SMZ

ZANZIBAR EXAMINATONS COUNCIL

FORM THREE ENTRANCE EXAMINATION

031 **PHYSICS**

Time: 2:30 Hours **ANSWERS** **Thursday 30th November, 2017.**

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) A car moving at a speed of 30 m/s is brought to rest in 10 seconds, retardation of the car is
A. 1 m/s²
B. 3 m/s²
C. 300 m/s²
D. 20 m/s

Answer: B. 3 m/s²
Reason: Retardation (deceleration) is calculated as Retardation = (Initial Velocity - Final Velocity) / Time. Substituting the values, (30 - 0) / 10 = 3 m/s².

ii) For moving a body from rest or stopping from motion, we need
A. Force
B. Mass
C. Time
D. Direction

Answer: A. Force
Reason: Force is required to overcome inertia, according to Newton's First Law of Motion.

iii) The value of acceleration due to gravity
A. Same everywhere
B. 8.9 m/s²
C. Changes from place to place
D. Changes at night

Answer: C. Changes from place to place
Reason: Gravitational acceleration depends on altitude, latitude, and the local geological structure.

iv) A body at rest can have
A. Speed
B. Velocity
C. Momentum
D. Energy

Answer: D. Energy
Reason: A body at rest can possess potential energy, depending on its position.

v) Medium through which light cannot pass is called
A. Transparent
B. Opaque
C. Translucent

D. Alloy

Answer: B. Opaque
Reason: An opaque medium does not allow light to pass through it.

vi) Electric current is produced by the flow of
A. Electrons
B. Protons
C. Neutrons
D. Nucleons

Answer: A. Electrons
Reason: Electric current is the flow of electrons in a conductor.

vii) Energy due to motion
A. Potential energy
B. Thermal energy
C. Kinetic energy
D. Nuclear energy

Answer: C. Kinetic energy
Reason: Kinetic energy is the energy of a body due to its motion, calculated as $KE = 1/2\ mv^2$.

viii) The length of 6.4 m is equal to
A. 64 cm
B. 640 cm
C. 6400 cm
D. 0.64 cm

Answer: B. 640 cm
Reason: 1 meter equals 100 centimeters, so $6.4 \times 100 = 640$ cm.

ix) The turning effect of force about a point
A. Archimedes' Principle
B. Center of Gravity
C. Principle of Moment
D. Moment of Force

Answer: D. Moment of Force
Reason: Moment of force is the turning effect of a force about a pivot point, calculated as Moment = Force × Perpendicular Distance.

x) A lever which has its fulcrum between the load and effort is called
A. First class
B. No class
C. Third class
D. Second class

Answer: A. First class
Reason: In a first-class lever, the fulcrum is between the effort and load.

2. Match each item in LIST A with a correct response in LIST B by writing its letter in the table below.

LIST A
i) Geothermal energy
ii) Renewable energy
iii) Wind energy
iv) Low tide
v) Water energy
vi) Nuclear energy
vii) Non-renewable energy
viii) Solar energy
ix) Solar cell
x) High tide

LIST B
A. Falling of ocean water
B. Inexhaustible
C. Energy from the sun
D. Energy from the firewood
E. Energy from underground hot rock
F. Energy from fossils
G. Air current energy
H. Energy from batteries
I. Hydroelectric energy
J. Exhausted
K. Energy from the coal
L. Device which harnesses solar energy
M. Rising of ocean water
N. Energy from charcoal

Answers:
i) E
ii) B
iii) G

iv) A
v) I
vi) F
vii) F
viii) C
ix) L
x) M

3. Fill the correct answer in the blank spaces provided.

i) The tendency of liquid to rise in narrow tubes or to be drawn into a small opening is _____.
Answer: Capillarity

ii) The people who study and work professionally in the field of physics are called _____.
Answer: Physicists

iii) Mass of a body has the _____ value at all places.
Answer: Same

iv) Force of attraction on a body toward the center of the Earth is called _____.
Answer: Gravitational force

v) A moving body possesses _____ energy.
Answer: Kinetic

vi) The _____ about the point is equal to the sum of _____ about the same point.
Answer: Clockwise moment; Anticlockwise moment

vii) Light can pass wholly through _____ medium.
Answer: Transparent

viii) A body falling on the ground, while reaching the ground it gains _____ energy.
Answer: Kinetic

ix) Current electricity is formed when charges _____ in a conductor.
Answer: Flow

x) Work is a _____ quantity.
Answer: Scalar

4. a) i) State the factors that affect the stability of a body.
- The size of the base of the body: A wider base increases stability.
- The position of the center of gravity: A lower center of gravity increases stability.
- The weight of the body: Heavier bodies tend to be more stable.

ii) Outline three types of equilibrium.
- Stable equilibrium
- Unstable equilibrium
- Neutral equilibrium

b) Explain briefly why luggage compartments are placed at the bottom of a bus.
Answer: Luggage compartments are placed at the bottom of a bus to lower the center of gravity of the bus, which increases its stability and reduces the likelihood of tipping over during movement or when taking sharp turns.

