

**THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
CERTIFICATE OF SECONDARY EDUCATION EXAMINATION**

031/1

PHYSICS 1

(For Both School and Private Candidates)

Time: 3 Hours

Year: 2024

Instructions

1. This paper consists of sections A, B and C with a total of **eleven (11)** questions.
2. Answer **all** questions in sections A and B and **two (2)** questions from section C.
3. Communication devices and any unauthorised materials are **not** allowed in the examination room.
4. Non-programmable calculators and mathematical tables may be used.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. Where necessary the following constants may be used:
 - (i) Acceleration due to gravity, $g = 10 \text{ m/s}^2$.
 - (ii) Specific heat capacity of copper = $390 \text{ J Kg } ^\circ\text{C}^{-1}$.
 - (iii) Specific heat capacity of water = $4200 \text{ J Kg } ^\circ\text{C}^{-1}$.
 - (iv) Specific heat capacity of a piece of metal = $400 \text{ J Kg } ^\circ\text{C}^{-1}$.
 - (v) Density of mercury = $13,600 \text{ kg/m}^3$.
 - (vi) Density of air = 1.25 kg/m^3 .
 - (vii) Pie, $\pi = 3.14$.
 - (viii) The speed of sound in air = 330 m/s .



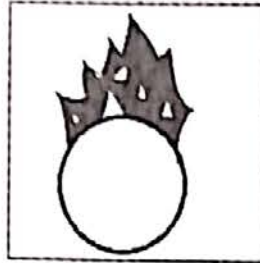
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SECTION A (16 Marks)

Answer all questions in this section.

1. For each of the items (i) - (x), choose the correct answer from the given alternatives and write its letter beside the item number in the answer booklet provided. (10 marks)

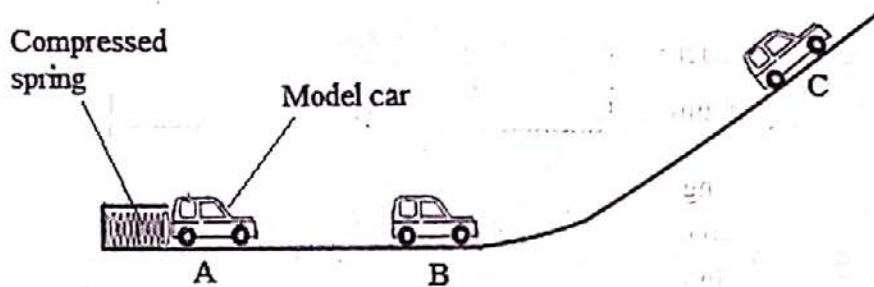
- (i) What does the following warning sign mean in relation to the contents in the container?



- A Radioactive B Explosive C Flammable
-D Oxidizing agent E Toxic
- (ii) The following are the uses of relative density in everyday life, **except**
- A Designation of various structures such as ship and planes
B Selections of building materials
-C Identification of germs
D Determination of density of unknown substances
E Designation of swimming and diving equipment
- (iii) Which one represent the fundamental forces?
- A Compressional, torsional and frictional forces
B Gravitational, torsional and frictional forces
-C Nuclear, gravitational and electromagnetic forces
D Stretching, attraction and repulsion forces
E Viscosity, frictional and restoring forces
- (iv) If a bubble of air is released at the bottom of a water pond, it will rise to the water surface of the pond. Why does this happen?
- A The weight of the bubble is greater than the upthrust
B The density of water is the same as that of the air bubble
-C Upthrust is equal to the weight of the air bubble
D Upthrust is greater than the weight of the air bubble
E Upthrust is less than the weight of the air bubble
- (v) How much heat energy is given out by a copper block of 40 g mass when it cools from 1840 °C to 40 °C?
- A 28008 J B 2800 J - C 2808 J D 28000 J E 28080 J

ps = h y m n

- (vi) In an experiment to observe the flow of different liquids in the same container, it takes 3 minutes and 10 minutes to pour cooking oil and honey into a 5 litre gallon, respectively. How is honey distinguished from cooking oil?
- A Honey has a higher viscosity than cooking oil
 - B Honey offers low resistance than cooking oil
 - C Cooking oil has higher viscous force than honey
 - D Honey is heavier than cooking oil
 - E Cooking oil offers high resistance than honey
- (vii) The following diagram shows a movement of a model car starting from point A after being released from a compressed spring and stops at point C above the horizontal surface. Which one will be the set of energy changes in this process?



