**THE UNITED REPUBLIC OF TANZANIA**

**NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**

**DIPLOMA IN EDUCATION EXAMINATION**

**731 PHYSICS 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. Discuss briefly five (5) differences existing between transmittal and non-transmittal approaches of teaching.

The transmittal approach is teacher-centered, where the teacher delivers information directly to students, who receive it passively. In contrast, the non-transmittal approach is learner-centered, encouraging active participation and self-discovery.

In the transmittal approach, learning is often lecture-based, with minimal student interaction. On the other hand, the non-transmittal method includes discussions, problem-solving, and inquiry-based learning, which engage students in the learning process.

Assessment in transmittal teaching is typically through tests and exams, focusing on memorization and recall. In non-transmittal approaches, assessment methods include projects, presentations, and practical applications that test students' understanding and critical thinking.

Transmittal methods ensure structured content delivery, covering the syllabus in a systematic way. However, non-transmittal methods allow flexibility, enabling students to explore concepts in-depth at their own pace.

Non-transmittal methods are more effective for developing creativity and problem-solving skills since they encourage students to think independently. In contrast, the transmittal approach may limit creativity as it focuses mainly on delivering predefined content.

2. What do you understand by the following terms?

(a) Physics teacher’s guide

A physics teacher’s guide is a resource designed to assist educators in planning and delivering lessons effectively. It provides structured lesson plans, teaching strategies, and suggested activities to enhance students' understanding.

(b) Physics student’s book

A physics student’s book is a textbook containing explanations, illustrations, and exercises to help learners grasp physics concepts. It serves as a reference for students, providing step-by-step guidance on various topics and practical applications.

3. Outline the major problems likely to be experienced by a teacher without a physics lesson plan in the classroom.

A teacher without a physics lesson plan may struggle with lesson organization, leading to a lack of direction in teaching. Without a structured plan, the teacher might cover topics randomly, causing confusion among students.

Time management becomes a challenge, as the teacher may spend too much or too little time on a particular topic. This can result in some concepts being rushed while others receive unnecessary emphasis.

Without a lesson plan, a teacher may fail to engage students effectively. Lesson activities and teaching methods might be chosen spontaneously, making it difficult to cater to different learning styles.

Assessment and evaluation become inconsistent, as the teacher may not have a clear strategy for testing students' understanding. This can lead to gaps in learning and difficulty in tracking student progress.

Lastly, a lack of planning can affect classroom management, as students may become disengaged or disruptive when lessons appear unstructured and uncoordinated.

4. What do you understand by the term "Physics laboratory management"?

Physics laboratory management refers to the effective organization, supervision, and maintenance of a laboratory to ensure smooth operation. It involves handling equipment, ensuring proper storage, and maintaining a safe working environment.

Good laboratory management includes enforcing safety protocols, such as wearing protective gear and following correct procedures while conducting experiments. It also ensures that students handle apparatus responsibly to prevent accidents.

Proper scheduling and allocation of lab resources are also part of management, ensuring that all students have equal access to equipment and materials for practical experiments.

5. Explain briefly the limitations of using simulation as a method of teaching physics.

One limitation of using simulation in physics teaching is the lack of hands-on experience. While simulations can visually represent complex concepts, they do not allow students to physically manipulate equipment, which is essential for developing practical skills.

Another drawback is the reliance on technology. Not all schools or students may have access to computers or the necessary software, limiting the effectiveness of simulations in learning.

Some simulations may oversimplify real-world physics, leading to misconceptions. They may not accurately replicate the unpredictability and variations that occur in real experiments.

Finally, simulations do not fully develop problem-solving and critical-thinking skills. Unlike real experiments where students must troubleshoot issues, simulations often provide pre-determined outcomes, reducing opportunities for discovery-based learning.

6. Define four (4) safety-related items that a physics laboratory must possess.

A physics laboratory must have fire extinguishers to control fire outbreaks caused by electrical faults or chemical reactions. This helps in preventing the spread of fire and ensuring the safety of students and teachers.

Safety goggles are essential for protecting students' eyes from harmful chemicals, bright light sources, or potential flying debris during experiments.

A first aid kit is necessary for treating minor injuries such as burns, cuts, or chemical spills on the skin. It ensures that immediate medical attention can be provided in case of accidents.

