THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION AND VOCATIONAL TRAINING

FORM TWO SECONDARY EDUCATION EXAMINATION, 2013

031   **PHYSICS**

<u>**Time: 2:30 Hours**</u>   **ANSWERS**   .

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 correct answer in the box provided for each of the following items:

(i) The relation of Physics with Chemistry is in making:
A. Algebra, trigonometry, and chemical change
B. Insect killers, perfume, and fertilizers
C. Photosynthesis and food
D. Rain gauge, wind vane, and thermometer
Answer: B

(ii) Which of the following groups of instruments is used to measure the basic fundamental quantities?
A. Beam balance, stop watch, and Vernier caliper
B. Chemical balance, stop watch, and measuring cylinder
C. Measuring cylinder, beam balance, and metre rule
D. Spring balance, stop watch, and micrometer screw gauge
Answer: A

(iii) Swelling of soaked beans in water is a demonstration of:
A. Capillarity
B. Diffusion
C. Osmosis
D. Viscosity
Answer: C

(iv) Which of the following is a property of a solid state?
A. Inter-particle distances are large
B. Particles are closely packed together
C. Particles are not closely packed together
D. Particles move randomly
Answer: B

(v) An instrument which is used to observe objects around obstacles is called:
A. Microscope
B. Periscope
C. Plane glass
D. Telescope
Answer: B

(vi) The relationship between pressure and area is that on:
A. Changing area, nothing happens
B. Decreasing area, pressure decreases
C. Decreasing pressure, volume increases
D. Increasing area, pressure decreases
Answer: D

(vii) A piece of metal with a volume of 0.00012 m³ has a mass of 0.12 kg. The density of metal will be:
A. 100 kg/m³
B. 1,000 kg/m³
C. 10,000 kg/m³
D. 100,000 kg/m³
Answer: B

(viii) If a student gets an electric shock and falls down unconscious in a Physics laboratory, which of the following would you do first to help the victim?
A. Administer breathing exercise
B. Call a medical doctor immediately
C. Call other students to surround the victim
D. Call a Physics teacher to give the victim medicine
Answer: B

(ix) The Sun is an example of a luminous body because it:
A. Is a big star
B. Is made by God
C. Produces its own light
D. Reflects light from the Earth
Answer: C

(x) A smell of rotten body can be felt through the process of:
A. Diffusion
B. Evaporation
C. Osmosis
D. Transpiration
Answer: A

(xi) The energy due to the rising and falling in the level of water in the oceans or seas is known as:
A. Electric energy
B. Nuclear energy
C. Wave energy
D. Wind energy
Answer: C

(xii) The following are applications of magnetism in daily life EXCEPT:
A. Banks make use of magnetic ink on cheques
B. Flour is passed near a magnet before being packed
C. Iron rods are used to separate sand from glass
D. VHS tapes are manufactured as a result of magnetism
Answer: C

(xiii) A measuring cylinder contains liquid to a level x. An object of volume z is totally immersed in the liquid contained in the cylinder. The new reading of the level of the liquid will be:

A. x

B. z

C. x + z

D. z – x

Answer: C

(xiv) An object with low center of gravity and a wide base is:

A. Neutral

B. Stable

C. Un-equilibral

D. Unstable

Answer: B

(xv) A ball of mass 0.6 kg is kicked vertically up to a height of 6 m. The potential energy acquired by the ball is:

A. 0.36 J

B. 3.6 J

C. 36 J

D. 360 J

Answer: C

Explanation: $PE = mgh = 0.6 \times 10 \times 6 = 36$ J

(xvi) From Archimedes' principle, the upthrust acting on a body is equal to the:

A. Apparent loss in weight

B. Apparent weight

C. Weight of a body in air

D. Weight of a body in water

Answer: A

(xvii) What is the total resistance of two resistors, $R_1 = 2\ \Omega$ and $R_2 = 3\ \Omega$, connected in parallel?

A. 1.2 Ω

B. 5 Ω

C. 0.6 Ω

D. 12 Ω

Answer: A

Explanation: $1/R = 1/R_1 + 1/R_2 = 1/2 + 1/3 = 3/6 + 2/6 = 5/6$; $R = 6/5 = 1.2\ \Omega$

(xviii) The SI unit of electric charge is:

A. Ampere

B. Coulomb

C. Ohm

D. Second

Answer: B

(xix) The acceleration of a body of mass 30 kg when a constant force of 150 N is applied on it will be:

A. 0.05 m/s²

B. 0.5 m/s²

C. 5.0 m/s²

D. 50 m/s²

Answer: C

Explanation: $a = F / m = 150 / 30 = 5.0$ m/s²

(xx) The materials which allow electricity and heat to pass freely are termed as:

A. Conductors

B. Insulators

C. Semi-conductors

D. Semi-insulators

Answer: A

Here are the solutions to the questions in the provided image:

2. Match each item in List A with a correct response in List B.

List A

(i) Attractive force between molecules of the same substance

(ii) Bodies that give out light

(iii) Device used to put on and off an electric current

(iv) Instrument used to convert wind energy to mechanical energy

(v) Magnetic field is zero

(vi) Measures body temperature

(vii) Measures mass of the body

(viii) Product of mass and velocity

List B

A. Adhesive force

B. Beam balance

C. Clinical thermometer

D. Cohesive force

E. Luminous objects

F. Magnetic field

G. Momentum

H. Neutral point
I. Six's thermometer
J. Spring balance
K. Switch
L. Windmill
Answers:
(i) D
(ii) E
(iii) K
(iv) L
(v) H
(vi) C
(vii) B
(viii) G

3. Complete each of the following statements:
(i) In the velocity-time graph, the slope represents acceleration.
(ii) The weight of a body when in water is known as apparent weight.
(iii) Devices for storing charge are called capacitors.
(iv) The type of force which causes the size and volume of an object to decrease is known as compressive force.