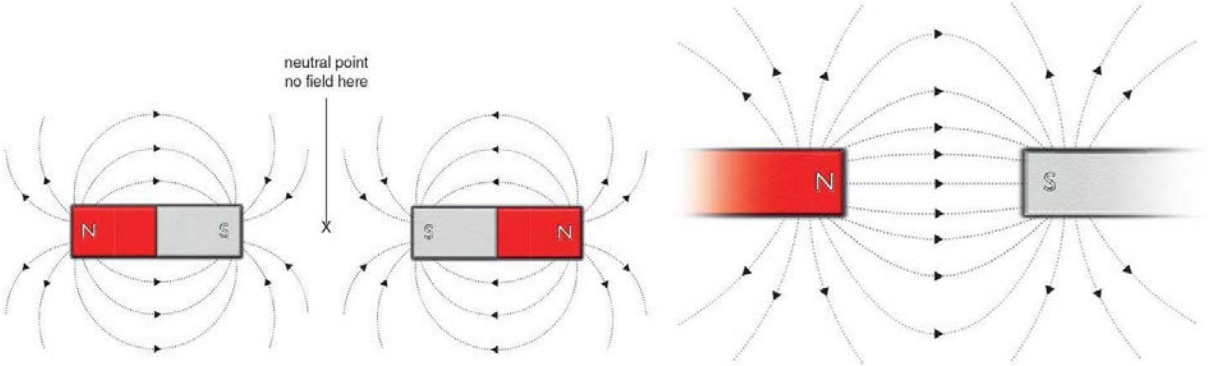
c) A meter rule (100 cm) is pivoted at midpoint. A 0.6 N weight is suspended from one end as shown in the figure below. How far must 1.0 N weight be suspended for the meter rule to balance?

Using the principle of moments:
Moment of 0.6 N weight = Moment of 1.0 N weight
0.6 x 50 = 1.0 x d
d = 30/1.0
d = 30 cm

Answer: The 1.0 N weight must be suspended 30 cm from the other end for the meter rule to balance.

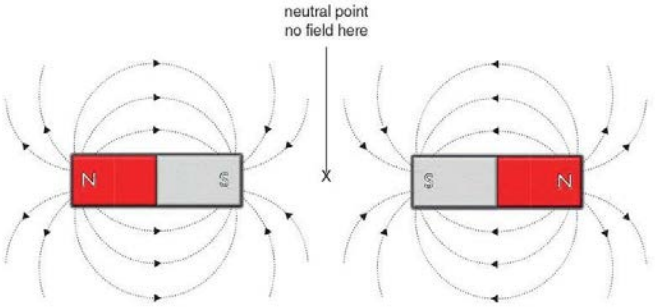
5. a) i) State the law of polarity.
Answer: Like poles repel each other, and unlike poles attract each other.

ii) Use a clear diagram to illustrate the law of polarity.
(Diagram would show two magnets with like poles (N-N) repelling and unlike poles (N-S) attracting).



b) By using a diagram, briefly explain how a neutral point can be formed.

Answer: A neutral point is formed where the magnetic fields of two opposing poles cancel each other out, resulting in zero magnetic field strength at that location.



6. a) i) Distinguish between cohesion and adhesion.
- Cohesion: The force of attraction between similar molecules, such as water molecules.
- Adhesion: The force of attraction between dissimilar molecules, such as water molecules and glass.

ii) Distinguish between elastic material and plastic material.
- Elastic material: A material that returns to its original shape after the force causing deformation is removed (e.g., rubber).
- Plastic material: A material that does not return to its original shape after the force causing deformation is removed (e.g., clay).

b) Outline two applications of diffusion.
- Diffusion is used in the perfume industry to spread fragrance in the air.
- Diffusion is applied in the exchange of gases in the lungs during respiration.

c) An object with a mass of 500 g is hung from a spring. How far (in meters) would it stretch? (Given force constant of k = 50 N/m)

The formula to calculate the stretch is:
$F = k \times x$
Here, F = weight = mass × g = $0.5 \times 9.8 = 4.9$ N
$x = F / k = 4.9 / 50 = 0.098$ m

Answer: The spring would stretch 0.098 m.

7. a) i) State Ohm's law.
Answer: Ohm's law states that the current flowing through a conductor is directly proportional to the potential difference across it, provided the temperature remains constant.

ii) What factors do the resistance of the conductors depend on?

