THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN EDUCATION EXAMINATION

731 PHYSICS TEACHING METHODS

Time: 3:30 Hours **ANSWERS** **Year: 2003**

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. Students were presented with bar magnets and different kinds of materials and were asked to identify their magnetic properties after examining through activities and experimentation. Explain briefly the kind of teaching approach that had been used in this lesson.

The teaching approach used in this lesson is the inquiry-based learning method. This method involves students actively engaging in the learning process through observation, experimentation, and analysis. Instead of being directly told the properties of different materials, students investigate by themselves, which promotes critical thinking and problem-solving skills. Through hands-on activities, students can explore magnetic properties firsthand, making the lesson more interactive and engaging.

2. What is meant by "physics laboratory management"?

Physics laboratory management refers to the effective organization and supervision of laboratory activities to ensure safety, efficiency, and productivity. It involves proper handling and maintenance of laboratory equipment, enforcing safety protocols, and ensuring that students follow standard procedures during experiments. Good laboratory management helps create a conducive learning environment where students can conduct practical work with minimal risks.

3. Explain briefly the procedure of helping a student who has suffered an electric shock.

If a student suffers an electric shock, the first step is to immediately switch off the power supply or use a non-conductive object like a wooden stick to separate them from the source of electricity. Next, the student should be checked for responsiveness and breathing. If they are unconscious, CPR should be performed while waiting for medical assistance. If the student is conscious, they should be made comfortable, and their condition monitored until professional help arrives. It is crucial to seek medical attention even if the shock seems minor, as internal injuries might not be immediately visible.

4. Explain briefly the features of the physics learner's textbook under knowledge and skills criteria.

A physics learner’s textbook should provide comprehensive theoretical knowledge and practical skills necessary for understanding physics concepts. Under the knowledge criteria, the textbook should explain key principles, laws, and formulas clearly with examples and diagrams. Under the skills criteria, it should include problem-solving exercises, laboratory experiments, and real-world applications to help students develop analytical and experimental skills. A well-structured textbook enhances both conceptual understanding and practical competency.

5. Show the differences between methods and techniques in the teaching and learning process.

Methods refer to the broader strategies used in teaching, such as lecture-based learning, inquiry-based learning, or problem-solving approaches. They define the overall structure of how information is delivered to students.

Techniques, on the other hand, are the specific ways a teacher implements these methods. For example, in an inquiry-based method, techniques could include group discussions, guided experiments, or interactive demonstrations. While methods provide a general framework, techniques are the practical steps taken to achieve learning objectives.

6. Instructional objectives are among the major criteria for selecting a teaching method. Explain.

Instructional objectives determine what students should learn and achieve after a lesson. These objectives influence the choice of teaching methods to ensure that learning is effective. For instance, if the objective is to develop problem-solving skills, an inquiry-based or problem-solving method would be suitable. If the objective is knowledge acquisition, a lecture method might be more appropriate. Selecting a teaching method that aligns with instructional objectives helps maximize learning outcomes.

7. State and explain four physics laboratory safety rules to the students.

The first rule is to wear protective gear, such as lab coats, safety goggles, and gloves, to prevent injuries from chemical spills or accidental exposure to harmful substances.

The second rule is to handle electrical equipment with caution. Students should always ensure that their hands are dry before touching electrical apparatus and should never tamper with live circuits to avoid electric shocks.

The third rule is to follow proper waste disposal procedures. Chemicals, broken glass, and other hazardous materials should be disposed of in designated containers to prevent contamination and injuries.

The fourth rule is to avoid eating or drinking in the laboratory. This prevents accidental ingestion of harmful substances and maintains a clean working environment.

8. What is meant by the term "physics curriculum"?

A physics curriculum refers to the structured outline of topics, concepts, and practical activities that guide physics education within a specific level of learning. It includes theoretical content, laboratory experiments, assessment methods, and learning objectives. The curriculum ensures that students receive a well-rounded education in physics by covering fundamental principles and real-world applications.

9. Earthing is very important in physics laboratory electrical devices and appliances. Show how you would lead your students in understanding the importance and application of earthing.

To help students understand earthing, I would begin with a demonstration using a simple electrical circuit connected to a metallic body and an earthing wire. This experiment would show how excess electrical charges are safely directed into the ground, preventing electric shocks.

Next, I would explain the theoretical concept, discussing how earthing protects users by reducing the risk of electrocution and electrical fires. Real-life examples, such as earthing in household appliances like refrigerators and electric cookers, would help students relate the concept to everyday life.

Finally, I would assign students a research task where they investigate and present findings on the importance of earthing in industries, emphasizing its role in electrical safety.

10. Prepare a lesson plan of 80 minutes to form II students on the topic "the determination of the e.m.f of a cell" using a potentiometer.

Lesson Plan:

Objective: By the end of the lesson, students should be able to explain and experimentally determine the e.m.f of a cell using a potentiometer.

Lesson Structure:
- Introduction (15 minutes): Explain the concept of e.m.f and introduce the potentiometer as an instrument used to measure it accurately. Discuss its principle and working mechanism.
- Demonstration (20 minutes): Set up the potentiometer circuit and show students how to take measurements using a standard cell.
- Student Activity (25 minutes): Divide students into groups and provide them with the necessary materials to conduct their own measurements under supervision.
- Discussion and Analysis (10 minutes): Students share their observations and discuss sources of errors in measurements.
- Conclusion (10 minutes): Summarize key points and assign follow-up questions for further practice.

