THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN EDUCATION EXAMINATION

731 CHEMISTRY TEACHING METHODS

Time: 3:30 Hours **ANSWERS** **Year: 2006**

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. Mention four (4) safe ways of storing chemicals in a school laboratory.

Chemicals should be stored in clearly labeled containers to avoid confusion and accidental use.

Flammable chemicals must be kept in flame-proof cabinets away from heat sources.

Toxic and corrosive chemicals should be stored in ventilated cabinets with secure locking systems.

Acids and bases must be stored separately to prevent dangerous reactions in case of leaks or spills.

2. Distinguish between achievement test and aptitude test in relation to Chemistry.

An achievement test measures the knowledge and skills a student has acquired in Chemistry over a period of instruction. It is based on the curriculum content covered.

An aptitude test assesses a student's natural ability or potential to learn Chemistry, regardless of previous instruction or exposure.

3. With the aid of two (2) examples in each case, define the following types of symbols which appear on containers of chemicals:

(a) Hazard
Hazard symbols are used to indicate the potential danger posed by chemicals. Examples include the skull and crossbones symbol for toxic substances and the flame symbol for flammable substances.

(b) Safety
Safety symbols indicate precautions that should be taken while handling chemicals. Examples include the glove symbol indicating that gloves must be worn and the goggle symbol for eye protection.

4. (a) What do you understand by the term brainstorming?

Brainstorming is a method of generating ideas or solutions through group discussion where all participants are encouraged to contribute freely without immediate criticism or judgment.

(b) Mention four (4) rules which govern the process of brainstorming.

All ideas must be accepted without judgment during the session.

Participants should build on each other's ideas to enhance creativity.

Encourage as many ideas as possible within the given time.

Record every idea presented for later evaluation.

5. (a) What is meant by instructional objectives?

Instructional objectives are specific statements that describe what learners should know, do, or feel after a learning activity. They guide lesson planning and assessment.

(b) Mention three (3) advantages of instructional objectives.

They help teachers focus on desired learning outcomes.

They provide a basis for evaluating student performance.

They guide the selection of appropriate teaching strategies and materials.

6. Define the following types of test items:

(a) Matching
Matching items consist of two columns, one with premises and the other with responses, where students are required to pair items correctly.

(b) Alternative choice
These items present two options such as true/false or yes/no, and the student selects the correct response.

(c) Multiple choice
This test type offers a question followed by several choices, usually one correct answer and distractors.

(d) Essay
Essay items require students to express their understanding in a structured written form, discussing, analyzing or explaining a topic in detail.

7. Explain four (4) advantages of using a chemistry textbook as a curriculum material.

Textbooks provide structured content aligned with the syllabus, making it easier for both teachers and students to follow lessons.

They contain exercises, summaries and illustrations that support learning and revision.

Textbooks serve as a reference source for additional information and deeper understanding of concepts.

They help in self-study, enabling students to learn outside the classroom.

8. Without putting some details, prepare a format of scheme of work to be used by chemistry teachers.

Week	Topic	Sub-topic	Objectives	Teaching Methods	Materials	Assessment

9. Specify four (4) criteria for selecting instructional materials.

Relevance to the lesson objectives and learner needs.

Accuracy and clarity of content.

Ease of use and accessibility for both teacher and learners.

Cost-effectiveness and durability.

10. (a) Write the aim of this experiment simply by looking at the set up in the diagram in figure 1.

The aim is to investigate the effect of particle size on the rate of reaction between hydrochloric acid and calcium carbonate.

(b) Why is acidified water used instead of pure or tap water in the trough?

Acidified water prevents the dissolution of carbon dioxide gas into water, ensuring accurate measurement of gas volume.

(c) Using a sample of 2 M HCl solution and some clean marble chips, describe a procedure for demonstrating the effects of particle size on the rate of a chemical reaction.

Place equal masses of large marble chips and powdered marble in separate conical flasks. Add equal volumes of 2 M HCl to each flask and immediately seal with a rubber bung connected to a delivery tube and gas collection apparatus. Measure the volume of CO_2 gas produced over time for each sample. Compare the rates to observe the effect of particle size.

(d) Complete table 1 below by calculating the rates, 1/t (s^{-1}), i.e., the reciprocals of time.

LARGE MARBLE CHIPS
30 s → 1/30 = 0.033
60 s → 1/60 = 0.017
90 s → 1/90 = 0.011
120 s → 1/120 = 0.008
150 s → 1/150 = 0.007
180 s → 1/180 = 0.006
210 s → 1/210 = 0.005
240 s → 1/240 = 0.004

POWDERED MARBLE
30 s → 1/30 = 0.033
60 s → 1/60 = 0.017
90 s → 1/90 = 0.011
120 s → 1/120 = 0.008
150 s → 1/150 = 0.007
180 s → 1/180 = 0.006
210 s → 1/210 = 0.005
240 s → 1/240 = 0.004

(e) Use the data in the completed table to plot on the same graph, two graphs, one for large marble chips and the other for powdered marble, where volume is on the y-axis and time on the x-axis.

This can be plotted by taking volume of CO_2 on the vertical axis and corresponding time values on the horizontal axis for each particle size, showing two curves.

(f) Explain why both graphs finally become horizontal.

Both graphs become horizontal when the reaction stops because all the acid has reacted with calcium carbonate. No more CO_2 gas is produced at this point.
11. (a) As a teacher, you have decided to use question and answer as your teaching/learning strategy for a form three chemistry class. Discuss nine (9) techniques which you have to employ in order to make the strategy as successful as possible.

