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: 2023**

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 unauthorized 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) Linear expansivity of aluminium = 0.00003 per ^oC.
   (iii) Linear expansivity of steel = 0.00001 per ^oC.
   (iv) Pie, $\pi = 3.14$.

SECTION A (16 Marks)

Answer **all** questions in this section.

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

(i) A study that deals with constellation, solar system and cosmos is referred to as
A Electromagnetism B Structure and properties of matter
C Light D Astronomy
E Geophysics

(ii) Which of the following burning medium requires a carbon dioxide extinguisher?
A Organic solids B Flammable liquids and greases
C Flammable gases D Combustible metals
E Electrical hazards

(iii) The initial volume of a liquid in a burette was 57 cm^3. If X cm^3 of the liquid was poured out of the burette and the final volume of the liquid remaining was 23 cm^3, calculate the value of X.
A 80 cm^3 B 50 cm^3 C 34 cm^3 D 46 cm^3 E -46 cm^3

(iv) Classify the force experienced when a metal solid or a hard object is twisted.
A Compression B Stretching
C Restoring D Torsion
E Friction

(v) Calculate the relative density of an object that weighs 3.5 N when in air and 2.8 N when fully immersed in water.
A 0.8 B 6.4 C 5.0 D 0.22 E 3.5

(vi) Why can water striders and pond skaters walk on water without sinking?
A Because of the process of osmosis
B Because of the property of capillarity
C Because of the presence of impurities in water
D Because of the force of surface tension
E Because of the force of cohesion and adhesion.

(vii) Identify the statement that describes the Pascal's Principle of transmission of pressure in fluids.

A Pressure is equally transmitted in liquid.
B Pressure is the ratio of force to area.
C Pressure depends on the height of the liquid column.
D Pressure is affected by the force of gravity.
E Pressure produces upthrust.

(viii) Suppose an engine raises 200 kg of water steadily through a height of 60 m in 20 sec. The upward force used is equal to the weight of water raised. Calculate the power in kW.

A 6 kW B 3 kW C 5 kW D 7 kW E 4 kW

(ix) The following statements about magnetic lines of force are correct **except:**

A Always form close loops.
B Start at north pole and end at the south pole.
C Cross one another.
D Stronger where the lines are closer together.
E Pass through all materials, both magnetic and non-magnetic.

(x) What is the distance and displacement covered by an athlete who runs 100 m to the North, 70 m to the East, 100 m to the South and 70 m to the West to complete the race?

A Distance is 0 m and displacement is 340 m
B Distance is 340 m and displacement is 0 m
C Distance is 340 m and displacement is 340 m
D Distance is 0 m and displacement is 0 m
E Distance is 700 m and displacement is 700 m

2. Match the properties or functions of the simple machines in **List A** with their corresponding names of the 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) Is useful in drawing water from a borehole.	A Wheelbarrow
(ii) Applies the principle of first class lever.	B Wheel and axle
(iii) Its velocity ratio increases by increasing the length of the ramp.	C Hydraulic press
(iv) The effort is between the load and fulcrum.	D Tong
(v) Operates based on the principle of transmission of pressure in fluids.	E Claw hammer
(vi) Carries objects from one point to another horizontally.	F Inclined plane
	G Pulley
	H Windmill
	I Screw jack

SECTION B (54 Marks)

Answer **all** questions in this section.

3. (a) A convex mirror is often used as the wing mirror of a car instead of plane mirror. Justify this statement giving one point. **(3 marks)**

(b) A camera is used to take a close-up picture of an object 3 cm tall. If the object is positioned 24 cm in front of the lens and a focused image is formed on the film 12 cm behind the lens, determine the focal length of the camera lens and the height of the image formed on the film. **(6 marks)**

4. (a) Why is it not be practical to make a barometer with water instead of mercury? **(4 marks)**

(b) A force of 200 N and 20 cm long spanner and 150 N and 30 cm long spanner were separately used to loosen the left and right front car tire nuts, respectively. Show that the 30 cm long spanner will be more effective than the 20 cm long spanner. **(5 marks)**

5. (a) Why while swimming, the swimmer pushes the water backward with his hands?

