THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATONS COUNCIL OF TANZANIA

FORM TWO NATIONAL ASSESSMENT

031 **PHYSICS**

Time: 2:30 Hours **ANSWERS** **Year: 2024.**

Instructions

1. This paper consists of sections A, B, and C.
2. Answer **all** questions in the spaces provided.
3. Section A and C carry **fifteen (15)** marks each and section B carries **seventy (70)** mark s.
4. All writings must be in **blue** or **black** ink.
5. Communication devices and any unauthorized materials are **not** allowed in the assessment room.
6. Write your **Assessment Number** at the top right hand corner of every page.

Section A (15 Marks)
Answer all questions in this section. For each of the items (i) – (x), choose the correct answer from the given alternatives and write its letter in the box provided.

(i) Which set of equipment represents the application of Physics in schools?
A. Voltmeter, tongs, and tripod stand
B. X-rays, CT-scanner, and ultrasound
C. Cooking pans, binoculars, and mosquito coils
D. Fax machines, airplanes, and train
Correct Answer: A
Reason: Voltmeter, tongs, and tripod stand are commonly used in physics experiments in schools, unlike the other options which represent medical equipment, household items, or general technologies.

(ii) How would you immediately stop hazards due to electric faults?
A. Remove the plugs
B. Switch off the socket key
C. Cut off all connecting wires
D. Switch off the main switch
Correct Answer: D
Reason: Switching off the main switch stops power supply completely, which is the safest immediate response to an electric fault.

(iii) Both density and relative density are physical quantities. How do they differ?
A. Density is a basic quantity, while relative density is a derived quantity
B. Density has units, but relative density has no units
C. Density has no units, while relative density has units
D. Density is a derived quantity, while relative density is a basic quantity
Correct Answer: B
Reason: Density is measured in kg/m^3, but relative density is a ratio and therefore dimensionless.

(iv) Why do scientists prefer sending rockets to Mars from the Moon rather than from the Earth?
A. The gravitational attraction of the Moon is larger than that of the Earth
B. The Moon's shape is smoother compared to the Earth
C. The Moon is at a higher position compared to the Earth
D. The gravitational constant of the Moon is less than that of the Earth
Correct Answer: D
Reason: The Moon's weaker gravity requires less energy for a rocket to escape its gravitational pull compared to Earth.

(v) A body weighs 0.52 N in air. It weighs 0.32 N when it is totally immersed in water and 0.36 N when totally immersed in another liquid. What is the density of the other liquid?
A. 1.25 g/cm^3
B. 0.8 g/cm^3

C. 1250 kg/m³
D. 3250 kg/m³
Correct Answer: A
Reason: The density is calculated using Archimedes' principle and buoyant force concepts.

(vi) Why is gas more easily compressed when compared to liquids?
A. Molecules in gas are much further apart than those in liquid
B. Molecules in gas are freer to move than those in liquid
C. Molecules in liquid can move over a short distance
D. Molecules in liquid are larger than those in gas
Correct Answer: A
Reason: The molecules in gases are widely spaced, allowing them to be compressed more easily compared to liquids, where molecules are closer together.

(vii) Why are the walls of a dam made thicker at the bottom than at the top?
A. Weight of water at the bottom is less
B. Pressure of water at the bottom is less
C. Weight of water at the bottom is greater
D. Pressure of water at the bottom is greater
Correct Answer: D
Reason: Pressure increases with depth in a liquid, so the bottom of the dam experiences higher pressure and requires thicker walls for structural support.

(viii) Which one is a natural source of light?
A. Electrical bulbs
B. Lightning
C. Candles
D. Torch

Correct Answer: B
Reason: Lightning is a natural phenomenon, while the other options are artificial sources of light.

(ix) Which statement is true about a body whose work done is zero?
A. Its displacement is in the opposite direction to the force applied
B. Its displacement is in the same direction as that of the applied force
C. Its displacement is in a direction perpendicular to the applied force
D. Its displacement is at an angle to the direction of the applied force
Correct Answer: C
Reason: When displacement is perpendicular to the force, no work is done as the component of force along displacement is zero.

(x) What is the SI unit of the capacitance?
A. Coulomb
B. Ampere
C. Farad
D. Volt
Correct Answer: C
Reason: Capacitance is measured in farads (F), which represent the charge stored per unit voltage.
2. Match the descriptions in List A with the names of their corresponding concepts in List B by writing the letter of the correct response in the table provided.

List A
(i) The distance covered by an object in a given direction in meters
(ii) The length of the path that is followed by an object and has a magnitude only
(iii) A set of axes from which an observer can measure the position of points in a system
(iv) The rate of change in displacement measured in meters per second
(v) The rate of change in velocity

List B
A. Acceleration
B. A frame of reference
C. Average speed
D. Displacement
E. Distance
F. Maximum altitude
G. Velocity

Answers:
(i) D
(ii) E
(iii) B
(iv) G
(v) A

3. (a) Mention four types of magnets according to their shapes.
- Bar magnet
- Horseshoe magnet
- Disc magnet
- Ring magnet

(b) Give three properties of magnetic lines of force.
- They form closed loops, starting from the north pole and ending at the south pole.
- They never intersect each other.
- They are denser at regions of stronger magnetic fields.

4. (a) (i) What are the three temperature scales that are commonly used?
- Celsius
- Fahrenheit
- Kelvin

(ii) Which liquid would you use to construct a simple liquid-in-glass thermometer using mercury, alcohol, and water as thermometric liquids? Give reasons for your answer.
- Alcohol
Reason: Alcohol has a lower freezing point than mercury, making it suitable for cold regions. It also expands uniformly and is visible when dyed, unlike water, which freezes easily and has poor thermal expansion.