- A Gravitational potential energy, kinetic energy then spring potential energy
 - B Kinetic energy, chemical energy then gravitational potential energy
 - C Chemical energy, kinetic energy then gravitational potential energy
 - D Spring potential energy, kinetic energy then gravitational energy
 - E Mechanical energy, kinetic energy then gravitational potential energy
- (viii) The Figures 1, 2 and 3 show a wire carrying electric current around the magnet. In which figure(s) the connection(s) will cause a magnet retain its magnetic field strength?

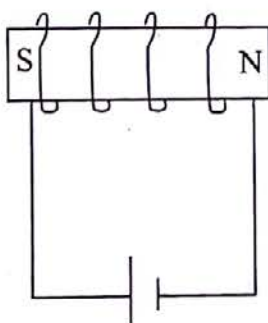


Figure 1

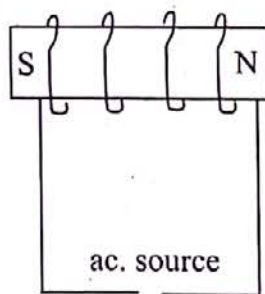


Figure 2

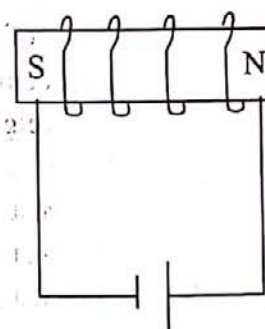
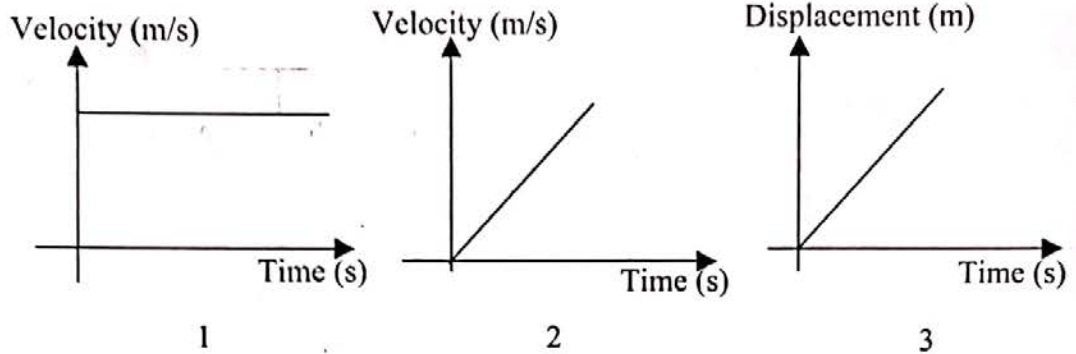


Figure 3

- A Figure 1
- B Figure 2
- C Figure 3
- D Figure 1 and 2
- E Figure 2 and 3

- (ix) The graphs, 1, 2 and 3 represent the motion of a body travelling from point M to N. Which graph(s) represents the motion of a uniform velocity in a straight line?



- A 1, 2 and 3
B 1 alone
C 2 and 3
D 1 and 3
E 1 and 2

- (x) Why windmills are constructed around the coastal areas, in open plains, in gaps of mountain ranges or at the top of rounded hills?

- A Because these are cheap areas to harvest wind energy.
B Because there are no obstructions and strong winds blow to rotate wind turbines propellers.
C Because when the sun heats the atmosphere some patches become warmer than the others.
D Because there are less movement of people and vehicles in those areas.
E Because the wind turbines are noisy and can spoil the landscape.

2. Match the descriptions of the terms used in simple machines in **List A** with its corresponding concept used in simple machines in **List B** by writing the letter of the correct response beside the corresponding item number in the answer booklet provided. (6 marks)

List A	List B
(i) The ratio of the distance moved by effort to the distance moved by the load. $\frac{d_E}{d_L}$	A A simple pulley
(ii) The ratio of the load raised steadily by a machine when an effort or force is applied. $\frac{L}{E}$	B Combination pulley
(iii) A fixed wheel with a rope passing round a groove in the wheel's circumference. $\downarrow \hookrightarrow$	C Efficiency
(iv) The ratio of the work output to the work input $\times 100\%$. ϵ	D Lever
(v) Consists of a rigid bar that moves about a fixed point. \bar{A}	E Mechanical advantage
(vi) A simple machine which can pull a heavy load along a slopping surface. $\uparrow \Delta$	F Single fixed pulley
	G An inclined plane
	H Velocity ratio

SECTION B (54 Marks)

Answer **all** questions in this section.

