# 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: 2022**

### 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. Section A carries **fifteen (15)** marks, section B **sixty (60)** marks and section C carries **twenty five (25)** marks.
4. Cellular phones and any unauthorized materials are **not** allowed in the examination room.
5. Non-programmable calculators and mathematical tables may be used.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. Where necessary the following constants may be used:
   (i) Acceleration due to gravity, $g = 10\ m/s^2$.
   (ii) Density of water = $1.0\ g/cm^3$.
   (iii) Pie, $\pi = 3.14$.
   (iv) Speed of sound is 340 m/s.

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## SECTION A (15 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) Which set best represents fundamental quantities with their SI units?

A Length (km), mass (kg), time (s), temperature ($^{o}$ C), amount of substance (mol) and electric current (A).

B Length (m), mass (kg), force (N), temperature (K), time (s), amount of substance (mol) and energy (J).

C Length (m), mass (kg), time (s), electric current (I), temperature ($^{o}$ C) and amount of substance (mol).

D Length (m), mass (kg), time (s), temperature (K), electric current (A) and luminous intensity (Cd).

E Length (km), mass (g), time (s), temperature (K), electric current (A) and amount of substance (mol).

(ii) Which one of the following conditions must be satisfied for a body to float?

A Apparent weight is equal to the difference between real weight of the body and its upthrust.

B Upthrust equals to the weight of the fluid displaced.

C Real weight of the body equals to its upthrust.

D Apparent weight is equal to the product of real weight of a body and its upthrust.

E Density of a body is equal to the density of surrounding fluid.

(iii) Which statement about the properties of gaseous state of matter is true?

A Particles vibrate in fixed positions.

B The shape is indefinite with definite volume.

C Particles are closely packed together.

D Both shape and volume are definite.

E The inter-particle distance is large.

(iv) At which position will the object be placed for a concave mirror to form virtual, magnified and erect image behind the mirror?

A Between the principle focus (F) and the pole (P) in front of the mirror.

B Between the principle focus (F) and the pole (P) behind the mirror.

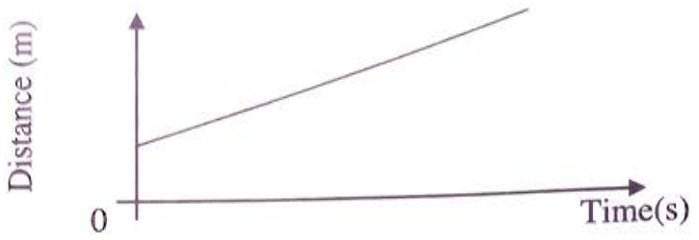
C Between the centre of curvature (C) and principle focus (F) in front of the mirror.

D Between the centre of curvature (C) and principle focus (F) behind the mirror.

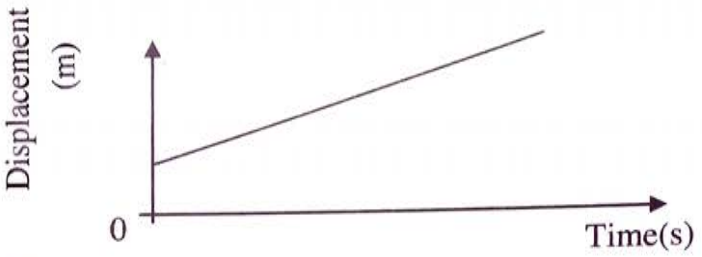
E Between the centre of curvature (C) and the pole (P) in front of the mirror.

(v) Which of the following uniform motion graphs represents velocity?

