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, $g = 10\ m/s^2$.
   (ii) Specific heat capacity of copper = 390 J Kg $°C^{-1}$.
   (iii) Specific heat capacity of water = 4200 J Kg $°C^{-1}$.
   (iv) Specific heat capacity of a piece of metal = 400 J Kg $°C^{-1}$.
   (v) Density of mercury = 13,600 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.

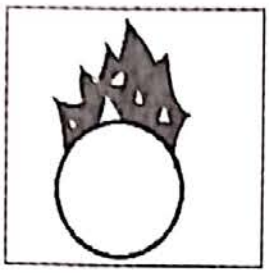
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SECTION A (16 Marks)

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

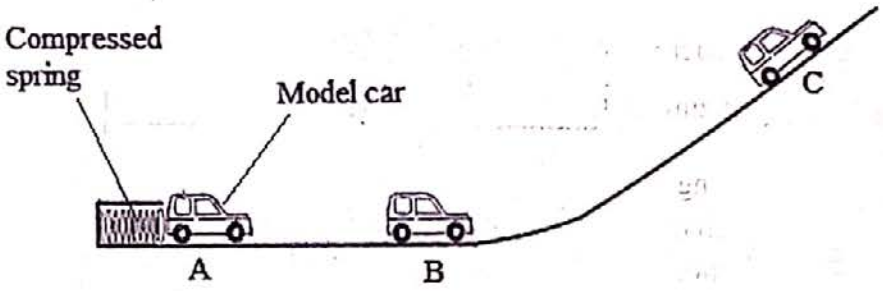
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(vi) In an experiment to observe the flow of different liquids in the same container, it takes 3 minutes and 10 minutes to pour cooking oil and honey into a 5 litre gallon, respectively. How is honey distinguished from cooking oil?

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?

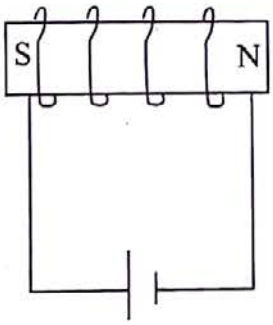


Figure 1

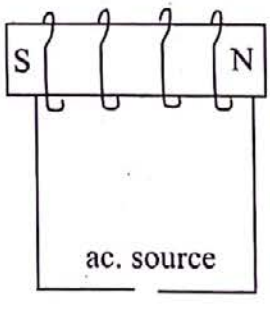


Figure 2

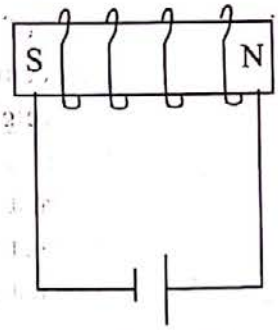
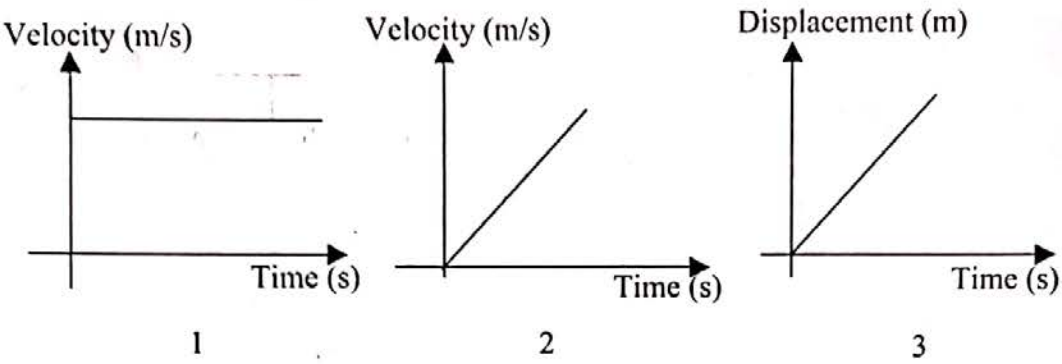


Figure 3

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

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(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?



1 2 3

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.