Begin by preparing a clear set of well-structured questions that align with the lesson objectives to guide students in developing a deeper understanding.

Ensure active participation by encouraging students to respond freely and involving all learners in the discussion.

Ask open-ended questions that promote critical thinking and stimulate classroom dialogue.

Start with simple questions and progress to more complex ones to build learner confidence and scaffold learning.

Use probing techniques by asking follow-up questions to encourage detailed explanations from students.

Allow sufficient wait time after asking a question to give students time to think and respond appropriately.

Appreciate and affirm all responses, even incorrect ones, to build confidence and maintain learner motivation.

Provide immediate feedback and clarification to ensure students understand the correct concepts.

Summarize key points discussed during the session to reinforce learning and address any misconceptions.

(b) (i) Explain the techniques of preparing to teach a chemistry lesson to a form two class using "active" approaches.

Use learner-centered methods such as group discussions, practical work, and demonstrations. Prepare materials that will allow learners to manipulate and explore concepts. Plan activities that involve discovery, such as experiments, games, or role plays. Prepare guiding questions and allow students to participate actively through problem-solving tasks and peer interaction.

(ii) Describe the possible problems of teaching a chemistry lesson without enough preparations.

Teaching without adequate preparation leads to poor delivery and confusion among learners. The teacher may lack confidence and fail to meet the lesson objectives. It also results in poor classroom management and low student engagement. The teacher may not have proper materials or examples, leading to ineffective learning.

12. An experiment to determine the rate of decomposition of dinitrogen pentoxide (N_2O_5) gas was carried out by Form IV students.

(a) Write the summary of the experiment based on the meaning of reaction rate.

The experiment aimed to measure how quickly dinitrogen pentoxide decomposes over time. This was done by recording the concentration of N_2O_5 at different time intervals and calculating how fast it decreases. The rate of reaction was determined by the change in concentration per unit time.

(b) The following were the results of the rate of decomposition of the gas:

(i) Calculate the average rate of decomposition of N_2O_5 at t = 0 and t = 2 min.
Initial concentration = 0.160 mol/L, Final concentration = 0.080 mol/L, Time = 2 min
Average rate = (0.160 - 0.080) / 2 = 0.040 mol L^{-1} min^{-1}

(ii) Sketch a graph of concentration against time so that the instantaneous rate can be found.
The graph will be a curve that slopes downwards from left to right. Concentration (y-axis) decreases over time (x-axis). The slope of the tangent at any point gives the instantaneous rate.

13. Using relevant equations, outline a procedure for preparing pure samples of each of the following compounds in the laboratory:

(a) Lead (II) sulphide from lead (II) carbonate
$PbCO_3 + H_2S \rightarrow PbS + H_2CO_3$

(b) Copper (II) chloride from copper (II) sulphate
$CuSO_4 + 2NaCl \rightarrow CuCl_2 + Na_2SO_4$

(c) Methane from sodium ethanoate
$CH_3COONa + NaOH \rightarrow CH_4 + Na_2CO_3$ (heat with soda lime)

(d) Ethyne from calcium carbide
$CaC_2 + 2H_2O \rightarrow C_2H_2 + Ca(OH)_2$

14. Prepare a marking scheme for the following question and score it out of twenty (20) marks.
Using relevant examples or chemical equations, give the difference between the following:

(a) Oxidation and reduction in terms of electron transfer.
Oxidation: loss of electrons (e.g. $Fe \rightarrow Fe^{2+} + 2e^-$)
Reduction: gain of electrons (e.g. $Cu^{2+} + 2e^- \rightarrow Cu$)

(b) Elimination and addition on a two carbon organic compound.
Elimination: removal of atoms (e.g. $C_2H_5OH \rightarrow C_2H_4 + H_2O$)
Addition: joining atoms (e.g. $C_2H_4 + H_2 \rightarrow C_2H_6$)

(c) Isotopy and isomerism.
Isotopes: same atomic number, different mass numbers (e.g. ^{12}C and ^{14}C)
Isomers: same molecular formula, different structure (e.g. butane and isobutane)

(d) Fractional distillation and destructive distillation of coal.
Fractional distillation: separation by boiling points
Destructive distillation: heating coal without air to obtain coke, coal tar, gas

(e) Reversible reaction and equilibrium reaction.
Reversible: proceeds in both directions (e.g. $N_2 + 3H_2 \rightleftharpoons 2NH_3$)
Equilibrium: rate of forward and backward reactions become equal

(f) Producer gas production and water gas production.
Producer gas: $C + O_2 \rightarrow CO_2$, CO (uses air)
Water gas: $C + H_2O \rightarrow CO + H_2$ (uses steam)

15. (a) What do you understand by the terms item stem, key, distracters and options as far as multiple choice test items are concerned?

Item stem is the question or statement that introduces the test item.
Key is the correct answer among the options.
Distracters are incorrect but plausible answers meant to test the learner's understanding.
Options include all possible answers including the key and distracters.

(b) Outline and briefly explain the guidelines that are used in constructing multiple choice questions.

Stems should be clearly worded and focused on one concept.
Distracters should be plausible and based on common misconceptions.
Avoid grammatical clues or patterns that reveal the correct answer.
Ensure the correct answer is randomly distributed across different positions.
Keep all options approximately equal in length and structure.