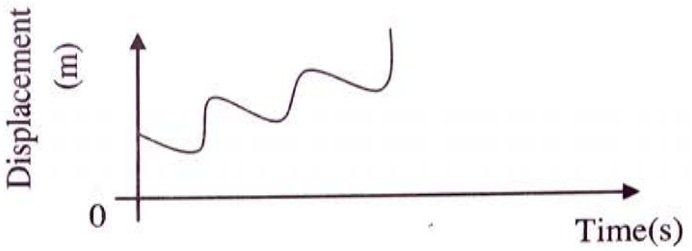
A



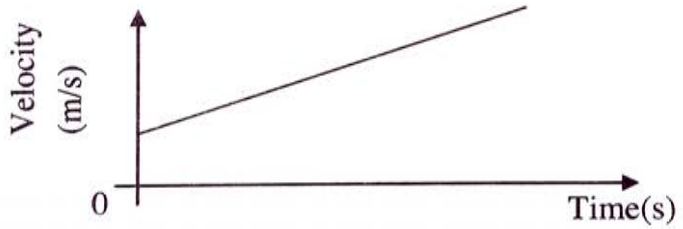

B



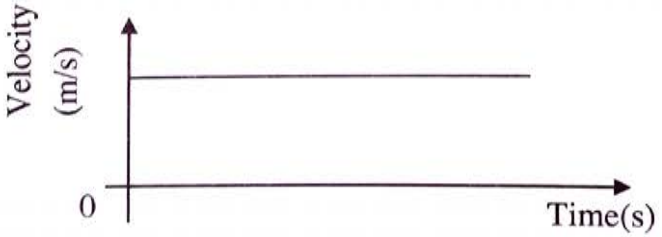

C




D




E




(vi) Two objects X and Y were supplied by equal quantities of thermal energy. It was observed that the temperature increase of object X is greater than the temperature increase of object Y. Which of the following statements explains the observation?

A X has a lower melting point than Y.
B X has a lower density than Y.
C X has a lower thermal capacity than Y.
D X is a better thermal conductor than Y.
E X is heavier than Y.

(vii) A hot water in a cup undergoes evaporation in an open air. What happens to the mass and weight of the water in the cup?

A Both mass and weight decrease

B Mass decreases while weight stays the same

C Both mass and weight stay the same

D Mass increases while weight decreases

E Mass stays the same while weight decreases

(viii) A student wishes to check the upper fixed point and the lower fixed point on Celsius scale thermometer as shown in Figure 1.

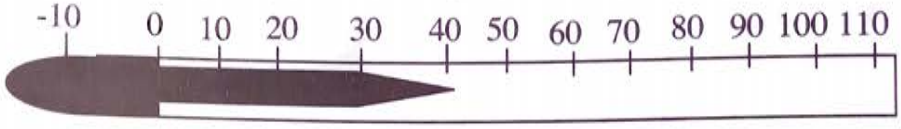



**Figure 1**

The student has four beakers namely *P*, *Q*, *R* and *S*.
*P* contains a mixture of ice and salt;
*Q* contains a mixture of ice and water;
*R* contains a mixture of boiling salt solution; and
*S* contains boiling water.
Which beakers should a student use to check the fixed points?

A *P* and *R* B *P* and *S* C *Q* and *S*
D *Q* and *R* E *S* and *R*

(ix) Which one of the following is **not** a property of cathode rays?

A They are a stream of fast moving protons.

B They travel in straight lines.

C They are deflected by electric fields.

D They are deflected by magnetic fields.

E They produce x-rays when stopped suddenly.

(x) What does the term milky way mean?

A A vast collection of asteroids.

B One of the galaxies of the universe.

C A group of stars that form a pattern in the sky.

D One of the meteoroids.

E One of the solar systems.

2. Match the applications of parts of the electromagnetic spectrum in **List A** with the corresponding parts of electromagnetic spectrum in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided. **(5 marks)**

| List A | List B |
|---|---|
| (i) Can be used to sterilize fruits and vegetables. | A Visible light |
| (ii) Stimulates the production of vitamin D in the human skin. | B X-rays |
| (iii) Stimulates the sensitive cells in the retina. | C Microwaves |
| (iv) Emitted by a remote control. | D Alpha particles |
| (v) Used for rapid cooking in an oven. | E Gamma rays |
| | F Infra-red rays |
| | G Radio waves |
| | H Ultra-violet rays |

## SECTION B (60 Marks)

Answer **all** questions in this section.