(4 marks)

(b) Figure 1 shows two simple machines A and B having the same efficiency. Justify that simple machine A requires minimum effort to raise a load of 5000 N. **(5 marks)**

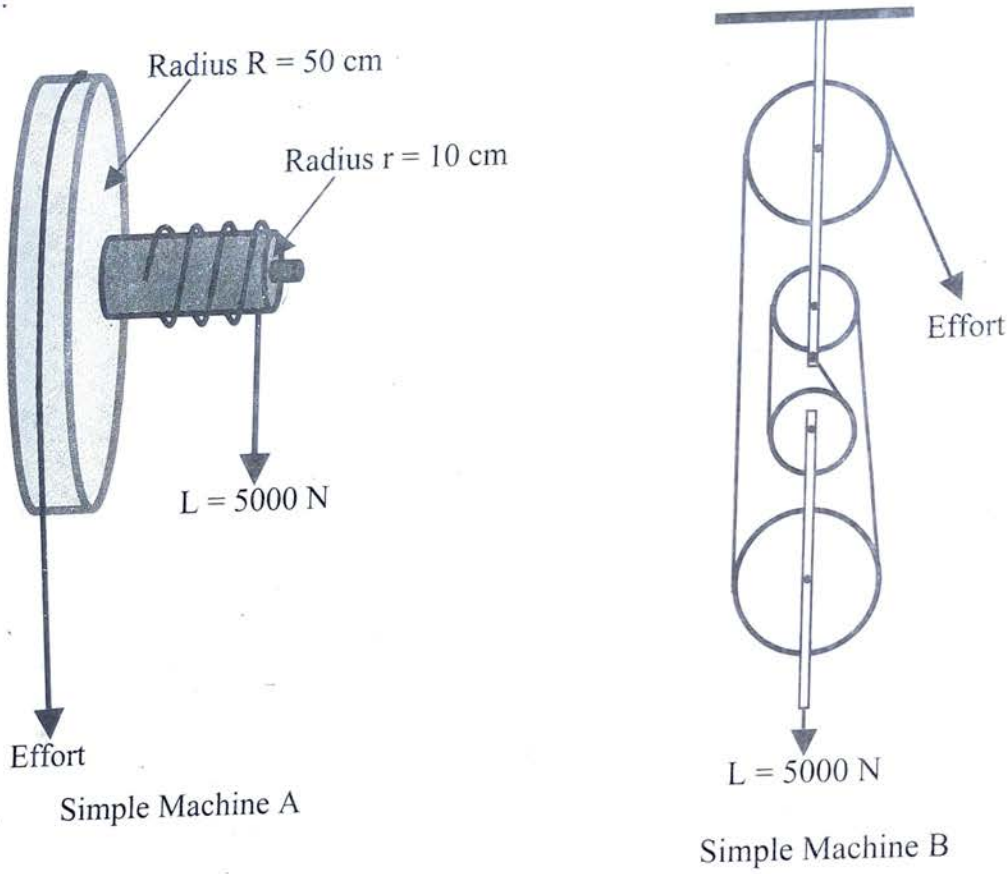

Figure 1

6. (a) Figure 2 shows a bimetallic thermostat strip used to regulate the temperature of the room by using a heater and a cooler. Which device between A and B is a heater? Justify your answer. **(4 marks)**

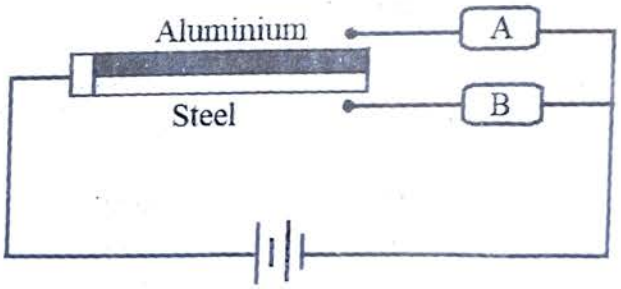

Figure 2

(b) Demonstrate by using a diagram on how heat transfer by convection takes place when water is heated? **(5 marks)**

