THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN EDUCATION EXAMINATION

731 CHEMISTRY TEACHING METHODS

Time: 3:30 Hours **ANSWERS** **Year: 2008**

Instructions

1. This paper consists of section A, B and C.

2. Answer all questions in section A and B and two questions from section C.

1. Explain briefly four (4) major steps of a scientific procedure as used in the teaching and learning of the Chemistry subject.

The first step is observation. This involves identifying a problem or phenomenon that needs scientific explanation. It forms the basis of investigation and stimulates curiosity.

The second step is hypothesis formulation. A hypothesis is a tentative explanation or prediction that can be tested. It helps to guide the experiment and focus data collection.

The third step is experimentation. This involves testing the hypothesis through controlled practical activities to collect data and observe outcomes.

The fourth step is conclusion and interpretation. After analyzing results from the experiment, a conclusion is drawn to support or reject the hypothesis and explain findings.

2. Give four (4) reasons why syllabus analysis is a crucial step for effective teaching and learning of Chemistry.

Syllabus analysis helps teachers identify the content to be covered within a given timeframe, ensuring systematic teaching.

It enables teachers to align lesson plans and assessments with curriculum objectives and learner needs.

It helps in selecting appropriate teaching methods, materials, and strategies suitable for each topic.

Syllabus analysis assists in preparing schemes of work and distributing lessons across the academic calendar effectively.

3. (a) With two (2) examples in each case, describe briefly textual and non-textual curriculum materials used in the teaching and learning of the Chemistry subject.

Textual materials include textbooks and laboratory manuals. These provide theoretical content, procedures, and exercises for learning Chemistry concepts.

Non-textual materials include models and charts. Models help in understanding molecular structures, while charts provide visual representation of concepts like the periodic table.

(b) State one (1) characteristic feature of textual and non-textual curriculum materials in Chemistry.

Textual materials present information in written form and require reading and interpretation, while non-textual materials use visuals or physical objects to simplify abstract concepts.

4. Write short notes on:

(a) Banking method.
This is a teaching approach where students are considered empty vessels to be filled with knowledge. Teachers deposit information without allowing learners to participate actively.

(b) Heuristic method as used in the teaching and learning of the Chemistry subject in secondary schools.
This method encourages discovery learning where students are guided to find answers through experiments and problem-solving. It promotes understanding, creativity, and analytical thinking.

5. One of the important concepts to be taught in Chemistry is chemical formulae. List down four (4) reasons of teaching such a concept.

Chemical formulae help students represent substances accurately in chemical equations.

They aid in understanding composition and proportions of elements in compounds.

They provide a foundation for learning chemical reactions and stoichiometry.

Knowledge of formulae promotes scientific communication and interpretation of chemical data.

6. Explain how you would lead students to calculate the percentage of sodium in the sodium carbonate (Na_2CO_3).

First, determine the molar mass of sodium carbonate: $Na_2CO_3 = (2\times23) + 12 + (3\times16) = 106$ g/mol.

Then calculate the total mass of sodium: $2\times23 = 46$ g.

Now use the formula: (Mass of sodium / Molar mass of compound) × 100
= (46 / 106) × 100 = 43.4%

7. Mention four (4) uses of tests given by Chemistry teachers after covering more than one topic.

Tests help in evaluating students' understanding and retention of content.

They identify learning gaps and guide remediation strategies.

They help in assessing teaching effectiveness and curriculum coverage.

They prepare students for national or final examinations through practice.

8. With examples, explain how you could lead students to develop an understanding of the concept exothermic reaction.

Begin by giving real-life examples like combustion and neutralization reactions.

Then demonstrate a simple experiment such as mixing hydrochloric acid and sodium hydroxide and observing the heat release.

Explain that exothermic reactions release heat to the surroundings, making the container warm.

Discuss the energy profile diagram showing reactants having higher energy than products.

9. After teaching the combining powers concept of the periodic table, one student had a problem of writing the formula of calcium chloride. The student had two options of writing the formula, Ca_2Cl or $CaCl_2$. Write a step-by-step procedure to help such a student to determine the correct formula for calcium chloride.

Step one: Identify the valency of calcium, which is 2.

Step two: Identify the valency of chlorine, which is 1.

Step three: Apply the criss-cross method. Bring the valency of calcium to chlorine and vice versa.

Step four: The resulting formula becomes $CaCl_2$, since two chlorine atoms are needed to balance the two positive charges of calcium.

Step five: Check and confirm the formula is electrically neutral.

10. One of the cross-cutting issues in education is environmental pollution. As a Chemistry teacher to be; discuss air pollution highlighting clearly its meaning, causes and effects to the environment.

Air pollution refers to the presence of harmful or excessive quantities of substances in the atmosphere, such as gases, particles, or biological molecules.

It is caused by industrial emissions, vehicle exhaust, burning of fossil fuels, deforestation, and use of harmful chemicals.

Air pollution affects human health by causing respiratory diseases, eye irritation, and cardiovascular problems.

It contributes to global warming, acid rain, ozone layer depletion, and harms ecosystems by affecting plant growth and animal life.

