UNIVERSITY OF ESWATINI

FACULTY OF EDUCATION

MAIN EXAMINATION PAPER

PGCE

AUGUST 2020

Title of paper: Curriculum Studies in Chemistry II

Course number: CTE530

Time allowed: 3 hours

Instructions:

1. This paper contains FIVE questions.
2. Answer ANY **FOUR** questions.
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.

Special Requirements

Appendix A: Ethanol

QUESTION 1

a) Suppose you gave the passage below to your Form 4 class as a reading exercise. Study the passage and then answer the *questions* below it.

The mole

Chemists measure the amount of a substance in a unit called 'the mole'. This is a convenient way of counting atoms. It allows chemists to make predictions about the masses of different substances that are involved in reactions.

One mole is the Avogadro number of particles (atoms, molecules, ions or electrons) in a substance.

The Avogadro number

One mole of atoms contains 6×10^{23} atoms, no matter what element it is. This is a very large number: it is 6 with 23 zeros after it. It is known as the Avogadro number.

This number is used in chemistry because if you could count out this many carbon atoms, the total mass of carbon you would have is 12 g. On the other hand, weighing out 12 g of carbon allows you to know how many atoms you have.

Moles of elements

One mole of carbon atoms has a mass of exactly 12 g. Because magnesium atoms each have twice the mass of carbon atoms (^{24}Mg compared with ^{12}C), one mole of magnesium has a mass of 24 g. In fact, one mole of any element has a mass in grams that is equal to its relative atomic mass. One mole of iron has a mass of 56 g.

Moles of compounds

A mole of a molecular compound contains 6×10^{23} molecules. It has a mass that is equal to its relative formula mass. So a mole of water (H_2O) has a mass of 18 g. A mole of carbon dioxide (CO_2) has a mass of 44 g. This also works for ionic compounds, so a mole of sodium chloride (NaCl) has a mass of 58.5 g.

This approach can also be used for elements that are made from molecules. For example, oxygen gas O_2 is diatomic (each molecule contains two atoms) so its relative formula mass is 32. One mole of oxygen molecules would therefore have a mass of 32 g. One mole of oxygen atoms (if you could ever isolate them) would have a mass of 16 g.

Questions:

i) Identify **six** pre-requisite chemical concepts pupils should have developed to be able to understand the passage? [3]

ii) Identify three key chemical concepts pupils might learn from reading the above passage? [6]

iii) What difficulties might pupils experience in understanding the passage given above? [4]

b) Describe **three** functions of concepts in learning chemistry, **AND** indicate the implications of each function for teaching for understanding. [12]

[25 marks]

QUESTION 2

a) Learning chemistry is not only affected by the subject matter, but also by the language of instruction and the language of science.

Discuss chemistry learning challenges learners tend to experience due to:

i) Language of instruction used in schools in Eswatini [7]

ii) Language of Science and Chemistry [8]

In each case illustrate your points in the discussion with concrete examples.

b) How might you ensure that language barriers are minimised when pupils learn Chemistry? [10]

QUESTION 3

Because the first 12 years of schooling have a tremendous effect on how individuals respond to post-secondary science, all primary and secondary students must have equal opportunities to actively learn science. Unfortunately, though, research has consistently shown a persistent gender gap in primary and secondary science classrooms, especially in physics and chemistry, with female students trailing their male counterparts both in interest in the subject as well as academic performance (Lexakos and Antoine, 2003, p30).

a) Discuss, *briefly*, the reasons advanced for the persistent gender gap referred to in the passage above. [12]

b) To what extent do you consider the aspects discussed above to apply in the Eswatini context? Justify your response. [5]

c) How might you provide "***students … equal opportunities to actively learn science***"? [8]

QUESTION 4

Use the syllabus section on the Sub-topic: ***C14.7 Alcohols*** taken from the EGCSE Physical Science syllabus (given below) and the hand-out on ***Ethanol*** (attached as Appendix A) to attend to the task below:

