THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATONS COUNCIL OF TANZANIA

FORM TWO NATIONAL ASSESSMENT

031 **PHYSICS**

Time: 2:30 Hours **ANSWERS** **Year: 2021.**

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. For each of the items (i)–(xx), choose the correct answer from the given alternatives and write its letter in the box provided.

(i) What is the name given to people who study and work professionally in the field which relates matter and energy?
A. Scientists
B. Gastronomists
C. Physicists
D. Geophysicists

Answer: C
Physicists study matter and energy and their interactions.

(ii) Which of the following experiments is the process of assigning numbers in measurement?
A. Qualitative experiment
B. Quantitative experiment
C. Scientific experiment
D. Physics experiment

Answer: B
Quantitative experiments involve assigning numerical values through measurement.

(iii) What is the implication of the statement that when a body floats, its apparent weight is zero?
A. The weight of a floating body is less than the upthrust acting on it.
B. The weight of a floating body is less than the weight of the fluid displaced.
C. The weight of a floating body is equal to the weight of the fluid displaced.
D. The weight of a floating body is greater than the upthrust acting on it.

Answer: C
For a body to float, its weight equals the weight of the displaced fluid.

(iv) Why are particles in a solid state so closely packed?
A. Because they have weak force of attraction.
B. Because they have very weak force of attraction.
C. Because they have moderate force of attraction.
D. Because they have very strong force of attraction.

Answer: D
The strong intermolecular forces in solids keep the particles closely packed.

(v) Why do beans seem to swell up when soaked in water overnight?
A. Due to diffusion action
B. Due to capillary action

C. Due to adhesive force
D. Due to osmosis process

Answer: D
Water moves into the beans through osmosis, causing them to swell.

(vi) Which statement correctly explains the term power?
A. Rate of doing work measured in watts.
B. Rate of doing work measured in watt per second.
C. The product of energy and time measured in joule-seconds.
D. Energy divided by time measured in joules.

Answer: A
Power is the rate of doing work and is measured in watts.

(vii) Which of the following materials was the earliest natural magnet to be discovered?
A. Bar magnet
B. Marble stone
C. Lodestone
D. An electromagnet

Answer: C
Lodestone is a naturally occurring magnet and was the first to be discovered.

(viii) What differentiates a single movable pulley from a single fixed pulley?
A. In single movable pulley, load is double the effort.
B. In single fixed pulley, load is double the effort.
C. In single movable pulley, effort is the same as load.
D. In single fixed pulley, effort is double the load.

Answer: A
In a movable pulley, the mechanical advantage reduces the effort needed to lift the load.

(ix) Which quantity describes the temperature at which pure ice melts at standard atmospheric pressure?
A. Vapour pressure
B. Ice point
C. Latent heat of fusion
D. Melting point

Answer: B
The ice point is the standard reference for the melting temperature of ice under normal pressure.

(x) What criterion supports the argument that potential and kinetic energies are similar?
A. Both produce heat.
B. Both are forms of mechanical energy.
C. Both are the substitute of the other.
D. Both are forms of electrical energy.

Answer: B
Both are forms of mechanical energy, with potential energy being stored energy and kinetic energy being energy of motion.
Here are the solutions for the remaining questions from the image:

(xi) Why are racing cars designed in such a way that their centers of gravity are lowered?
A. To increase the center of gravity.
B. To decrease the stability.
C. To lower the stability.
D. To increase the stability.

Answer: D
Lowering the center of gravity increases the stability of the car during high-speed maneuvers.

(xii) What happens when the body moves with a constant speed?
A. Its acceleration is zero.
B. Its acceleration increases.
C. Its acceleration decreases.
D. Its deceleration increases.

Answer: A
When a body moves at a constant speed, its velocity is constant, so there is no acceleration.

(xiii) Which class of lever do wheelbarrows, nutcrackers, and bottle openers belong to?
A. Third class
B. Second class
C. First class
D. Fourth class

Answer: B
These tools are second-class levers, where the load is between the effort and the fulcrum.

(xiv) How would the formation of an image in a plane mirror be described?
A. Same size as object, virtual and upright.
B. Larger, real, and upside down.
C. Smaller, virtual, and upright.
D. Larger, virtual, and upright.

Answer: A
A plane mirror forms an image that is the same size as the object, virtual, and upright.

(xv) What parameter(s) affects the magnitude of the energy of a moving body?
A. The speed of moving body.
B. The mass of moving body.
C. The speed and mass of the moving body.
D. The force of gravity.

