THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

DIPLOMA IN EDUCATION EXAMINATION

731 PHYSICS TEACHING METHODS

Time: 3:30 Hours **ANSWERS** **Year: 2018**

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.

SECTION A (40 Marks)

Answer all questions in this section.

1. Outline four (4) criteria for selecting teaching methods in Physics

Content Complexity: Methods should match the difficulty of physics topics, like using lectures for simple concepts, ensuring effective delivery of physical principles.

Student Ability: Techniques should suit the skill level, such as experiments for advanced learners, aligning with physical understanding and engagement.

Resource Availability: Selection depends on available equipment, like using models when labs are limited, supporting practical physics applications.

Objective Alignment: Methods should meet lesson goals, such as demonstrations for concept clarity, achieving intended physical outcomes.

2. State four (4) procedures you would follow in teaching density and pressure by using discussion strategy

Introduce Topic: Begin with a question, like "What affects pressure?", setting the stage for exploring physical density and pressure concepts.

Present Examples: Share cases, such as water pressure at depth, prompting analysis of physical properties.

Facilitate Discussion: Encourage input, like comparing solid and liquid density, fostering understanding of physical principles.

Summarize Findings: Conclude with key points, such as density = mass/volume, consolidating physical insights from the discussion.

3. Differentiate between demonstration and experimentation in Physics

Demonstration: A controlled display by the instructor, like showing a pendulum swing, focuses on illustrating physical concepts directly.

Experimentation: Involves student participation, such as measuring pendulum periods, emphasizes hands-on physical investigation and discovery.

4. State four (4) characteristics that must be possessed by a good Physics teacher

Knowledgeable: Proficient in physics concepts, like understanding motion laws, ensuring accurate physical explanations.

Patient: Tolerant with varied learning paces, like explaining circuits repeatedly, supporting physical comprehension.

Organized: Well-prepared with lesson plans, like structured experiments, facilitating smooth physical activity execution.

Communicative: Clear in conveying ideas, such as explaining force diagrams, enhancing physical concept understanding.

5. (a) Laboratory benches fall into three (3) main types. Mention them

Fixed Benches: Permanently installed, like solid wood tables, provide stable physical workspaces.

Mobile Benches: Movable on wheels, such as adjustable carts, offer flexible physical setups.

Modular Benches: Customizable sections, like detachable units, allow adaptable physical arrangements.

5. (b) Among the benches mentioned in (a) above state the type which is commonly used in schools

Fixed Benches: Commonly used due to their durability and stability, suitable for routine physical experiments in school settings.

6. Write four (4) features that must be possessed by good Physics reference materials

Accuracy: Contains correct physical data, like precise gravity values, ensuring reliable physics information.

Clarity: Presents concepts clearly, such as well-labeled diagrams, facilitating physical understanding.

Comprehensiveness: Covers broad topics, like mechanics and optics, providing thorough physical knowledge.

Up-to-Date: Includes recent findings, such as modern physics theories, reflecting current physical science.

7. State four (4) difficulties likely to be experienced by a teacher teaching without a lesson plan

Lack of Direction: Missing focus, like unclear physics topics, leads to disorganized physical activity execution.

Time Mismanagement: Overrunning or rushing, such as incomplete experiments, disrupts physical session flow.

Poor Content Coverage: Skipping key concepts, like omitting pressure laws, limits physical understanding.

Reduced Effectiveness: Inconsistent delivery, such as uneven explanations, hinders physical concept retention.

8. Study the following demonstration experiment done by a teacher in a school and then write the hypothesis of the given observations. Comment on the depth of water seen as observed from above

Diagram Description:

A beaker with water, a ruler partially submerged, observed from above and at an angle.

Observations:

(a) Seen from above, the ruler appears to be bent/broken at the surface of water

(b) The bending of the ruler in water is upwards

(c) Seen from a certain angle, the far side of the ruler appears bigger

Hypothesis:

(a) The apparent bending of the ruler at the water surface occurs due to the refraction of light, bending as it passes from water to air.

(b) The upward bending of the ruler in water results from the higher refractive index of water compared to air, altering light paths.

(c) The magnified appearance of the far side from an angle is due to the lensing effect of water, bending light to enlarge the image.

Comment: The depth of water appears shallower than actual due to refraction, reducing the perceived physical length of the submerged ruler.

9. Outline an experiment to determine acceleration due to gravity using a simple pendulum and comment on the pendulum

Procedure:

Suspend a mass on a string (pendulum) of length L, about 1 m.

Displace it slightly and release, measuring the time T for 20 oscillations with a stopwatch.

Calculate T/20 for one period, repeat for accuracy, and use $g = 4\pi^2L/T^2$ to find gravity.

Comment: The pendulum assumes small angles for accuracy, with a light, inextensible string and minimal air resistance affecting physical measurements.

SECTION B (40 Marks)

Answer two (2) questions from this section.

10. Write a lesson plan of 80 minutes that you would use to teach the topic: Atmospheric Pressure to form I pupils using the activity method. Assume that hemispheres of 45 pupils and you are provided with five sets of magdeburg hemispheres and two syringes.

Topic: Atmospheric Pressure

Duration: 80 Minutes

Lesson Plan:

Objective: Students will demonstrate atmospheric pressure using Magdeburg hemispheres and calculate pressure differences with syringes, essential for understanding physical principles.

Lesson Outline:

Introduction (10 minutes)

Pose a question: “Why does a straw work?” Show a diagram of atmospheric pressure, engaging students with physical concepts.