Warning signs and labels should be placed on hazardous materials and equipment. They help in alerting students and teachers to potential dangers, ensuring safety measures are followed in the lab.

7. "The nature of the subject is one of the criteria used by teachers in the teaching and learning process." Substantiate.

The nature of a subject influences the teaching methods used in delivering its content. In physics, which involves both theoretical and practical components, teachers must balance lectures, experiments, and problem-solving activities.

Physics requires hands-on learning through experiments, making laboratory sessions essential. Unlike theoretical subjects, physics depends on empirical evidence, so teachers must incorporate demonstrations and student-led investigations.

Problem-solving is a key aspect of physics, requiring the use of mathematical concepts. Teachers must adopt methods such as worked examples and guided practice to help students develop analytical skills.
Assessment methods in physics also depend on its nature. In addition to written exams, practical assessments and project-based evaluations are used to measure students' understanding and application of concepts.

8. Give two (2) reasons why the use of lesson notes is important in the teaching and learning of physics concepts.

Lesson notes provide a structured summary of key concepts, helping students review and reinforce their learning. They act as a reference material that students can revisit when preparing for exams or solving problems.

Lesson notes assist in time management by ensuring that teachers cover the syllabus systematically. With well-prepared notes, teachers can deliver lessons efficiently without skipping important topics or spending too much time on a single concept.

9. Explain the differences existing between experimentation and demonstration in the context of Physics Teaching Methods.

Experimentation involves students actively performing experiments, collecting data, and drawing conclusions. It emphasizes hands-on learning and helps students develop critical-thinking and problem-solving skills.

Demonstration, on the other hand, is when the teacher performs an experiment while students observe. It is used when an experiment is too complex, dangerous, or requires specialized equipment that may not be available for every student.

Experimentation encourages student participation and independent learning, while demonstration provides a controlled and guided learning experience. Both methods are useful depending on the nature of the lesson and the resources available.

10. Explain how you would arrange a field trip for form four students to study the production of X-rays.

To arrange a field trip for form four students to study the production of X-rays, the first step would be to identify a suitable facility, such as a hospital radiology department or a research laboratory, where students can observe X-ray production in a real-world setting. This would involve seeking permission from the institution and ensuring they have experts who can explain the process to students.

Next, I would prepare students by covering the basic theoretical background on X-rays before the trip. This would include discussing how X-rays are generated, their applications, and safety measures. Pre-trip discussions help students understand what to expect and prepare relevant questions.

Transportation and logistics must be arranged to ensure safe and timely travel. This includes securing a bus, confirming the number of students attending, and preparing any necessary documentation, such as permission letters from the school and parents.

During the field trip, students would be guided by both their teacher and professionals at the facility. They would observe X-ray machines in operation, learn about radiation protection measures, and understand the different applications of X-rays in medicine and industry.

After the trip, students would be required to prepare a report or presentation on their observations. This helps reinforce what they learned and allows them to reflect on the practical applications of X-rays in daily life.

11. Discuss the role of a physics teacher in teaching the topic "magnetic properties" to form three students using the inquiry method.

In the inquiry method, the physics teacher acts as a facilitator rather than simply delivering information. The teacher's role is to guide students in exploring the concept of magnetic properties through questioning, experimentation, and discussion.

To begin, the teacher would present a real-life problem or question related to magnetism, such as "Why do some materials attract while others do not?" This stimulates curiosity and encourages students to think critically.

The teacher would then organize hands-on activities where students investigate magnetic properties through experiments. For example, students could test different materials to determine which are magnetic, explore the effects of magnetic fields, or observe how magnets interact with each other.

Another key role of the teacher is to encourage students to analyze their observations and develop explanations based on evidence. The teacher prompts students with guiding questions to help them understand concepts such as magnetic poles, field lines, and the interaction between magnets.

Finally, the teacher ensures that students communicate their findings through discussions or written reports. By allowing students to present and defend their conclusions, the teacher promotes deeper understanding and critical thinking in learning magnetic properties.

12. The lecture method is unavoidable for a large group of students and the acquisition of abstract knowledge/concepts. Discuss briefly its modification to suit the purpose.

While the lecture method is often necessary for large classes, it can be modified to make learning more interactive and engaging. One way to improve lectures is by incorporating visual aids such as diagrams, animations, and simulations, which help students visualize abstract physics concepts.

