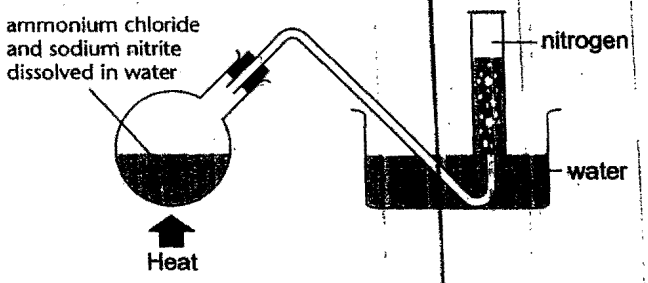

Figure 1 Laboratory preparation of nitrogen

The properties of nitrogen

It is a diatomic molecule(N_2). It is a colourless, odourless, tasteless gas which is slightly denser than air. It has a boiling point of –196 °C. It is sparingly soluble in water, less soluble than oxygen. Under normal conditions nitrogen is inactive. It does not burn or support burning. When a glowing splint is inserted into a gas jar of nitrogen it is extinguished. In the presence of a catalyst, however, it can be made to combine with hydrogen to form ammonia and it will combine directly with many metals forming nitrides. For example:

magnesium + nitrogen → magnesium nitride

$$3Mg_{(s)} + N_{2\,(g)} \rightarrow Mg_3N_{2\,(s)}$$

When water is added to this compound ammonia is given off, which can be recognised by its characteristic, choking smell.

magnesium nitride + water → ammonia + magnesium hydroxide

$$Mg_3N_{2\,(s)} + 6H_2O_{(\ell)} \rightarrow 2NH_{3\,(g)} + 3Mg(OH)_{2\,(s)}$$

Testing for the presence of nitrogen

Nitrogen is identified by its inactiveness and negative response to all usual tests:

- it does not support combustion or burning so it can be distinguished from oxygen.
- it does not burn so it can be distinguished from gases which do burn, such as carbon dioxide, hydrogen and acetylene.
- it does not turn lime water milky and can therefore be distinguished from carbon dioxide.

The uses of nitrogen

1. Nitrogen is used in large quantities in the production of ammonia gas during a process called the Haber process. The ammonia is used to produce nitric acid. Nitric acid is used in the manufacture of dyes, explosives and fertilisers.
2. Liquid nitrogen is used as a refrigerant. Its low temperature makes it useful for freezing food quickly.
3. Because of its unreactive nature, nitrogen is used as an inert atmosphere for some processes and chemical reactions. For example, empty oil tankers are filled with nitrogen to prevent fires.
4. It is used in food packaging, for example in crisp packets, to keep the food fresh and in this case to prevent the crisps from being compressed.
5. Plants make use of nitrogen indirectly in the form of nitrogenous compounds for protein synthesis and cytoplasm for their growth and survival.

Making ammonia – the Haber process

This is an industrial process in which ammonia gas is manufactured

...n using potassium permanganate and ...ydrogen peroxide. - state the uses of oxygen including use in oxygen tents, in hospitals and with acetylene in welding. - describe, in simple terms, respiration, combustion and rusting. - describe methods of rust prevention: paint and other coatings e.g., galvanizing to exclude oxygen. **C12.5 Carbon dioxide** - describe formation of carbon dioxide from: the complete combustion of carbon containing substances, as a product of respiration and as a product of the reaction between an acid and a carbonate. **C12.6 Nitrogen** - describe the need for nitrogen, phosphorus and potassium compounds in plant life. - name the uses of nitrogen in the manufacture of ammonia. - name the uses of ammonia in the manufacture of fertilisers e.g., ammonium sulfate, ammonium nitrate and in the manufacture of household detergents. **C12.7 Carbon and carbonates** - define allotropy as an existence of an element in two or more forms in the same physical state. - name the allotropes of carbon as graphite and diamond. - describe the manufacture of calcium oxide (quick lime) from calcium carbonate (limestone) in terms of the chemical reaction involved. - state some uses of lime and slaked lime in treating acidic soil and neutralising acidic industrial waste products. - state the uses of calcium carbonate in the manufacture of iron, glass and cement.	- describe the essential conditions for the manufacture of ammonia by the Haber process. - relate their structures to the use of graphite as a lubricant and in diamond cutting. Describe thermal decomposition of carbonates in the reactivity series. -
C13. Organic chemistry	
All learners should be able to: **C13.1 Name of compounds** - name, and draw the structure of unbranched alkanes, alkenes, alcohols and acids containing up to four carbon atoms; and the products of the reactions stated in C13.5 -C13.8. - state the type of compound present given a chemical name, ending in *-ane, -ene, -ol* or *-oic acid* or a molecular structure. **C13.2 Fuels** - name as fuels coal, natural gas and petroleum. - name methane as the main constituent of natural gas. - describe petroleum as a mixture of hydrocarbons and its separation into useful fractions by fractional distillation. **C13.3 Usee of petroleum fractions** - name the uses of the fractions:	- name, and draw the structure of unbranched alkanes, alkenes, alcohols and acids containing up to six carbon atoms; and the products of the reactions stated in C13.5 -C13.8.

Liquefied petroleum gas, as a fuel for cooking, petrol in petrol engines, the paraffin fraction in oil stoves and aircraft fuel, the diesel fraction for fuel in diesel engines, the lubricating fraction for lubricants and making waxes and polishes, bitumen for making roads. **- appreciate the hazards associated with the use of petroleum fractions.** **C13.4 Homologous series** - describe the homologous series as a 'family' of similar compounds with similar properties due to the presence of the same functional group. - describe the general characteristics of a homologous series. **C13.5 Alkanes** - describe the properties of alkanes (exemplified by methane) as being generally unreactive, except in terms of burning. **C13.6 Alkenes** - describe the properties of alkenes in terms of combustion, addition reactions with bromine, hydrogen and steam. - distinguish between saturated and unsaturated hydrocarbons from molecular structures and by simple chemical tests.	- describe the manufacture of alkenes and of hydrogen by cracking. - describe the formation of poly(ethene) as an example of addition polymerisation of monomer units. - describe the pollution problems caused by non-biodegradable plastics.