UNIVERSITY OF SWAZILAND
FACULTY OF EDUCATION
MAIN EXAMINATION

MAY 2019

B. Ed. III AND PGCE

Title of paper: Curriculum Studies in Chemistry II

Course number: CTE330/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

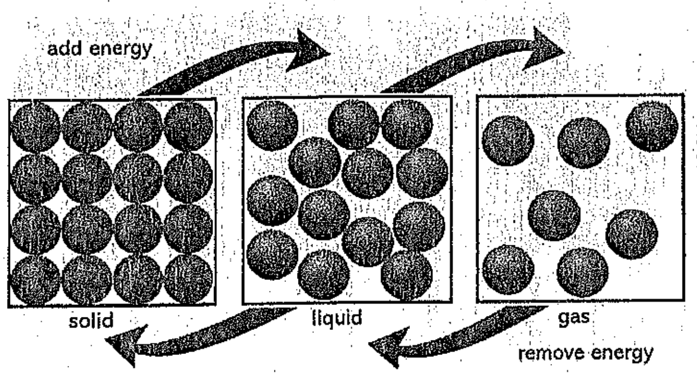
Information Sheet A: ***Stoichiometry of Chemical Reactions***

Information Sheet B: ***SGCSE Physical Science syllabus topics/subtopics***

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

QUESTION 1

As a student teacher who may be using the information presented in the picture below. Study the picture and interpret the information presented and then respond to the items (a) – (c) given below it.



Changes in state of matter happen because matter gains or loses heat energy.

a) Identify, and state five acceptable concepts communicated through the diagram. [5]

b) Using a table show the

i) Four alternative conceptions that might be conveyed by the representation of matter shown in the diagram, and [8]

ii) the **acceptable conception** [4]

iii) Select two alternative conceptions from those listed in (ii) above and describe a strategy/strategies on how you might help the learners reject the alternative conception. [8]

QUESTION 2

The number of women in science and engineering is growing, yet men continue to outnumber women, especially at the upper levels of these professions. In elementary, middle, and high school, girls and boys take math and science courses in roughly equal numbers, and about as many girls as boys leave high school prepared to pursue science and engineering majors in college. Yet fewer women than men pursue these majors. (Hill, Corbett & St. Rose, 2010).

a) Identify and describe **four** factors that may lead to the above observations. [16]

b) Describe four ways through which a chemistry teacher might improve on the observations stated by Hill, et al. (2010) above. [9]

QUESTION 3

a) "Language is often a major barrier for the novice in learning chemistry. However, there are other language-related problems which make chemistry difficult for students …" (Childs, Markic & Ryan 2015).

Using the attached **Information Sheet A** on ***Stoichiometry of Chemical Reactions*** as a source of examples, discuss fully how language may be a barrier in learning chemistry with respect to:

i) English as a language of instruction in Eswatini [10]

ii) Scientific/chemistry language [10]

b) What strategies might a chemistry teacher employ to overcome language related problems? [5]

QUESTION 4

Science and technology *and society* are sometimes not … considered *as playing a role* in sustainable development … in promoting or undermining *the latter* (Kongoli, 2016) (*modification by examiner*).

a) Within the context of chemistry discuss:

i) the relationship between science, technology and society. [10]

ii) how science and technology affects sustainable development. [10]

b) Describe briefly the role a chemistry curriculum can play in sustainable development? [5]

QUESTION 5

a) From the SGCSE –Physical Science syllabus topics/subtopics provide on Information Sheet B (attached):

Propose and **justify** a possible linear sequence for teaching the given subtopics (A to F). [8]

b) With the aid of content contained in Information Sheet A, propose a 40 minute lesson plan. [17]

Information sheet A

Stoichiometry of Chemical Reactions

Equations for Ionic Reactions

Given the abundance of water on earth, it stands to reason that a great many chemical reactions take place in aqueous media. When ions are involved in these reactions, the chemical equations may be written with various levels of detail appropriate to their intended use. To illustrate this, consider a reaction between ionic compounds taking place in an aqueous solution. When aqueous solutions of $CaCl_2$ and $AgNO_3$ are mixed, a reaction takes place producing aqueous $Ca(NO_3)_2$ and solid AgCl:

$$CaCl_2(aq) + 2AgNO_3(aq) \longrightarrow Ca(NO_3)_2(aq) + 2AgCl(s)$$

This balanced equation, derived in the usual fashion, is called a **molecular equation** because it doesn't explicitly represent the ionic species that are present in solution. When ionic compounds dissolve in water, they may ***dissociate*** into their constituent ions, which are subsequently dispersed homogenously throughout the resulting solution (a thorough discussion of this important process is provided in the chapter on solutions). Ionic compounds dissolved in water are, therefore, more realistically represented as dissociated ions, in this case:

$$CaCl_2(aq) \longrightarrow Ca^{2+}(aq) + 2Cl^-(aq)$$
$$2AgNO_3(aq) \longrightarrow 2Ag^+(aq) + 2NO_3^{\ -}(aq)$$
$$Ca(NO_3)_2(aq) \longrightarrow Ca^{2+}(aq) + 2NO_3^{\ -}(aq)$$

Unlike these three ionic compounds, AgCl does not dissolve in water to a significant extent, as signified by its physical state notation, *s*.