3. (a) A concave mirror is used to form an image of a pin object. By using a well labelled diagram; show how you can obtain an upright and enlarged image. **(4 marks)**

(b) With the aid of diagrams, describe three ways in which a human eye can be compared to photographic camera. **(6 marks)**

4. (a) Carefully study the Figure 2 and then anwer the question that follows:

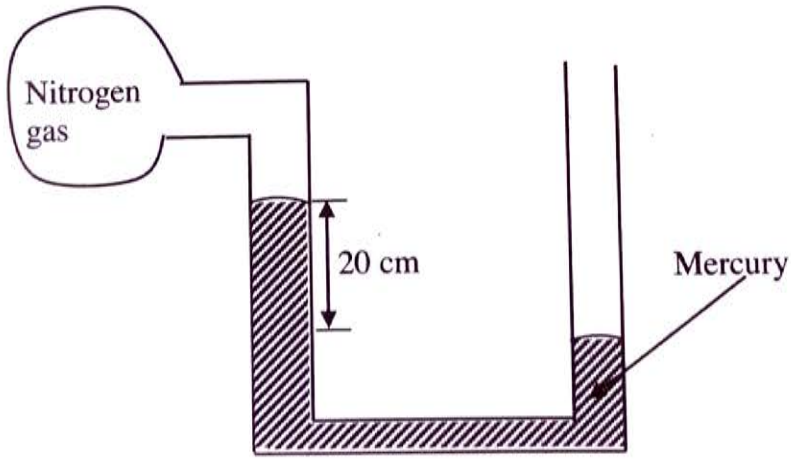



**Figure 2**

Determine the pressure of the gas given that atmospheric pressure is 102,000 Pa and density of mercury is 13.6 g/cm$^3$. **(5 marks)**

(b) Why a ship cannot overturn when hit by a strong wave on one side? **(5 marks)**

5. (a) Figure 3 shows a car moving to a farm. Identify four pairs of action/reaction forces taking place and describe their effects. **(4 marks)**

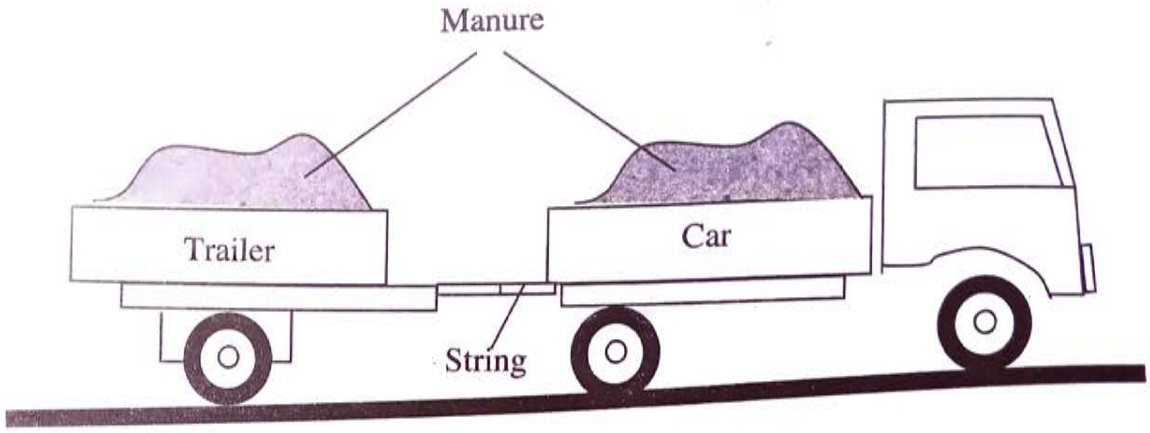



**Figure 3**

(b) A pulley system with efficiency of 75% is made up of four pulleys. Sketch a well labelled diagram of this machine and then determine the effort required to raise two bags of maize each weighing100 kg. **(6 marks)**