- Material of the conductor.
- Length of the conductor.
- Cross-sectional area of the conductor.
- Temperature of the conductor.

b) i) Will the current flow more easily through thick or thin wire of the same material when connected to the same source?
Answer: The current will flow more easily through the thick wire because it has a lower resistance due to its larger cross-sectional area.

c) In the circuit diagram given:

i) Find the total resistance of the circuit.
Explanation: The resistors 8 ohms and 12 ohms are connected in parallel. The total resistance for parallel resistors is calculated as:
$1/Rp = 1/R1 + 1/R2$
$1/Rp = 1/8 + 1/12$
$1/Rp = (3 + 2)/24 = 5/24$
$Rp = 24/5 = 4.8$ ohms

Now, the equivalent resistance Rp is in series with the 7-ohm resistor. Therefore, the total resistance is:
$Rt = Rp + 7 = 4.8 + 7 = 11.8$ ohms.

Answer: The total resistance of the circuit is 11.8 ohms.

ii) Find the total current flowing in the circuit.
Explanation: The total current is found using Ohm's law:
$I = V/Rt$
$I = 6\ V / 11.8$ ohms $= 0.508$ A.

Answer: The total current flowing in the circuit is 0.508 A.

8. a) i) Define the term clinical thermometer.
Answer: A clinical thermometer is a thermometer used to measure the body temperature of humans or animals. It typically has a range of 35°C to 42°C.

ii) Define Six's thermometer.
Answer: Six's thermometer is a type of thermometer that records the maximum and minimum temperatures over a period of time. It is commonly used in meteorological observations.

b) List down two precautions during the use of a clinical thermometer.
Answer:

- Ensure the thermometer is clean and disinfected before use.
- Do not use the thermometer immediately after consuming hot or cold beverages.

9. Convert the following units of temperature:

i) Convert 85°F to °C:
Explanation: The formula to convert Fahrenheit to Celsius is:
$°C = (°F - 32) \times 5/9$
$°C = (85 - 32) \times 5/9 = 53 \times 5/9 \approx 29.4°C$

Answer: 85°F is approximately 29.4°C.

ii) Convert 100°C to °F:
Explanation: The formula to convert Celsius to Fahrenheit is:
$°F = (°C \times 9/5) + 32$
$°F = (100 \times 9/5) + 32 = 180 + 32 = 212°F$

Answer: 100°C is equal to 212°F.

9. a) Fill in the gaps with the correct response.

a) Rheostat
Sketch: A variable resistor used to control current.
Uses: Regulates the flow of electric current in circuits.
Physical Effect/Principle: Resistance control.

b) Ammeter
Sketch: A device to measure electric current.
Uses: Measures the current in an electric circuit.
Physical Effect/Principle: Measurement of electric current (Ampere's Law).

c) Simple Pendulum
Sketch: A weight hanging from a fixed point, free to swing back and forth.
Uses: Measures time or demonstrates oscillatory motion.
Physical Effect/Principle: Periodic motion and gravity.

d) Rectangular Prism
Sketch: A solid with rectangular faces.
Uses: Demonstrates refraction and reflection of light.
Physical Effect/Principle: Optics and light behavior.

e) Plane Mirror
Sketch: A flat, reflective surface.
Uses: Reflects light to form clear images.
Physical Effect/Principle: Reflection of light.

b) In the experiment to determine the density of the materials of one hundred shilling coins, the following results were obtained:

i) Determine the slope of the graph.
Answer: The slope = (Change in mass) / (Change in number of coins) = (125 g - 15 g) / (14 - 2) = 110 / 12

= 9.17 g/coin.

ii) Find the density (D) of the material of the coins where $D = 45/n\pi d^2t$., n = slope
Given values:
d = 2.41 cm, t = 0.22 cm.
$D = 45 / [n\pi(2.41)^2(0.22)]$
$D = 45 / [9.17\pi(5.8081)(0.22)]$
$D = 1.22\ g/cm^3$

10. a) State Newton's second law of motion.
Answer: Newton's second law of motion states that the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass. The formula is F = ma.

b) Explain four important applications of impulse (Newton's second law of motion) in our daily life.
Answer:

- In airbags to reduce impact during car accidents.
- In cricket, a batsman uses follow-through to reduce the force of impact.
- In catching a ball, hands are moved backward to decrease the impact.
- In road safety barriers to extend the time of impact and reduce force.

11. a) Define the following terms:

i) Pressure
Pressure is defined as the force applied per unit area. Mathematically, pressure is given by the formula:
Pressure (P) = Force (F) / Area (A).
Its SI unit is the Pascal (Pa).

ii) Thrust
Thrust is a force exerted by a fluid or solid to propel an object in a specific direction. It is measured in Newtons (N) and acts perpendicular to the surface.

b) Explain four situations in which pressure is applied:

- In medical syringes: Pressure is applied to inject or extract fluids from the body.
- Cutting tools: Knives and scissors use pressure to cut materials by concentrating force on a small area.
- Hydraulic systems: Pressure is applied in car brakes to stop or slow the vehicle.
- High-heeled shoes: The small area of the heel exerts high pressure on the ground, making impressions on soft surfaces.