SMZ

ZANZIBAR EXAMINATONS COUNCIL

FORM THREE ENTRANCE EXAMINATION

031 **PHYSICS**

Time: 2:30 Hours **ANSWERS** **Thursday 30th November, 2019.**

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.

1. Write the letter of the most correct answer in the box below.
i) The turning effect of a force about a point is called
A. Gravitational force
B. Centre of gravity
C. Moment of the force
D. Principle of moment

Answer: C. Moment of the force
Reason: The moment of the force refers to the rotational effect of a force applied at a distance from a pivot point. Other alternatives like gravitational force and center of gravity do not define this rotational effect, while the principle of moment refers to the law governing the moments but not the moment itself.

ii) Laboratory rules are useful in
A. Making students enjoy science subject in the laboratory
B. Making students conduct experiments freely in the laboratory
C. Ensuring good communication in the laboratory
D. Ensuring safety in the laboratory

Answer: D. Ensuring safety in the laboratory
Reason: Laboratory rules are designed primarily to ensure the safety of everyone in the lab, preventing accidents and injuries. Other options like enjoying science and good communication are secondary outcomes and not the primary purpose of the rules.

iii) Physics, Chemistry, and Biology are natural science subjects which need
A. Practical and theory work for learning
B. Only theory for learning
C. Practical work only
D. Only observation

Answer: A. Practical and theory work for learning
Reason: Learning in natural sciences requires a combination of practical and theoretical approaches to understand concepts fully. Options B and C are incomplete as they focus only on one aspect, and option D is too narrow.

iv) If one cell in a two-cell torch is placed in the opposite direction
A. The torch will give normal light
B. The torch will not give light
C. The torch will give bright light
D. The torch will give dim light

Answer: B. The torch will not give light
Reason: Placing a cell in the opposite direction disrupts the electric circuit, preventing the flow of current and hence no light is produced. Other options do not account for the circuit being incomplete.

v) Work and energy have the same SI unit
A. Calorie
B. Pascal
C. Joule
D. Watt

Answer: C. Joule
Reason: Work and energy are both measured in joules in the SI system. Calories and watts measure other forms of energy or power, and Pascal is a unit of pressure.

vi) Liquid A has a density of 13.6 g/cm³ and Liquid B has a density of 1.25 g/cm³. A hydrometer will sink
A. More in A than B
B. More in B than A
C. Equally in both A and B
D. None of the above

Answer: B. More in B than A
Reason: A hydrometer sinks more in less dense liquids, and since Liquid B is less dense than Liquid A, it will sink more in Liquid B.

vii) The variation between pressure and area is when
A. Changing area, nothing happens
B. Decreasing area, pressure decreases
C. Decreasing pressure, volume increases
D. Increasing area, pressure decreases

Answer: D. Increasing area, pressure decreases
Reason: Pressure is inversely proportional to area, so when the area increases, the pressure decreases.

viii) When a body of mass M is lifted through a height h, it possesses the energy known as
A. Kinetic energy
B. Light energy
C. Chemical energy
D. Potential energy

Answer: D. Potential energy
Reason: When a body is lifted, it stores energy due to its position relative to the ground, which is potential energy.

ix) The process of removing magnetism from a magnetic material is
A. Polarization
B. Magnetization

C. Demagnetization
D. Magnetizing

Answer: C. Demagnetization
Reason: Demagnetization is the process of removing magnetism, while the other terms refer to different concepts related to magnetism.

x) The property of the solid state is
A. Inter-particles distance is large
B. Particles are closely packed together
C. Particles are not closely packed together
D. Particles move randomly

Answer: B. Particles are closely packed together
Reason: In a solid state, particles are tightly packed in a fixed structure, unlike liquids or gases where particles are more dispersed or move randomly.

2. Match uses in LIST A with their corresponding instruments / devices in LIST B by writing its letter in the table below.

List A
i. Measure length, depth, internal, and external diameters
ii. Measure force of pull
iii. Transfer specific amount of liquid from one container to another
iv. Measure body temperature
v. Measure any amount of volumes of liquids
vi. A simple piston pump that injects liquid
vii. Indicate whether a surface is vertical or horizontal
viii. A pump used to lift heavy load
ix. Used to see over an obstacle from a hidden position
x. It enables a liquid to flow without pumping due to pressure difference

List B
A. Pipette
B. Bicycle pump
C. Spirit level
D. Periscope
E. Spring balance
F. Lift pump
G. Measuring cylinder
H. Vernier caliper

I. Force pump
J. Syringe
K. Hydraulic press
L. Siphon

Answers
i - H
ii - E
iii - A
iv - C
v - G
vi - J
vii - C
viii - F
ix - D
x - L

3. Fill the correct answer in the blank spaces provided.
i) The quantity of space that an object occupies is known as volume.
ii) A body moves with a uniform velocity, if its rate of change of displacement with time is constant.
iii) The causes of an object to rotate or turn about a fixed point is moment of force (torque).
iv) The force due to gravity produces weight when it acts on a body.
v) The sun's rays travel in a straight line at a speed of 3 × 10^8 m/s.
vi) The force which opposes the relative velocity between the layers is referred to as viscous force.
vii) The formation of shadow is evidence that light travels in straight lines.
viii) The process of inducing magnetism in a magnetic material is magnetization.
ix) A ship floats in water due to the fact that its density becomes less than that of the water in which it floats.
x) The attraction force between same molecules is called cohesive force.