6. (a) Figure 4 shows a circuit diagram for controlling the temperature of a sitting room. Describe how the circuit controls the temperature when the switch is closed. **(6 marks)**

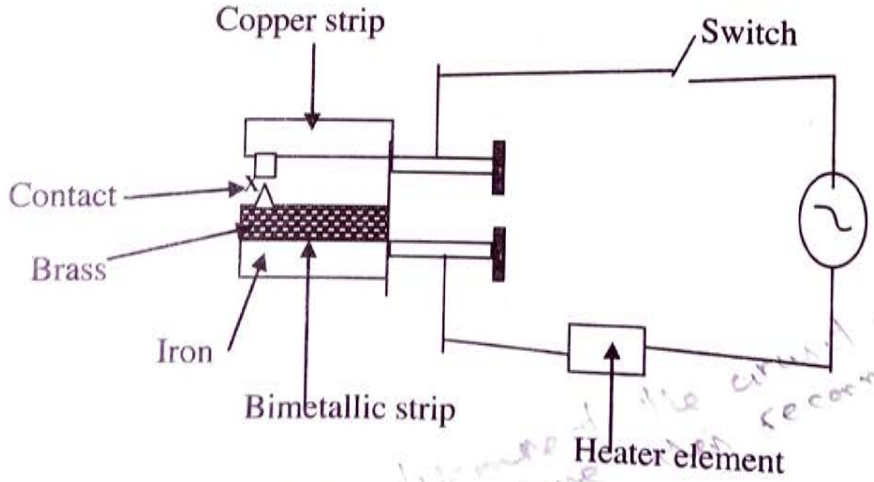



**Figure 4**

(b) Why does it take less time to boil vegetables in a cooking pot with a lid on than one without a lid? Briefly explain. **(4 marks)**

7. (a) An electric kettle containing two heating coils A and B is used to boil water. If it takes 10 minutes for coil A to boil water and 20 minutes for coil B to boil the same amount of water, how long does it take for the water to boil when the two coils are joined in series? **(6 marks)**

(b) The half-life of a radioactive substance is 138 days. A sample of the substance has $1.6 \times 10^{11}$ undecayed atoms at the beginning. How many undecayed atoms will be left after 690 days? **(4 marks)**

8. (a) Analyze five effects of volcanoes eruption on the Earth's surface. **(5 marks)**

(b) A turning fork produces resonances in a tube at 40 cm and 85 cm respectively. Calculate the wavelength of the turning fork. **(5 marks)**

## SECTION C (25 Marks)

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

9. (a) A stretched taut string of length 40 cm and mass $2 \times 10^{-3}$ kg is pulled with a tension of 100 N. Determine the frequency of the first and second harmonics when it is plucked at its middle. **(6 marks)**

(b) When a potential difference of 60 V is applied across a primary circuit of a transformer, a current of 3.7 A flows. Find the potential difference across the secondary circuit if there is a current of 0.15 A flowing in it. Take the efficiency of the transformer to be 95 %. **(6.5 marks)**

10. (a) Explain four factors that affect the resistance of a conductor. **(4 marks)**

(b) The parallel combination of 2 Ω and 5 Ω resistors are connected across the external resistor of 3 Ω through the supply of 4 V. Draw the circuit diagram and find the current flowing through a 5 Ω resistor. **(5 marks)**

(c) With the aid of a common-emitter amplifier circuit, explain why n-p-n transistor is named so. **(3.5 marks)**

11. (a) How does sound from the disco hall transmitted into your room? Briefly explain. **(6 marks)**

(b) How are the microwaves used in cooking? **(2.5 marks)**

(c) How is the destructive interference used in noise reduction system? Briefly describe. **(4 marks)**