7. (a) Compare the effect of frequency and amplitude to musical sound. Give two points each. **(4 marks)**

(b) With the aid of a diagram, compare the penetrating ability of the three types of radiations on a piece of paper, aluminum sheet and lead block. **(5 marks)**

8. (a) Why are the surface waves more dangerous than the primary and secondary waves? **(3 marks)**

(b) Describe the three uses of constellations. **(6 marks)**

SECTION C (30 Marks)

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

9. (a) By drawing circuit diagrams supported by the graphs, compare the charging and discharging processes of a capacitor given that you are provided with a cell (E), a voltmeter (V), a switch (S), a capacitor (C), a resistor (R) and connecting wires. **(6 marks)**

(b) Two wires A and B of the same material and length have the cross-sectional area in the ratio 2:1. If the same potential difference is applied across each wire, comment on the amount of current flowing between the wires A and B. **(6 marks)**

(c) Why a low voltage supply should have a low internal resistance. Explain by using an appropriate formula. **(3 marks)**

10. (a) How will the penetrating power of X rays be affected when:

(i) their wavelength is reduced? **(2 marks)**

(ii) voltage across X-ray tube is increased? **(2 marks)**

(b) When a speaker is brought near to a Television (TV) operating using cathode ray tube, the picture on the screen is affected but when taken away, the picture becomes normal. Account for this observation. **(5 marks)**

(c) Transistor is a three terminal device that is used to amplify the strength of weak signals. Draw the NPN transistor circuit connections with four terminals in the following modes: Common Base (CB), Common Emitter (CE) and Common Collector (CC) indicating the input and output circuits. **(6 marks)**

11. (a) The shortest length of the air column in a resonance tube with one end closed and the other end open which resonates to a note of frequency 500 Hz is found to be 160 mm. Calculate the shortest length of the column of air which resonates in similar conditions to a note of frequency 800 Hz. **(5 marks)**

(b) Show how Lenz's law is a special case of the law of conservation of energy. **(3 marks)**

(c) Figure 3 illustrates an electric bell operated by a battery.

(i) What will happen to the armature A when the switch is closed? **(3.5 marks)**

(ii) Describe the function of steel strip S. **(3.5 marks)**

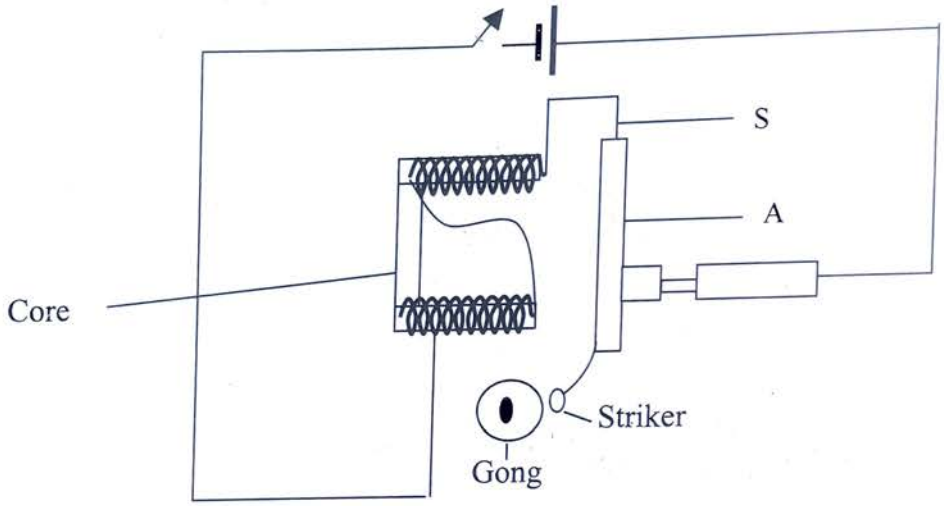

Figure 3