3. (a) Figure 4 shows two plane mirrors, A and B inclined at 70° to each other. A ray of light parallel to mirror A is inclined to mirror B. What is the angle of reflection of the light ray on mirror A? (4 marks)

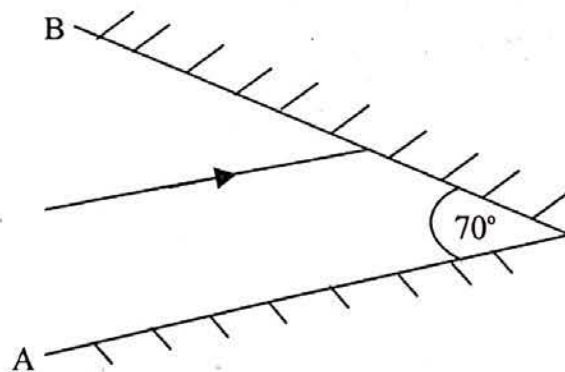
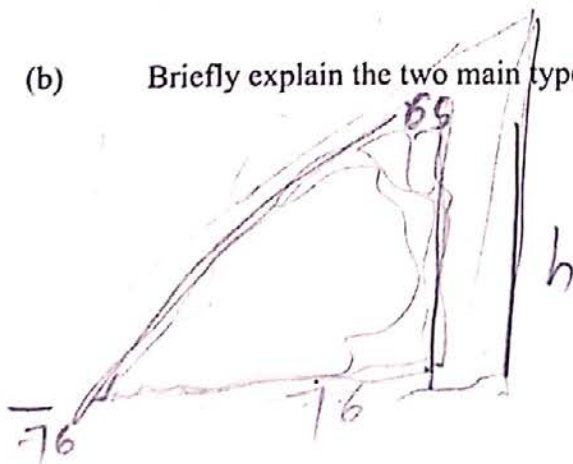


Figure 4

- (b) A projector lens is used to produce a sharp image of an object when the distance between the object and screen is 160 cm. If the linear magnification is 7, calculate the focal length of the lens. (5 marks)
4. (a) The air pressure at the base of a mountain is 76 cm of mercury and at the top is 65 cm of mercury. Calculate the height of the mountain. (4 marks)
- (b) Two boys, Q and P are carrying a ladder of weight 800 N. If Q holds the ladder 2 m from its centre of gravity and P holds the ladder 3 m from its centre of gravity, with the aid of a sketch, calculate the load that each of them supports. (5 marks)
5. (a) A 3 kg hammer is used to drive a nail into a piece of wood. If at the time of impact, the hammer's speed is 5 m/s and it drives the nail 1 cm into the wood, find the impulse of the force on the nail. (4 marks)
- $P = h \cdot \omega$ (b) A bicycle wheel has a radius of 45 cm while the rear sprocket has a radius of 4.5 cm. If an effort of 160 N is applied at the sprocket, calculate the maximum load that can be carried out by the bicycle system with efficiency of 80%. (5 marks)
6. (a) Why particles in a solid expand when left in hot water? Briefly explain by using kinetic theory of matter. (4 marks)
- (b) A piece of metal with the mass of 200 g at a temperature of 100 °C is quickly transferred into a 50 g of water at 20 °C. Find the final temperature of water. (5 marks)
7. (a) A closed pipe which is opened at one end has a fundamental frequency of 400 Hz. Draw its mode of vibration of air column at its fundamental mode and first overtone. (4 marks)
- (b) A uranium nucleus ${}_{92}^{238}\text{U}$ decays into a lead nucleus ${}_{82}^{206}\text{Pb}$. Calculate the number of alpha and beta particles emitted. (5 marks)
8. (a) Describe the three types of volcanoes by giving one example in each case. (4.5 marks)
- (b) Briefly explain the two main types of ocean tides. (4.5 marks)



$$P = h \cdot \rho \cdot g$$

$$P = h \cdot \rho \cdot g$$

$$76 + x = 65$$

$$\downarrow 776 + 18 = 4225$$

SECTION C (30 Marks)

speed = $\frac{\text{distance}}{\text{time}}$
 $C = \dots$

Answer two (2) questions from this section.