4. a) Define the following terms.
i) Speed
Explanation: Speed is the rate at which an object covers distance. It is a scalar quantity and measured in meters per second (m/s).
ii) Uniform acceleration
Explanation: Uniform acceleration refers to a constant rate of change of velocity of an object over time.
b) Differentiate between uniform acceleration and uniform deceleration.
Explanation:
- Uniform acceleration occurs when an object's velocity increases at a constant rate.
- Uniform deceleration occurs when an object's velocity decreases at a constant rate.

c) i) A car travels at a speed of 10 m/s accelerates uniformly at 2 m/s². Find its velocity in 5 s.

Solution:

Final velocity (v) is given by:
$v = u + at$
$v = 10 + (2 \times 5)$
$v = 10 + 10$
$v = 20$ m/s

ii) A train slows from 20 m/s with a uniform deceleration of 2 m/s². How long will it take to reach 5 m/s?
Solution:
Time (t) is given by:
$v = u - at$
$t = (u - v) / a$
$t = (20 - 5) / 2$
$t = 15 / 2$
$t = 7.5$ s

5. a) Mention three factors that affect the capacitance of a conductor.
i) The surface area of the plates.
ii) The distance between the plates.
iii) The dielectric material used between the plates.

b) Mention types of mechanical energy.

i) Kinetic energy.
ii) Potential energy.

c) A body of mass 15 kg is raised to a height of 7 meters above the ground in 4 seconds.

i) Find the energy possessed by the body after raising it. Solution:
Potential energy (PE) = $m \times g \times h$
$PE = 15 \times 9.8 \times 7$
$PE = 1029$ J

ii) What is the type of energy possessed by the body?
Answer: Potential energy.

6. a) i) What do you mean by the term momentum?
Momentum is the quantity of motion of a moving body and is calculated as the product of its mass and velocity.
ii) Write its S.I Unit.
Answer: Kilogram meter per second (kg·m/s).

b) State the principle of conservation of linear momentum.
The total linear momentum of a closed system remains constant if no external force acts on the system.

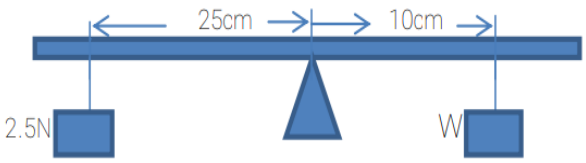
c) A rocket expels gas at a rate of 0.5 kg/s. If the force produced by the rocket is 100 N, what is the velocity with which the gas is expelled?
Solution:
Force (F) = Rate of change of momentum
$F = m \times v$
$v = F / m$
$v = 100 / 0.5$
$v = 200$ m/s

7. a) What is Fulcrum?
A fulcrum is the pivot point around which a lever rotates.
b) Give two applications of a lever.
i) Scissors.
ii) Crowbar.
c) Using the principle of lever, explain why it is easier to open the door by pushing near the knob than by pushing near the hinges.
The lever arm is longer near the knob, which increases the moment of force, making it easier to open the door.
d) What class of lever is a door?
Answer: Class 2 lever.

8. a) What is meant by the term concurrent forces?
Concurrent forces are two or more forces that act at a common point but may have different directions. Their resultant is found by vector addition.
b) Give four applications of equilibrium in our daily life.

i) Balancing a see-saw.
ii) Construction of stable buildings.
iii) Proper positioning of furniture to avoid tipping.
iv) Suspension of objects in a balanced state.

c) A metre rule is pivoted and balanced as illustrated by the diagram below and balanced by a force of 2.5 N. Calculate the weight W.



Solution:

Using the principle of moments:
Sum of clockwise moments = Sum of anticlockwise moments

Clockwise moment = W × 10 cm
Anticlockwise moment = 2.5 N × 25 cm
Equating the two:
W × 10 = 2.5 × 25
W = (2.5 × 25) / 10
W = 6.25 N

Answer: The weight W is 6.25 N.