Answer: C
Kinetic energy depends on both the mass and speed of the moving body, as given by the formula KE = $\frac{1}{2}mv^2$.

(xvi) The following observations are correct on the concept of structure and properties of matter except:
A. A drop of water on clean glass spreads over the surface of glass.
B. Water wets glass but mercury does not.
C. A pond skater is capable of walking on the surface of water.
D. Water falls inside the tube but mercury rises when poured in the same tube.

Answer: D
Mercury falls inside the tube due to cohesion being stronger than adhesion, but it does not rise.

(xvii) Why is the weight of a body greater at the poles than at the equator?
A. Because the earth is not perfectly spherical.
B. Because weight is not constant.
C. Because weight is measured by spring balance.
D. Because gravity is greater at the poles.

Answer: D
The gravitational pull is stronger at the poles due to the earth's slightly flattened shape.

(xviii) Which of the following devices work by the help of atmospheric pressure?
A. Flushing tanks and hydraulic press.
B. Lift pumps and Hydrometers.
C. Bicycle pumps and Syringes.
D. Lactometers and Thermometers.

Answer: C
Bicycle pumps and syringes utilize atmospheric pressure to function.

(xix) What is the function of a capacitor in electronic devices?
A. Detect charges on materials.
B. Produce electrostatic charges through induction.

C. Store electric charges.
D. Produce electrostatic charges through rubbing.

Answer: C
Capacitors are used to store electric charges in electronic devices.

(xx) The amount of current flowing in the circuit is 4.0 Amperes. If a potential difference is 48 V, what is its resistance?
A. 12 Ω
B. 24 Ω
C. 48 Ω
D. 100 Ω

Answer: A
Using Ohm's law, R = V/I, R = 48/4 = 12 Ω
Here is the updated solution with plain text formatting for calculations:

2. Match the descriptions of the magnetic terms in List A with the correct magnetic terms in List B.

List A
(i) Keep magnet away from the source of heat.
(ii) The substance which cannot be magnetized or attracted by a magnet.
(iii) The point in which the magnetic field is zero.
(iv) The region around a magnet which can attract magnetic materials.
(v) The arrangement of magnetic dipoles in groups.

List B
A. Magnetic field
B. Magnetic induction
C. Storage of magnet
D. Storage of point charge
E. Neutral point
F. Magnetic domain
G. Non-magnetic material

Answers:
(i) C
(ii) G
(iii) E
(iv) A
(v) F

3. Complete each of the following statements:
(i) Quantities like length, mass, amount of current, and time in Physics are known as fundamental quantities.
(ii) The velocity ratio of a block and tackle pulley system which contains 3 fixed and 2 movable pulleys is 5.
(iii) If a force of 12 N acts on a body of 1.2 kg, the acceleration of the body will be:
a = F / m = 12 / 1.2 = 10 m/s^2
(iv) The instrument used to detect and identify the presence of electric charges on an object is known as an electroscope.
(v) During respiration, oxygen enters into the bloodstream by the process known as diffusion.

4. (a) Explain the following terms:
(i) Joule: A unit of energy equal to the work done when a force of one newton is applied over a distance of one meter.
(ii) Energy: The ability or capacity of a body to do work.
(iii) Watt: A unit of power equivalent to one joule of work done per second.

(b) State the principle of conservation of energy:
Energy cannot be created or destroyed; it can only be transformed from one form to another, and the total energy of an isolated system remains constant.

(c) A bus of 10,000 kg is traveling from Musoma to Mwanza with a speed of 25 m/s. Calculate its kinetic energy:
$KE = (1 / 2) \times m \times v^2$
$KE = (1 / 2) \times 10000 \times (25)^2$
$KE = 5000 \times 625$
$KE = 3125000$ J
The kinetic energy of the bus is 3,125,000 J.

5. (a) Apply Newton's first law of motion to explain why an object pulled along the ground with constant velocity has zero net force but the force exerted on it is not zero:
Newton's first law states that a body remains in its state of rest or uniform motion unless acted upon by an external force. In this case, the object moves with constant velocity because the pulling force balances the frictional force, resulting in zero net force. However, the pulling force compensates for the friction, ensuring constant motion.

(b) State the principle of the conservation of linear momentum:
The total linear momentum of a closed system remains constant provided no external forces act on it.