Briefly explain pressure as force per unit area, setting the stage for physical activity.

Main Lesson (50 minutes)

Demonstration (15 minutes): Use one set of Magdeburg hemispheres, pump out air, and show they resist separation due to atmospheric pressure, illustrating physical force.

Activity (25 minutes): Divide into five groups (9 students each), provide each with a hemisphere set and syringe. Students pump air, note resistance, and use syringes to measure pressure differences, critical for physical experimentation.

Discussion (10 minutes): Groups share observations, like force needed to separate hemispheres, analyzing physical pressure effects.

Conclusion and Assessment (20 minutes)

Summarize key points, such as pressure = force/area, using examples like 1013.25 hPa at sea level.

Assign a task: “Calculate pressure if force is 500 N over 0.1 m^2,” assessing physical understanding.

Homework: Describe the experiment in 50 words, reinforcing physical concepts.

Resources: Magdeburg hemispheres (5 sets), syringes (2), diagram, pump, critical for conducting physical experiments.

Assessment: Activity participation and task responses, essential for evaluating physical comprehension.

11. In physics exercise and problems, the following terms/concepts are used: to find, calculate, state the law of, and demonstrate. To each of the four items:

(a) Show clearly what the intended learner should be able to do as per the given instruction.

(b) Provide a specific example for the usage of the term.

To find

(a) The learner should determine the value of a given physical quantity based on provided information.

(b) Example: "Find the acceleration of a car that increases its velocity from 10 m/s to 30 m/s in 5 seconds."

Calculate

(a) The learner should use mathematical formulas and given values to compute a numerical answer.

(b) Example: "Calculate the kinetic energy of a 2 kg object moving at a speed of 5 m/s."

State the law of

(a) The learner should recall and write down a specific law in physics.

(b) Example: "State Newton's Second Law of Motion."

Demonstrate

(a) The learner should practically show or explain a concept, often through an experiment or example.

(b) Example: "Demonstrate how a simple pendulum follows the principles of periodic motion."

12. Account on how each of the following teaching/learning aids affect the teaching/learning of Physics in the classroom

(a) Textual References: Books and notes provide detailed physics theories, like Newton's laws, enhancing understanding through structured physical information.

(b) Chalkboard: Allows real-time diagrams, such as force vectors, improving clarity of physical concepts during explanations.

(c) Models: Physical representations, like a pulley system, demonstrate mechanics, aiding hands-on grasp of physical principles.

(d) Graphs and Illustrations: Visual data, such as velocity-time graphs, clarify trends, supporting analysis of physical relationships.

13. (a) Explain briefly why an atom is electrically neutral

An atom is electrically neutral because the number of protons (positive charges) equals the number of electrons (negative charges), balancing the physical electric charge.

(b) All processes in static electricity can best be explained in terms of loss or gain of electrons. Explain

Static electricity results from electron transfer, such as rubbing a rod gaining electrons to become negative, or losing them to become positive, driving physical charge separation and effects.

(c) When is a body said to be charged?

A body is charged when it has an imbalance of electrons, such as excess electrons creating a negative charge, or a deficit causing a positive charge, indicating physical electric state change.

14. Prepare lesson notes for form I students on the topic Pressure in Liquids for a single period of 40 minutes

Topic: Pressure in Liquids

Duration: 40 Minutes

Lesson Notes:

Objective: Understand pressure in liquids as force per unit area and its dependence on depth.

Content:

Definition: Pressure = Force/Area ($P = F/A$), measured in Pascals (Pa), key for physical analysis.

Depth Effect: Pressure increases with depth, $P = \rho gh$ (ρ = density, g = gravity, h = depth), critical for physical property understanding.

Examples: Water pressure at 10 m depth with $\rho = 1000$ kg/m³, $g = 9.8$ m/s², $P = 1000 \times 9.8 \times 10 = 98{,}000$ Pa, essential for physical calculation.

Procedure:

Introduce with a question: “Why is it harder to dive deeper?”

Demonstrate with a water column, showing pressure rise with depth.

Discuss factors, like density and gravity, using a diagram of a submerged object.

Activity: Measure water height in a tube, calculate pressure at different depths, vital for physical experimentation.

Conclusion: Summarize pressure dependence on depth, reinforcing physical principles.

Assessment: Solve “$P = 1000 \times 9.8 \times 5$, find pressure at 5 m,” critical for evaluating physical comprehension.

Resources: Water tube, ruler, calculator, diagram, essential for conducting physical analysis.

15. Prepare a marking scheme of a maximum of 10 marks for the following question:

A current of 3 A flows for 2 minutes through a wire of resistance 20 Ω. If the specific heat capacity of the water is 4200 J/kg·K for water, calculate the temperature rise of the water.

Marking Scheme:

Step 1: Calculate power ($P = I^2R$) = $(3)^2 \times 20 = 9 \times 20 = 180$ W (2 marks)

Step 2: Calculate energy ($E = P \times t$) = $180 \times (2 \times 60) = 21{,}600$ J (2 marks)

Step 3: Assume mass of water (e.g., 1 kg, state assumption) (1 mark)

Step 4: Use $Q = mc\Delta T$, $\Delta T = Q/(mc) = 21{,}600 / (1 \times 4200) = 5.14$°C (3 marks)

Step 5: Final answer with unit, 5.14°C (2 marks)

Total: 10 marks, essential for evaluating physical problem-solving skills.