Explicitly representing all dissolved ions results in a **complete ionic equation**. In this particular case, the formulas for the dissolved ionic compounds are replaced by formulas for their dissociated ions:

$$Ca^{2+}(aq) + 2Cl^-(aq) + 2Ag^+(aq) + 2NO_3^{\ -}(aq) \longrightarrow Ca^{2+}(aq) + 2NO_3^{\ -}(aq) + 2AgCl(s)$$

Examining this equation shows that two chemical species are present in identical form on both sides of the arrow, $Ca^{2+}(aq)$ and $NO_3^{\ -}(aq)$. These **spectator ions**—ions whose presence is required to maintain charge neutrality—are neither chemically nor physically changed by the process, and so they may be eliminated from the equation to yield a more succinct representation called a **net ionic equation**:

$$\cancel{Ca^{2+}(aq)} + 2Cl^-(aq) + 2Ag^+(aq) + \cancel{2NO_3^{\ -}(aq)} \longrightarrow \cancel{Ca^{2+}(aq)} + \cancel{2NO_3^{\ -}(aq)} + 2AgCl(s)$$
$$2Cl^-(aq) + 2Ag^+(aq) \longrightarrow 2AgCl(s)$$

Following the convention of using the smallest possible integers as coefficients, this equation is then written:

$$Cl^-(aq) + Ag^+(aq) \longrightarrow AgCl(s)$$

This net ionic equation indicates that solid silver chloride may be produced from dissolved chloride and silver(I) ions, regardless of the source of these ions. These molecular and complete ionic equations provide additional information, namely, the ionic compounds used as sources of Cl^- and Ag^+.

Information sheet B

SGCSE Physical Science syllabus topics/sub-topic and the depth of content within each topic/sub-topic

A Speed of reaction

All learners should be able to:

1. define speed of a reaction
2. define a catalyst as a substance that changes the speed of a chemical reaction without undergoing any chemical change
3. classify catalysts into inorganic and organic (enzymes) catalysts
4. describe the effect of concentration, particle size, catalysts (including enzymes) and temperature on the speed of reactions
5. plot graphs and interpret data obtained from experiments concerned with speed of reaction
6. explain the effect of concentration, particle size, catalysts (including enzyme) and temperature on the speed of reactions in terms of the collision theory
7. describe the application of the above factors to the danger of explosive combustion with fine powders (e.g., flour mills) and gases (e.g., mines)
8. devise and explain a suitable method for investigating the effect of a given variable on the speed of a reaction

B Preparation of salts

All learners should be able to:

1. describe and prepare soluble salts from bases, carbonates, metals and ammonium salts
2. prepare, separate and purify insoluble salts (see C2.2 – Methods of purification)

C Atomic structure

All learners should be able to:

1. describe the simple structure of atoms in terms of neutrons, protons and electrons
2. state relative charges and approximate relative masses of protons, neutrons and electrons
3. define proton (atomic) number and nucleon number
4. deduce information from the notation $^{a}_{b}X$ for an atom
5. describe the build-up of electrons in shells
6. describe the significance of the outermost electrons and the noble gas electronic configuration
7. define isotopes as atoms of the same element with the same number of protons but different number of neutrons (The ideas of the distribution of electrons in s- and p-orbitals and in d-block elements are not required.)

D Reactivity series

All learners should be able to:

1. place in order of reactivity: calcium, aluminium, copper, (hydrogen), iron, magnesium, potassium, sodium, zinc and gold by reference to their reactions, if any, with aqueous ions of other metals, reaction with: water, steam and dilute hydrochloric acid
2. account for the apparent unreactivity of aluminium in terms of the oxide layer adhering to the metal
3. deduce an order of reactivity from a given set of experimental result
4. design an experiments to investigate the order of reactivity of metals

E Extraction of metals

All learners should be able to:

1. describe the ease in obtaining metals from their ores by relating the elements to the reactivity series.
2. name metals that occur native including copper and gold
3. name the main ores of aluminium, copper and iron
4. describe the essential reactions in the extraction of iron in the Blast Furnace
5. outline the manufacture of aluminium from pure aluminium oxide using electrolysis
6. describe the importance of conserving resources
7. describe the environmental impact of the mining and extraction of metals on vegetation , plants, human beings and animals

F Bonding

All learners should be able to:

1. describe the formation of ions by electron loss or gain
2. describe the formation of ionic bonds between the alkali metals and the halogens
3. describe the formation of ionic bonds between metallic and non-metallic elements
4. draw 'dot and cross' diagrams to show the formation of ionic bonds