9. (a) Three capacitors with capacitances of $15 \mu\text{F}$, $25 \mu\text{F}$ and X are configured in a circuit such that the equivalent capacitance is $7 \mu\text{F}$.
- (i) Identify the type of arrangement of capacitors. (2.5 marks)
- (ii) Determine the capacitance of capacitor, X . (2.5 marks)
- (b) Study the electrical circuit arrangement in Figure 5, then answer the questions that follow:

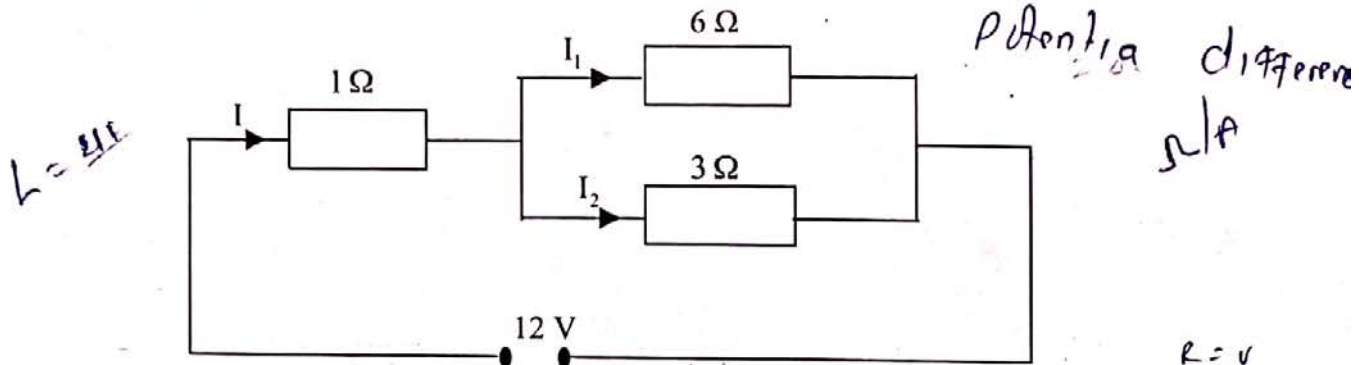


Figure 5

$M_1 T_1 = M_2 T_2$

- (i) Calculate the current flowing in each of the three resistors. (2.5 marks)
- (ii) Find the potential difference across each resistor. (2.5 marks)
- (c) The following table shows some of the electrical appliances found at home.

Power Rating of some Electrical Appliances Found at Home

Appliance	Power Rating
Bulb	250 W
TV set	500 W
Electric heater	3.0 kW
Electric iron	2.0 kW

$I = \frac{V}{R}$
 $V = I R$
 $P = \frac{V^2}{R}$
 $P = I^2 R$

Assuming that TANESCO charges electrical energy at a rate of Tsh 80/= per unit, calculate the total cost of running these appliances if all are switched on a single day from 6:00 pm to 11:00 pm. (5 marks)

10. (a) How would you distinguish cathode-rays from X-rays when placed or passed through the magnetic field, electric field and small paddle wheel? (4.5 marks)
- (b) Hard X rays are mostly applicable in industries while Soft X rays are commonly used in the medical field. Account for their differences. (3 marks)
- (c) You are given with the following electronic materials: A diode (D); a resistor (R); a step-down transformer; and connecting wires. Draw a rectifier circuit by using these materials showing also the input and output wave forms. (7.5 marks)

11. (a) A man is standing at point P between the walls X and Y shown in Figure 6 then claps his hands once. If the first two echoes are separated by 0.4 s, find the separation distance of the wall X and Y. (4 marks)



Figure 6

- (b) Draw a well labelled diagram of an induction coil and give its two applications. (5.5 marks)
- (c) Figure 7 shows a relay circuit for security door alarm;
- (i) Explain how it works step by step.
- (ii) In what way is it "fail safe"? (5.5 marks)

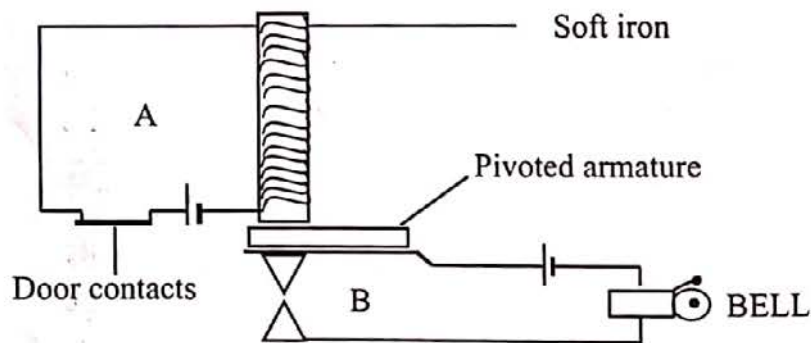


Figure 7