11. In one experiment, copper and silver electrodes were cleaned, dried and weighed, then replaced in their respective voltammeters and a current of 0.45 A was passed for 25 minutes. Thereafter the electrodes were removed, cleaned, dried and reweighed. The masses of copper and silver deposited were 0.221 g and 0.753 g respectively. The entire experiment is diagrammatically represented as follows:

(a) Calculate the quantity of electricity (Q) passed through the electrodes.
$Q = I \times t = 0.45 \times (25 \times 60) = 675$ C

(b) Calculate the molar masses for both copper and silver.
Molar mass of copper = 63.5 g/mol
Molar mass of silver = 108 g/mol

(c) Write cathode reactions for copper and silver.
For copper: $Cu^{2+} + 2e^{-}$ ------> Cu
For silver: $Ag^{+} + e^{-}$ ---------> Ag

12. Write short notes on the uses of Chemistry in today's general life.

Chemistry plays a vital role in medicine, enabling the development of drugs like antibiotics and vaccines through understanding molecular interactions. This improves healthcare and saves lives.

It drives advancements in agriculture by creating fertilizers and pesticides, such as ammonium nitrate, enhancing crop yield and food security. This supports sustainable farming practices.

Chemistry contributes to energy production, with processes like petroleum refining and battery development (e.g., lithium-ion batteries) powering vehicles and devices. This fuels modern technology and transportation.

It improves daily products, such as detergents and plastics, through chemical synthesis, making household tasks easier and more efficient. This enhances quality of life.

Lastly, environmental chemistry helps address pollution by developing water purification methods and biodegradable materials. This promotes a cleaner, healthier planet.

13. Mention and describe the major types of evaluation that are to be employed in the teaching and learning process of Chemistry.

Formative evaluation involves ongoing assessments, like quizzes on reaction rates, to monitor student progress and provide immediate feedback. This helps teachers adjust instruction to meet learner needs.

Summative evaluation occurs at the end of a unit, such as a final exam on organic chemistry, to assess overall understanding and assign grades. This evaluates mastery of the curriculum.

Diagnostic evaluation identifies student strengths and weaknesses before teaching, like a pre-test on atomic structure, to tailor lessons accordingly. This ensures targeted instruction.

Practical evaluation assesses hands-on skills through lab experiments, such as titrations, to evaluate students' ability to apply theoretical knowledge. This bridges theory and practice.

Lastly, peer evaluation encourages students to assess each other's work, like group projects on chemical bonding, fostering collaboration and critical thinking. This enhances learning through peer feedback.

14. (a) Deduce the salient features of a Chemistry lesson plan.

(b) Outline and discuss four things to be considered by a Chemistry teacher when preparing a lesson plan.

(c) Using the reaction between copper (II) sulphate and aqueous sodium hydroxide as an example, explain step by step how you could teach form II students a Chemistry sub-topic IONIC EQUATIONS.

(a) Deduce the salient features of a Chemistry lesson plan:

A Chemistry lesson plan includes clear objectives, specifying what students should learn, such as understanding ionic equations, guiding the lesson's focus.

It outlines teaching methods, like demonstrations or discussions, to engage students effectively in topics like chemical reactions.

The plan details resources and materials, such as copper sulfate for experiments, ensuring all necessary tools are prepared.

It incorporates assessment strategies, like questioning or a short quiz, to evaluate comprehension of concepts taught.

Lastly, it includes a timeline, allocating time for each activity, ensuring the lesson fits within the class period.

(b) Outline and discuss four things to be considered by a Chemistry teacher when preparing a lesson plan:

Student prior knowledge should be assessed to build on existing understanding, such as knowing basic chemical formulas before introducing equations, ensuring the lesson is appropriately pitched.

The teacher must select engaging activities, like a precipitation reaction demonstration, to maintain student interest and reinforce abstract concepts like ion formation.

Safety considerations are critical, especially for experiments involving chemicals like sodium hydroxide, requiring precautions like wearing gloves to prevent accidents.

Lastly, the teacher should align the lesson with curriculum goals, ensuring topics like ionic equations meet educational standards and prepare students for assessments.

(c) Using the reaction between copper (II) sulphate and aqueous sodium hydroxide as an example, explain step by step how you could teach form II students a Chemistry sub-topic IONIC EQUATIONS:

Introduce the reaction by explaining that copper (II) sulfate ($CuSO_4$) and sodium hydroxide (NaOH) react to form a precipitate, writing the molecular equation: $CuSO_4(aq) + 2NaOH(aq) \text{-----> } Cu(OH)_2(s) + Na_2SO_4(aq)$. This sets the foundation.

Demonstrate the reaction by mixing the solutions in a clear container, showing the blue $Cu(OH)_2$ precipitate, to make the concept visual and engaging for students.

Break down the equation into ions, explaining that $CuSO_4$ dissociates into Cu^{2+} and SO_4^{2-}, and NaOH into Na^+ and OH^-, while $Cu(OH)_2$ is insoluble: $Cu^{2+}(aq) + 2OH^-(aq) \text{------> } Cu(OH)_2(s)$. This introduces ionic dissociation.

Identify spectator ions (Na^+ and SO_4^{2-}) that remain unchanged, canceling them to form the net ionic equation: $Cu^{2+}(aq) + 2OH^-(aq) \text{----> } Cu(OH)_2(s)$, clarifying the core reaction.

Engage students with a similar example, like zinc sulfate and NaOH, guiding them to write the ionic equation, reinforcing the concept through practice.

Assess understanding by asking students to explain the ionic equation in their own words or solve a related problem, ensuring they grasp the sub-topic fully.