> ***C14.7 Alcohols***
>
> 1. *describe the formation of ethanol by the catalytic addition of steam to ethene*
> 2. *describe the formation of ethanol (and carbon dioxide) by fermentation and its importance to the wine and brewing industry*
> 3. *describe the properties of alcohols in terms of combustion and dehydration*
> 4. *state the uses of ethanol as:*
>   - *a solvent*
>   - *a fuel*
>   - *for sterilization*
>   - *as a constituent of alcoholic beverages*
> 5. *state the advantage of using alcohol as a fuel over petrol*

Discuss the relevance of sub-topic **C14.7 Alcohols**, **AND** illustrate fully how it reflects the relation between science, technology and society. [25]

QUESTION 5

a) When preparing a scheme of work, a chemistry teacher is required to carry out a **syllabus analysis** and a **topic analysis**.

Describe each of the **bolded** terms, and show how they benefit the process of preparing a scheme of work. [9]

b) Describe each of the following and show its significance in preparing schemes of work in chemistry? Illustrate your response with clear examples

i) Logical sequencing

ii) Learning activities

iii) Teaching and learning materials

iv) Provision for comments [16]

Appendix A

Ethanol

What is Ethanol? - Formula, Structure & Uses

Ethanol is a chemical compound that is present in a lot of things we use on a daily basis, ranging from perfumes to alcoholic beverages. In this lesson, we will learn more about the formula, structure, and uses of ethanol.

Ethanol: Formula and Structure

Did you know that the red fluid that rises in a thermometer is ethanol? Did you also know that the alcohol present in alcoholic beverages is ethanol?

Ethanol, also commonly referred to as ethyl alcohol, pure alcohol, grain alcohol, and drinking alcohol, is most known as the alcohol present in alcoholic beverages. Ethanol, which can also be abbreviated as **EtOH**, is a colourless liquid with a slight odour, and it is soluble in water. It is flammable and volatile, so it evaporates easily when left in an open container.

Ethanol's chemical formula is C_2H_6O. This chemical formula can also be written as CH_3CH_2OH or C_2H_5OH. It is made of nine atoms that include two carbon (C) atoms, six hydrogen (H) atoms, and one oxygen (O) atom.

Its chemical structure is comprises a methyl group (which is the CH3-), a methylene group (which is the $-CH_2-$), and a hydroxyl group (which is the -OH) in the chemical structure.

Uses of Ethanol

Ethanol is such a simple chemical compound, but it has so many uses. It is used in antiseptics, household cleaning products, and even varnishes. In this section, we'll look at some of the many uses of ethanol.

Alcoholic Beverages

In adult social gatherings and parties, it will be highly likely that there will be alcoholic beverages. Ethanol is the alcohol that is found in our alcoholic beverages like beer, whiskey, and brandy. In alcoholic beverages, the ethanol is produced from the process of **fermentation**, which is the chemical breakdown of sugar by yeast.

There are times when we are served 'flaming beverages'. This is due to the fact that ethanol, which is present in the drink, is flammable.

Hand Sanitizers and Medical Wipes

We often see hand sanitizer dispensers in public restrooms. During the flu season, we also tend to carry a small bottle of hand sanitizer in our bags. Ethanol is effective in killing organisms like bacteria, fungi, and viruses, so it is no surprise that another common use of ethanol is that it is an ingredient in hand sanitizer gels. It is also used in medical wipes and at clinics and hospitals.

Various Solvents

Do you ever wonder what the solvent is for products like perfumes, varnish, and paints? What these products have in common is that the solvent used is ethanol. Because it is easily mixed with water and many other organic compounds, ethanol makes an ideal solvent for these products. It is a common solvent in personal care products, like deodorants, hairsprays, and astringents. It is also found in food additives, like food colouring and flavouring. Paints, lacquers, and varnish also have ethanol as one of their components.