11. Explain briefly how you would help the victims of the following accidents in a laboratory.

a) Solids or liquids in the mouth but not swallowed
The victim should be instructed to spit out the substance immediately. If irritation occurs, they should rinse their mouth with clean water. If the substance is hazardous, they should be given water or milk to dilute the effect and seek medical attention.

b) Burns caused by hot objects
The affected area should be immediately cooled under running water for at least 10 minutes to reduce pain and prevent further tissue damage. If the burn is severe, the victim should be covered with a clean cloth and taken to a medical professional.

c) Acids on skin
The affected area should be thoroughly rinsed with plenty of water for at least 15 minutes to remove the acid. If irritation persists, a neutralizing agent like diluted baking soda can be applied before seeking medical help.

d) Cuts
For minor cuts, clean the wound with antiseptic and apply a sterile bandage. If the cut is deep and bleeding heavily, apply pressure using a clean cloth and seek medical attention.

e) Glass in the eye
The victim should avoid rubbing the eye and keep it closed to prevent further damage. If possible, they should rinse the eye with clean water or saline solution. Medical assistance should be sought immediately to safely remove the glass.

12. Write down a marking scheme for the following questions. The total mark for questions (a) and (b) should be 10.

a) Define the following terms:

i) Acceleration
Acceleration is the rate of change of velocity of an object per unit time. It is a vector quantity, meaning it has both magnitude and direction, and is measured in meters per second squared (m/s^2). (2 marks)

ii) Velocity
Velocity is the rate of change of displacement of an object per unit time in a specified direction. It is also a vector quantity and is measured in meters per second (m/s). (2 marks)

iii) Scalar quantity
A scalar quantity is a physical quantity that has only magnitude but no direction. Examples include mass, temperature, and energy. (2 marks)

iv) Vector quantity
A vector quantity is a physical quantity that has both magnitude and direction. Examples include force, velocity, and acceleration. (2 marks)

b) A motor car is uniformly retarded and brought to rest from a speed of 108 km/h in 15 seconds. Find its acceleration.

First, convert the speed from km/h to m/s:
108 km/h = (108 × 1000) / (60 × 60) = 30 m/s.

Using the equation of motion:
$v = u + at$,
where $v = 0$ m/s (final velocity), $u = 30$ m/s (initial velocity), $t = 15$ s, and a = acceleration.

Rearrange the equation:
$a = (v - u) / t = (0 - 30) / 15 = -2$ m/s^2.

The negative sign indicates deceleration. The car's acceleration is -2 m/s². (2 marks)

13. Suppose you are appointed as head of the physics department in a new school, which performs poorly in physics examinations. Explain how you would alleviate the problem.

To improve physics performance, I would first analyze past examination results to identify weak areas among students. This would help in tailoring lessons and revision strategies to address the specific challenges they face.

I would introduce interactive teaching methods such as hands-on experiments, group discussions, and problem-solving sessions to make physics more engaging and easier to understand. These methods encourage active participation and help students grasp abstract concepts better.

Additionally, I would organize remedial classes for struggling students and create a mentorship program where top-performing students assist their peers. This peer-learning approach can boost confidence and improve comprehension.

To enhance practical skills, I would ensure that students get sufficient time in the laboratory to perform experiments, as practical application reinforces theoretical knowledge. I would also arrange field visits to industries or science fairs to expose students to real-world applications of physics.

Lastly, I would encourage regular assessments, quizzes, and discussions to monitor progress and provide feedback. Open communication with students about their difficulties would help in refining teaching approaches and ensuring that learning objectives are met effectively.

14. Discuss the procedure that you would follow in verifying Hooke's law to your students (use spiral spring).

To verify Hooke's law, I would begin by explaining the principle: the extension of a spring is directly proportional to the applied force, provided the elastic limit is not exceeded.

For the experiment, I would set up a retort stand with a clamp and suspend a spiral spring from it. A pointer would be attached to the spring to measure extensions against a fixed ruler.

I would first record the initial length of the spring without any load. Then, I would gradually add known masses (e.g., 50 g, 100 g, 150 g) one at a time and measure the corresponding extension for each mass.

Next, I would instruct students to plot a graph of force (weight) against extension. According to Hooke's law, the graph should be a straight line passing through the origin, showing a linear relationship between force and extension.

Finally, I would discuss the significance of the graph, emphasizing that the slope represents the spring constant (k). If the relationship deviates from linearity at higher loads, it indicates that the elastic limit has been exceeded.

15. By considering the motion of a simple pendulum, write short notes on energy conservation as the bob moves from one point to another and back. A drawing is necessary.

A simple pendulum consists of a mass (bob) attached to a string that swings back and forth under the influence of gravity. Throughout its motion, energy is conserved and continuously converted between kinetic and potential forms.

At the highest points of the swing, the bob has maximum potential energy (PE) and zero kinetic energy (KE), as it momentarily stops before changing direction. This potential energy is due to the height of the bob above its equilibrium position.

As the bob descends, potential energy is converted into kinetic energy. At the lowest point of the swing, the bob has maximum kinetic energy and minimal potential energy because it is at its lowest height and moving at the highest speed.

As the bob moves upward again, kinetic energy is converted back into potential energy. The process repeats as the pendulum swings back and forth, demonstrating the principle of energy conservation.

In an ideal case (without air resistance), the total mechanical energy remains constant. However, in reality, some energy is lost as heat due to air resistance and friction at the pivot, gradually reducing the amplitude of the motion.