(b) Write a limitation and the two precautions of using a clinical thermometer.
Limitation: A clinical thermometer can only measure temperatures within a limited range (35°C to 42°C).
Precautions:
(i) Do not place the thermometer in hot water, as it may break due to expansion.
(ii) Ensure the thermometer is disinfected before and after use to prevent contamination.

5. (a) Why does a person fall in the direction of a slow-moving car if he or she jumps from it?
The person's body has inertia, which means it tends to retain the motion of the car. When they jump off, their body continues to move in the direction of the car's motion, causing them to fall in that direction.

(b) Briefly explain two examples that show the applications of Newton's third law of motion in real life situations.
- Rocket propulsion: The exhaust gases are ejected backward with force, and the rocket moves forward with an equal and opposite force.
- Swimming: A swimmer pushes water backward with their hands and legs, and the water pushes them forward with an equal and opposite force.

(c) Why do action and reaction forces not cancel each other?
Action and reaction forces act on different bodies, not on the same object. Since they operate on separate entities, they cannot cancel out but rather work to produce motion or equilibrium between the objects.

6. Suppose a bird is on top of a tree and a boy who is at rest throws a stone to hit it such that the bird falls and strikes the ground with a velocity of 80 m/s:
Solutions:

(a) Determine the height of the tree from the ground to its top.
To find the height, use the equation of motion:
$v^2 = u^2 + 2gh$
Where:
$v = 80$ m/s (final velocity)
$u = 0$ m/s (initial velocity)

$g = 10\ m/s^2$ (acceleration due to gravity)

Substitute the values:
$80^2 = 0 + 2(10)h$
$6400 = 20h$
$h = 320\ m$
The height of the tree is 320 meters.

(b) Calculate the time taken by the bird to hit the ground.
Use the equation of motion:
$v = u + gt$
$80 = 0 + 10t$
The time taken by the bird to hit the ground is 8 seconds.

7. (a) Outline four types of simple machines.
(i) Lever
(ii) Pulley
(iii) Inclined plane
(iv) Screw

(b) The block and tackle pulley system has a velocity ratio of 4. If a load of 225 N is raised by using a force of 75 N, determine:

(i) The mechanical advantage of the system.
Mechanical advantage (MA) is given by:
$MA = Load / Effort$
$MA = 225 / 75$
$MA = 3$
The mechanical advantage of the system is 3.

(ii) The efficiency of the system.
Efficiency is calculated as:
$Efficiency = (MA / VR) \times 100\%$
$Efficiency = (3 / 4) \times 100\%$
$Efficiency = 75\%$

The efficiency of the system is 75%.

8. (a) Why is it important to keep the center of gravity of a motor-bus as low as possible?
A low center of gravity increases the stability of the motor-bus by reducing the risk of overturning when taking sharp turns or during sudden maneuvers.

(b) Your Physics teacher has assigned you to determine the weight of a meter rule using the concept of forces in equilibrium.
(i) Name three types of materials which should be used in the task.
- A meter rule
- A knife-edge or pivot
- A set of weights or a known mass

(ii) With the aid of a diagram, explain how you will determine the weight of the meter rule.
- Place the meter rule on a knife-edge so that it is balanced. The balancing point is the center of gravity of the meter rule.
- Suspend a known weight, W on one side of the meter rule at a measured distance d_1 from the center of gravity.
- Adjust the position of the weight until the meter rule balances horizontally again.
- Use the principle of moments to calculate the weight of the meter rule, Wm.

The principle of moments states:
Clockwise moment = Anticlockwise moment
If the distance of the known weight from the pivot is d1, and the distance of the meter rule's weight from the pivot is d2, then:
W x d1 = Wm x d2

To find the weight of the meter rule (Wm):
Wm = (W x d1) / d2

9. (a) (i) What do you understand by the term geothermal as a source of energy?
Geothermal energy refers to the heat energy derived from beneath the Earth's surface. It is generated from the natural processes of radioactive decay and heat stored in rocks and water reservoirs underground.

(ii) Outline four steps in which electricity is produced from geothermal energy.
1. Wells are drilled into geothermal reservoirs to access steam or hot water.
2. The steam or hot water is brought to the surface and used to spin turbines.
3. The turbines drive generators that convert mechanical energy into electricity.
4. The cooled water or condensed steam is reinjected into the Earth to sustain the reservoir.

9. (b) In three points, give the disadvantages of wind energy.
- Wind energy is intermittent and depends on weather conditions, making it unreliable as a sole energy source.
- Wind turbines can be noisy and may disturb nearby residents or wildlife.

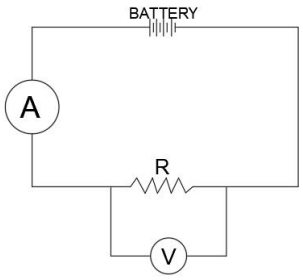
- The installation of wind farms requires significant space, which can disrupt ecosystems and landscapes.

10. Suppose you are a physics laboratory leader and you are asked by your teacher to prepare the electrical components and instruments for an experiment to determine the relationship between voltage and current.

(a) List down five electrical components which will be used in this experiment.

- Ammeter
- Voltmeter
- Resistor or variable resistor
- Battery or power supply
- Connecting wires

(b) Draw a simple electric circuit which will be suitable for that experiment.



(c) Using the simple electric circuit drawn in 10 (b) above, state the criteria used to connect the ammeter and voltmeter electrical components in the circuit.

- The ammeter is connected in series with the resistor to measure the current passing through the circuit.
- The voltmeter is connected in parallel across the resistor to measure the potential difference (voltage) across it.