(c) A ball of mass 0.15 kg moving at a speed of 20 m/s increases the speed to 80 m/s in 0.5 seconds. Calculate the average force applied:
$F = m \times (v - u) / t$
$F = 0.15 \times (80 - 20) / 0.5$

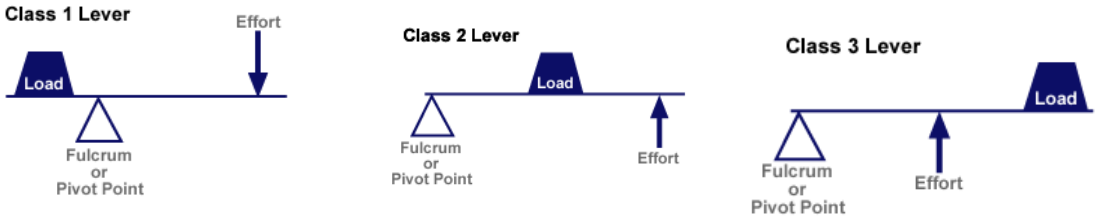
F = 0.15 x 60 / 0.5
F = 0.15 x 120
F = 18 N

The average force applied is 18 N.

6. (a) Why is the efficiency of a pulley system always less than 100%? Give two reasons.

- Friction: Some energy is lost due to friction between the moving parts of the pulley system.
- Stretching of the rope: Energy is also lost due to the slight stretching of the rope or belt used in the system.

(b) Draw diagrams of lever system to show



7. (a) How does static equilibrium differ from dynamic equilibrium?
- Static equilibrium occurs when an object is at rest and all the forces acting on it balance each other.
- Dynamic equilibrium occurs when an object is in motion at constant velocity and the forces acting on it also balance each other.

(b) Why do mechanics prefer to use a spanner with a longer stem rather than one with a shorter stem to tighten or loosen a nut on a bolt?
A longer spanner increases the perpendicular distance from the pivot point to the point of force application. This increases the moment of force, making it easier to tighten or loosen the nut with less effort.
(c) The moment of force about a point is 12,000 Nm. If the magnitude of the force is 6000 N, find the perpendicular distance between the point and the line of action of the force.
Moment = Force × Distance
Distance = Moment / Force
Distance = 12,000 / 6,000
Distance = 2 m

The perpendicular distance is 2 m.

8. (a) Use the concept of pressure to explain why buildings are constructed with wide foundations.

- Wide foundations distribute the weight of the building over a larger area, reducing the pressure on the ground. This prevents the building from sinking into the ground.

(b) Mention two experiments which show the evidence that atmospheric pressure exists.

- The crushing of a tin can when air is removed from it demonstrates atmospheric pressure.
- The rise of liquid in a straw when air is sucked out proves the existence of atmospheric pressure.

(c) A woman of mass 64 kg is standing on sand soil with high-heel shoes of area 2 cm^2.
(i) Find the pressure exerted by the woman on the ground.
Pressure = Force / Area
Force = Mass × Gravity = 64 × 10 = 640 N
Area = 2 cm^2 = 0.0002 m^2
Pressure = 640 / 0.0002
Pressure = 3,200,000 Pa

The pressure exerted is 3,200,000 Pa.

(ii) Why do her feet sink into the ground?
The high pressure exerted on the ground due to the small area of the high heels causes the sand to compress and sink under her weight.

9. (a) Write down three equations of uniform acceleration of motion and explain the meaning of each symbol.
1. $v = u + at$
2. $s = ut + 1/2\ at^2$
3. $v^2 = u^2 + 2as$
Where:
- v = final velocity
- u = initial velocity
- a = acceleration
- t = time
- s = displacement

(b) A football p of mass 0.5 kg was kicked by a goalkeeper at 12 m/s and collides with another football q of mass 0.45 kg which was at rest. After the collision, both balls move off together at 10 m/s.
Solution:
(i) Momentum of ball p before the collision:
Momentum = Mass × Velocity
Momentum = 0.5 × 12
Momentum = 6 kg·m/s

(ii) Momentum of ball p after the collision:
Momentum = Combined mass × Velocity
Combined mass = 0.5 + 0.45 = 0.95 kg
Momentum = 0.95 × 10
Momentum = 9.5 kg·m/s

10. (a) State any two important requirements for a complete circuit.

- A power source such as a battery.
- A continuous conducting path for the flow of current.

(b) Distinguish between resistance and resistors.

- Resistance is a property of a material that opposes the flow of electric current.
- A resistor is a physical component used in a circuit to provide resistance.

(c) Draw a simple circuit to show two bulbs in series connected to a battery of two cells.