UNIVERSITY OF ESWATINI

FACULTY OF EDUCATION

RE-SIT EXAMINATION PAPER

PGCE-FT/IDE-PGCE

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Course Code/Title of paper: CTE530 Curriculum Studies in Chemistry II

IDE-CTE530 Curriculum Studies in Chemistry II

Time allowed: 3 hours

Instructions:

1. This paper contains **FIVE** questions.
2. Question 1 is COMPULSORY. You may then choose and answer ANY THREE questions from Questions 2, 3, 4, 5.
3. Marks for each question and sub-question are indicated at the end each question/sub-question.
4. Any piece of material or work that is not intended for marking purposes should be clearly CROSSED OUT.
5. Ensure that responses to each question have the same number as the question and are not intercepted by responses to other questions.

Appendix A: **Stoichiometry of Chemical Reactions**

Appendix B: **EGCSE PHYSICAL SCIENCE Syllabus 6888**

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

QUESTION 1

This question is compulsory –so you must attempt it

a) The alternative conceptions listed below are reported by Ozman (2004)

A chemical bond is a physical entity.
Bond breaking releases energy
Bond making involves energy input
Chemical bonds form in order to produce filled shells
Molecules form from isolated atoms.

Show why each of these chemical ideas vary from accepted conceptions and are therefore *classified as alternative conceptions.* [10]

b) Why is it necessary for teachers to recognise that students develop alternative conceptions of chemistry concepts? [6]

c) Show clearly how language fosters chemistry learning in the chemistry classroom? [9]

QUESTION 2

Learning Chemistry is often challenging for learners.

Discuss **five** aspects of Chemistry you may consider to be the sources of chemistry learning challenges for learners. [25]

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 information sheet attached as **Appendix 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 in learning chemistry? [5]

QUESTION 4

Study the sub-topics C13.1 Air and C13.2 Water (Attached as Appendix B). Then discuss five aspects that make these sub-topics relevant for Eswatini. Support your response with concrete examples. [25]

QUESTION 5

a) Attached, as Appendix B, is the EGCSE –Physical Science syllabus section on Topic C13 Non-metals

Suggest, and justify, a sequence for teaching the sub-topics for Topic C13. 15]

b) What is the purpose of the following in lesson plans:

i) Lesson introduction? [5]

ii) Lesson conclusion? [5]

Appendix A Stoichiometry of Chemical Reactions *[for use with Question 3]*

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

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^+.

Appendix B EGCSE PHYSICAL SCIENCE Syllabus 6888:

(For use with Question 4 & Question5)

C13.0 Non-metals

All learners should be able to:

C13.1 Air

1. describe the volume composition of air
2. describe the fractional distillation of liquid air to obtain oxygen gas, nitrogen gas and the noble gases for industrial use
3. name common pollutants in air as carbon monoxide, sulfur dioxide, oxides of nitrogen, lead compounds, chlorofluorocarbons (CFCs) and excess carbon dioxide
4. describe the sources of each of the pollutants:
   - carbon monoxide from incomplete combustion of carbon-containing compounds,
   - sulfur dioxide from the combustion of fossil fuels containing sulfur compounds leading to 'acid' rain,
   - oxides of nitrogen from car exhausts,
   - lead compounds from car exhausts,
   - excess carbon dioxide from the combustion of fuels and
   - CFCs from aerosol sprays
5. state adverse effects of the pollutants on:
   - buildings (SO_2 and oxides of nitrogen),
   - plants (SO_2 and oxides of nitrogen)
   - health (oxides of nitrogen, sulfur dioxide, lead compounds, carbon monoxide)
   - the ozone layer (CFCs)
6. state the composition of catalytic converters in car exhaust systems (palladium, platinum and rhodium)
7. explain the importance of catalytic converters in car exhaust systems to remove carbon monoxide and oxides of nitrogen
8. describe the role of carbon dioxide in global warming
9. describe the role of ozone in absorbing ultraviolet (UV) radiation

C13.2 Water

1. describe and perform a chemical test for water using anhydrous copper(II) sulfate or cobalt(II) chloride
2. distinguish between the ion content of soft and hard water
3. distinguish between temporary hardness and permanent hardness
4. state advantages and disadvantages of hard water as having health, domestic and industrial implications
5. describe how hard water can be made soft by boiling, distillation and by using an ion exchanger
6. describe, in outline, the purification of water in terms of filtration, sedimentation and chlorination

C13.3 Hydrogen

1. name the uses of hydrogen in the manufacture of ammonia, margarine (see C14.6 – Organic Chemistry) and as a fuel in rockets
2. describe the preparation, collection and properties of hydrogen
3. describe formation of hydrogen as a product of electrolysis of water (see C12.7 – Electricity and Chemistry)

C13.4 Oxygen

1. describe the combustion of elements e.g. magnesium
2. describe the properties of oxygen
3. describe the preparation and collection of oxygen using potassium manganate(VII) and hydrogen peroxide
4. state the uses of oxygen including use in oxygen tents, in hospitals and with acetylene in welding
5. describe, in simple terms, respiration, combustion and rusting
6. investigate the conditions necessary for rusting to occur
7. describe methods of rust prevention: paint and other coatings e.g., galvanising to exclude oxygen
8. explain sacrificial protection in terms of the reactivity of zinc and iron

C13.5 Carbon dioxide

1. 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
2. describe the preparation, collection and properties of carbon dioxide
3. state the uses of carbon dioxide including use in fire extinguishers and fizzy drinks

C13.6 Nitrogen

1. describe the preparation of nitrogen by fractional distillation of liquid air
2. describe the essential conditions in the manufacture of ammonia by the Haber process
3. explain why the conditions used in the manufacture of ammonia are essential to obtaining the best yield of ammonia
4. name the uses of ammonia in the manufacture of fertilisers e.g. ammonium sulfate, ammonium nitrate and in the manufacture of household detergents
5. describe the need for nitrogen, phosphorus and potassium compounds in plant life

C13.7 Carbon and carbonates

1. define allotropy
2. name the allotropes of carbon as diamond, graphene and graphite
3. describe the manufacture of calcium oxide (quick lime) in a kiln from calcium carbonate (limestone) in terms of the chemical reaction involved
4. state some uses of lime and slaked lime in treating acidic soil and neutralising acidic industrial waste products
5. describe the uses of calcium carbonate in the manufacture of iron, glass and cement
6. interpret the ease of decomposition of metal carbonates in terms of the reactivity series