(v) The tendency of an object to remain on the surface of a fluid due to the force exerted by the fluid is called buoyancy.

4. (a) Define the term "Pressure":
Pressure is the force acting per unit area on a surface, mathematically given as $P = F / A$.

(b) A rectangular object whose dimensions are 1.4 m by 0.1 m by 2.0 m has a density of 200 kg/m³.
Solution:
Calculate the minimum pressure when placed on a surface.
Force = Weight = Mass × Gravity
Mass = Density × Volume = $200 \times (1.4 \times 0.1 \times 2.0) = 56$ kg
Force = $56 \times 10 = 560$ N
Area = $1.4 \times 2.0 = 2.8$ m²
Pressure = Force / Area = $560 / 2.8 = 200$ Pa
The minimum pressure is 200 Pa.

5. (a) Define each of the following terms as applied in Physics:
(i) Volume: The amount of three-dimensional space occupied by an object or substance.
(ii) Moment of force: The turning effect of a force about a point, given as the product of the force and its perpendicular distance from the point of rotation.

(b) An object of 100 kg is lifted to a height of 5 m above the ground in 3 seconds. Calculate:
(i) Work done:
Work = Force × Distance = Weight × Height = 100 × 10 × 5 = 5000 J
(ii) Power:
Power = Work / Time = 5000 / 3 = 1666.67 W

6. (a) Define the term "Force" and state its SI unit:
Force is a push or pull acting on an object due to its interaction with another object, which can cause a change in motion. Its SI unit is the Newton (N).

(b) A spring balance reads 12 N when a metal block is suspended from it and 10 N when the block is completely immersed in water. Calculate:
(i) Upthrust on the block:
Upthrust = Weight in air - Weight in water = 12 - 10 = 2 N

(ii) Relative density of the block:
Relative density = Weight in air / Upthrust = 12 / 2 = 6

7. (a) Define the following terms as applied to machines:
(i) Load: The weight or resistance that a machine is designed to lift or overcome.
(ii) Effort: The force applied to a machine to overcome the load.
(iii) Efficiency The ratio of the useful work output of a machine to the work input, expressed as a percentage. Mathematically, Efficiency = (Work output / Work input) × 100%.

(b) A load of 500 N is raised through 5 m by a machine when its effort moves simultaneously through a distance of 25 m. If the efficiency of the machine is 80%, calculate its mechanical advantage.
Solution:
Efficiency = (Mechanical Advantage / Velocity Ratio) × 100%
Mechanical Advantage = (Efficiency × Velocity Ratio) / 100

Velocity Ratio = Distance moved by effort / Distance moved by load = 25 / 5 = 5
Mechanical Advantage = (80 × 5) / 100 = 4
The mechanical advantage is 4.

8. (a) (i) State the law of conservation of linear momentum.
The total linear momentum of an isolated system remains constant provided no external force acts on it.

(ii) Define the term "elastic collision".
An elastic collision is a type of collision in which the total kinetic energy of the system before and after the collision remains the same.

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(b) A body of mass 8 kg moving with a velocity of 20 m/s collides with another body of mass 4 kg moving with a velocity of 10 m/s in the same direction. The velocity of the 8 kg body is reduced to 15 m/s after the collision. If the bodies do not stick together after the collision, calculate the final velocity of the 4 kg body.

Solution:

Using the law of conservation of momentum:

$m\_1u\_1 + m\_2u\_2 = m\_1v\_1 + m\_2v\_2$

$(8 \times 20) + (4 \times 10) = (8 \times 15) + (4 \times v\_2)$

$160 + 40 = 120 + 4v\_2$

$200 = 120 + 4v\_2$

$4v\_2 = 80$

$v\_2 = 20$ m/s

The final velocity of the 4 kg body is 20 m/s.

9. (a) Differentiate a ray of light from a beam of light.
- A ray of light is a single line or narrow path along which light energy travels.
- A beam of light is a collection of rays of light traveling in the same direction.

(b) Mention four properties of an image formed by a plane mirror:
(i) The image is virtual.
(ii) The image is the same size as the object.
(iii) The image is laterally inverted.
(iv) The image appears to be behind the mirror at the same distance as the object is in front of it.

10. (a) State the law of magnetism.
Like poles of a magnet repel each other, and unlike poles attract each other.

(b) For each of the following, sketch the resulting magnetic field and mark the position of the neutral point if any:
(i) Two N-poles are brought close to each other but not touching:
- The magnetic field lines will repel and curve outward from each pole, with no neutral point as the fields do not cancel.
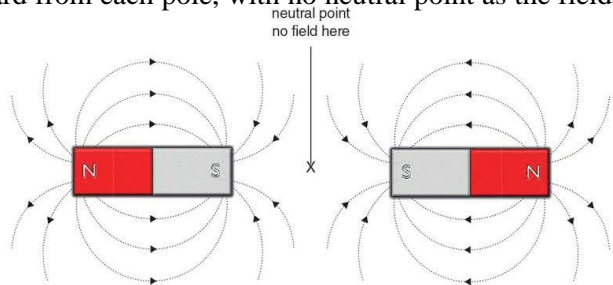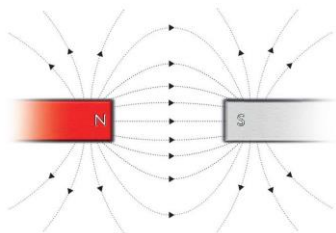
(ii) N-pole and S-pole are brought close to each other but not touching:
- The magnetic field lines will curve from the N-pole to the S-pole, showing attraction. The neutral point does not exist between unlike poles.

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