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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.	A A simple pulley
(ii) The ratio of the load raised steadily by a machine when an effort or force is applied.	B Combination pulley
(iii) A fixed wheel with a rope passing round a groove in the wheel's circumference.	C Efficiency
(iv) The ratio of the work output to the work input ×100%.	D Lever
(v) Consists of a rigid bar that moves about a fixed point.	E Mechanical advantage
(vi) A simple machine which can pull a heavy load along a slopping surface.	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)

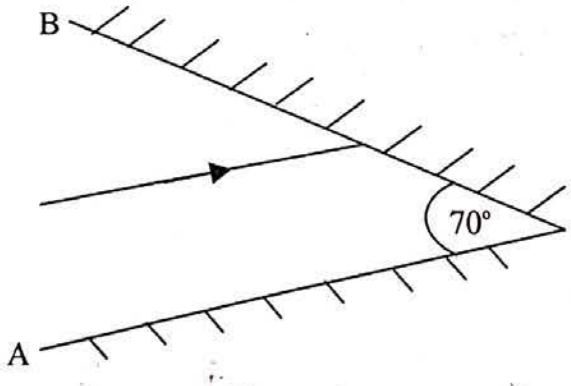


Figure 4

(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)**

(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.

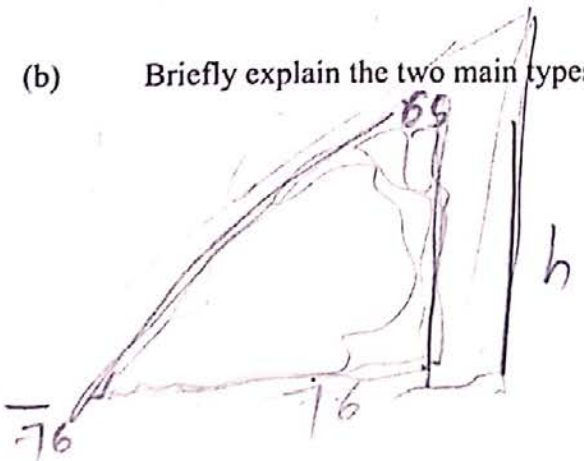
(5 marks)

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 $^{238}_{92}U$ decays into a lead nucleus $^{206}_{82}Pb$. 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)**



SECTION C (30 Marks)

Answer **two (2)** questions from this section.

9. (a) Three capacitors with capacitances of 15 μF, 25 μF and X are configured in a circuit such that the equivalent capacitance is 7 μF.

(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:

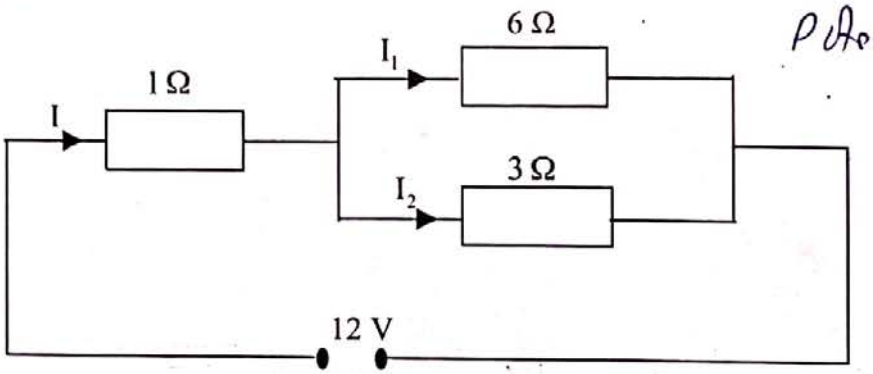


Figure 5

(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

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)**

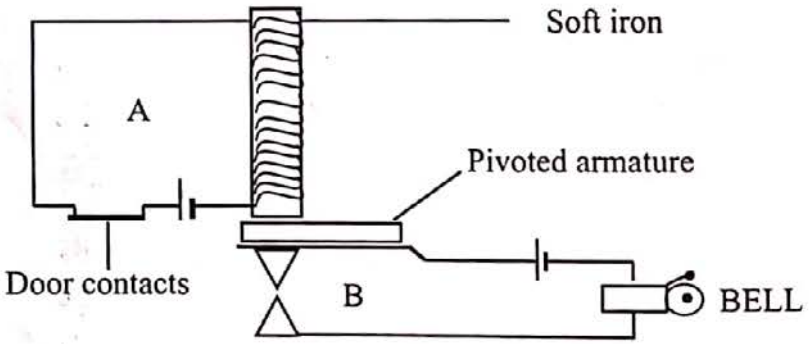


Figure 7

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