Another modification is the use of questioning techniques to encourage student participation. Instead of delivering content passively, the teacher can ask thought-provoking questions, prompting students to think critically and engage in discussions.

Breaking lectures into shorter segments with interactive activities can also improve effectiveness. For example, after explaining a concept, the teacher can include quick problem-solving exercises or group discussions before continuing with the lecture.

The integration of technology, such as online quizzes or classroom response systems, allows students to assess their understanding in real time. This helps both students and teachers identify areas that need further clarification.

Finally, relating lecture content to real-world applications makes the material more relevant and engaging. Providing examples of how physics concepts apply in daily life or industry helps students appreciate the importance of the subject.

13. Suppose you were appointed to head the Physics Department in a certain school, what would be your roles?

As the head of the Physics Department, my primary role would be to oversee the teaching and learning of physics, ensuring that lessons are delivered effectively according to the syllabus. This includes supervising teachers, monitoring lesson plans, and ensuring that teaching methods align with educational standards.

Another key role would be to manage and maintain the physics laboratory. I would ensure that all necessary equipment and materials are available, properly stored, and safe for use. This also involves enforcing safety protocols and training students and staff on proper laboratory procedures.

I would also be responsible for organizing professional development programs for physics teachers. This could include workshops, seminars, or peer discussions to help teachers stay updated with new teaching strategies and scientific advancements.

Additionally, I would coordinate practical assessments and examinations, ensuring that students are adequately prepared for both theoretical and practical evaluations. This involves designing fair and challenging tests that assess students' understanding of physics concepts.
Lastly, I would work to promote student interest in physics by organizing extracurricular activities such as science fairs, physics clubs, and field trips. These activities help students develop a passion for the subject and explore physics beyond the classroom.

14. Prepare a marking scheme for the following question.

An electric train moves from rest with a uniform acceleration of 1.5 $m/s^2$ for the first 10 seconds. It continues with an acceleration of 0.5 $m/s^2$ for further 20 seconds and then moves with constant velocity for 90 seconds. It finally takes 30 seconds to decelerate uniformly to rest.

(a) Draw a graph of velocity against time for the journey.

Marking scheme:
- Correct labeling of axes: 1 mark
- Proper division of time intervals: 1 mark
- Correct representation of acceleration phases: 2 marks
- Constant velocity phase correctly drawn: 1 mark
- Correct deceleration phase: 1 mark
- Smooth and correctly scaled graph: 1 mark

Total: 7 marks

(b) Deduce the total distance travelled from the graph or otherwise.

Marking scheme
- Correct calculation of velocity at each phase: 2 marks
- Calculation of area under graph (using kinematic equations or integration): 3 marks
- Correct final answer in meters with proper units: 1 mark
Total: 6 marks

(c) What is the average speed of the train for the whole journey?
Marking scheme:
- Correct use of the formula: average speed = total distance / total time: 1 mark
- Substituting correct values: 1 mark
- Correct final answer with proper units: 2 marks
Total: 4 marks

15. Prepare instructional materials to be followed by form four students when doing the experiment on how to determine acceleration due to gravity using a simple pendulum.

To conduct the experiment on determining acceleration due to gravity using a simple pendulum, students will need the following instructional materials:

A retort stand with a clamp or any firm support is necessary to suspend the pendulum string. This ensures minimal interference from external factors such as hand movement.

A metal bob (pendulum bob) and a string are required to form the pendulum. The bob should be heavy enough to minimize air resistance, and the string should be inextensible to maintain uniform length during oscillations.
A stopwatch is essential for measuring the time taken for multiple oscillations accurately. Using multiple oscillations reduces errors caused by reaction time in manual measurements.

A meter ruler is used to measure the length of the pendulum string accurately. The length of the pendulum is a crucial factor in calculating acceleration due to gravity.

A protractor can be used to ensure that the pendulum is displaced at a small angle (less than 15°) to approximate simple harmonic motion, where the restoring force is proportional to displacement.

A notebook and pen are necessary for recording observations, including time measurements, length of the pendulum, and calculated values for gravity. Proper documentation ensures accurate analysis of results.

By following these instructions, students can conduct the experiment effectively and determine the acceleration due to gravity using the simple pendulum method.