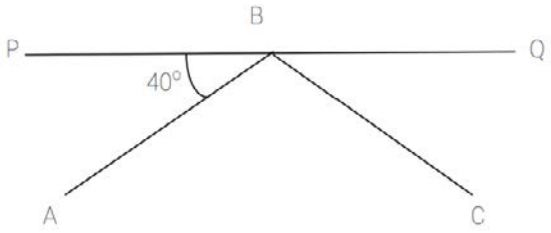
9 a) The formula for the gradient is:
Gradient (N) = (Change in y) / (Change in x)
Choose two points from the table, for example:
Point 1: (x = 5, y = 12.5)
Point 2: (x = 25, y = 60.1)
Gradient (N) = (60.1 - 12.5) / (25 - 5)
N = 47.6 / 20
N = 2.38
Answer: Gradient, N = 2.38

iii) Calculate the mass, M, of the wooden meter rule, where N = 50 / M.
Rearrange the formula to find M:
M = 50 / N
Substitute N = 2.38:
M = 50 / 2.38
M = 21.01 g
Answer: The mass, M, is 21.01 g.

b) i) Two mirrors are arranged such that they produce nine (9) images of a pin placed between them. Calculate the angle between the two mirrors.

The formula for the angle is:
Angle = 360° / (Number of images + 1)
Substitute the number of images = 9:
Angle = 360° / (9 + 1)
Angle = 360° / 10
Angle = 36°
Answer: The angle between the two mirrors is 36°.

ii) The diagram below shows a ray of light AB that is reflected from a plane mirror PQ. Find the size of angle ABC.



The law of reflection states that the angle of incidence equals the angle of reflection.
From the diagram:
Angle of incidence = 40°
Thus, angle B = 40°.
For triangle ABC:
Angle ABC = 180° - (40° + 40°)
Angle ABC = 180° - 80°
Angle ABC = 100°
Answer: The size of angle ABC is 100°.

iii) When two plane mirrors are placed at an angle of 45°, how many images are formed?

The formula to calculate the number of images formed is:
Number of images (N) = (360° / Angle between mirrors) - 1
Substitute the angle = 45°:
N = (360° / 45°) - 1
N = 8 - 1
N = 7

Answer: 7 images are formed.

10 a) State the fundamental law of static electricity.
The fundamental law of static electricity states that:

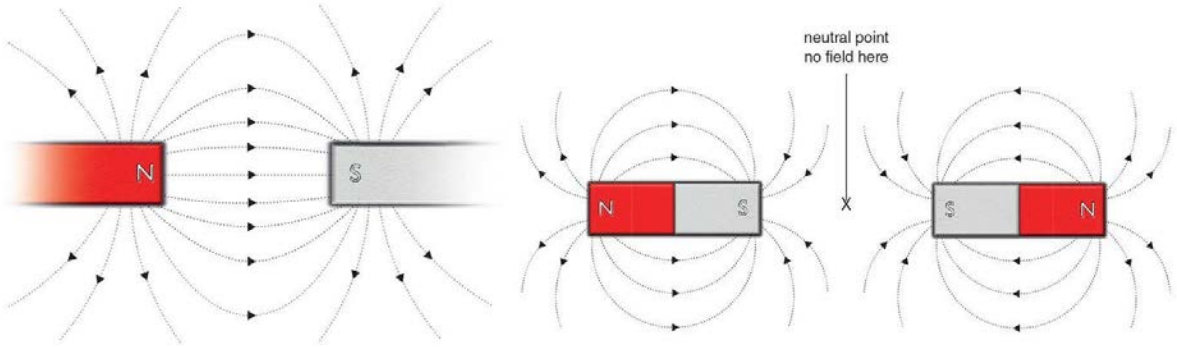
Answer: Like charges repel, and unlike charges attract.

b) i) Mention three categories of a magnet.

a. Permanent magnet
b. Temporary magnet
c. Electromagnet

b) ii) Differentiate between the angle of declination and angle of dip.
Angle of Declination: The angle between the geographic north and magnetic north as observed at a given location.
Angle of Dip: The angle made by the Earth's magnetic field with the horizontal plane at a specific location.

c) Draw a diagram of a magnetic line of force between two bar magnets such that:



11 a) i) What are sustainable energy sources?
Sustainable energy sources are those that meet present energy demands without depleting natural resources or causing harm to the environment. These sources are renewable and can be used repeatedly without diminishing their availability.

ii) State four applications of energy generated from solar.
- Generating electricity through solar panels for homes and industries.
- Heating water using solar water heaters.
- Charging electronic devices such as solar-powered batteries.
- Powering streetlights and other outdoor lighting systems.

b) i) Define geothermal energy.
Geothermal energy is the heat energy obtained from the Earth's interior. It is harnessed by tapping into steam or hot water reservoirs beneath the Earth's surface for power generation or direct heating.

ii) List three areas where geothermal energy can be harnessed.
- Geothermal power plants.
- Hot springs and geysers.
- Residential and industrial heating systems using geothermal heat pumps.

c) i) What is a windmill?
A windmill is a mechanical device that converts wind energy into rotational energy for performing work such as pumping water, grinding grains, or generating electricity.

ii) Mention three disadvantages of energy caused by wind.

1. Wind energy production depends on the availability and consistency of wind.
2. Wind turbines can be noisy and disrupt local wildlife habitats.
3. The initial installation cost of wind turbines is high.