

END OF YEAR EXAMINATIONS 2024

Uganda Certificate of Education

S.1 PHYSICS

Paper 1

2 Hours

INSTRUCTIONS:

- You are required to attempt all items in this paper.
- Write your answers on the answer sheet(s) provided, beginning the solution of each item on a fresh page.
- Where calculations are involved, show all the necessary working.
- Attach the question paper on your answer sheet(s).

ITEM 1

You found a group of your fellow classmates having some arguments that ended in a quarrel and you happened to hear some of the arguments from the members that;

- (i) we are able to see the moon because it produces its own light.
- (ii) When you put an object in the path of light, a dark image is formed.
- (iii) Light travels only in a straight line.

Task:

Help your classmates to;

- (a) Know whether the statement in (i) is true or false. If false, tell them why we are able to see the moon.
- (b) Know the nature of the object in (ii), and also tell them the term given to the dark image formed.
- (c) Prove to them that light travels only in a straight line.

ITEM 2

The class monitor of a S.1 class in a certain school always encourages her classmates to sweep the class room very early in the morning claiming that during this time, the dust in the classroom doesn't spread too much as the case is when the classroom is swept during lunch time.

As a learner of Physics,

- (a) comment on the truth of the monitor's claim.
- (b) state the name of the process that is responsible for the movement of the dust particles and state the factors that affect the process.
- (c) assuming you are taken to the Physics laboratory, describe how you would demonstrate the process responsible for the movement of the dust particles.

ITEM 3.

Ten identical golden-coloured cubes are handed to you. The person wants you to buy them for UGX 40,000 each gramme, saying that are gold nuggets. You pull out your old geology text and look up gold in the mineral table, and read that its density is 19.3g/cm^3 . You measure one cube and find that it is 2cm on each side and weighs 0.04kg.

Task.

- (a) Determine density of each cube
- (b) With a reason, are they gold nuggets?
- (c) Determine the cost of the golden-coloured if they are gold nuggets.

ITEM 4.

Due to frequent fire outbreaks, a workshop was organized and your friend reached late when the first speaker was concluding his speech. On asking the neighbors, they told him that the speaker advised them to buy a device that they can put in their houses or workplaces to always alert them in case of any fire outbreak.

On his way back home, he met an accident which had just occurred. He made a stopover to see what exactly had happened. While on the scene, he heard that the Police was using an uncalibrated thermometer to measure the temperature of the car tyres as part of the evidence and he was eager to know the temperature of the car tyres.

He also accessed a piece of document which the Police officer had and had the following information:

- Length of the mercury thread when in contact with the tyre: 40cm
- Length of the mercury thread at the ice point: 10cm
- Length of the mercury thread at the steam point: 80cm.

Task:

Help your friend to;

- (a) know the name of the device and briefly describe to him how it works so that he is convinced to buy it.(Diagram of the device needed)
- (b) know the temperature of the car tyres obtained by the Police.

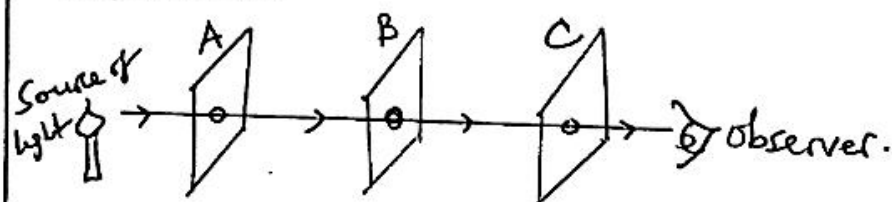
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ITEM 1.

- a) The statement in (i) is false.
The moon does not produce its own light.
We are able to see the moon because it reflects sunlight.
This reflected light is what makes the moon appear bright in the night sky.
- b) The object in (ii) is an opaque object.
The dark image formed is a shadow.
- c) To prove to them that light travels only in a straight line; a simple experiment is designed using three cardboards with holes, string, and a source of light.

- Three cardboards A, B and C are arranged with their holes in a straight line. This is ensured by passing a string through the holes of the cardboards.



The observer is able to see the light from the source.
- When the cardboards are displaced so that their holes are no longer in a straight line, the observer is unable to see the light from the source.
- This shows that light travels only in a straight line.

ITEM 2.

a) The class monitor's claim is true; Dust particles are constantly in motion ~~and~~ ~~due to~~ due to Brownian motion, which is more pronounced at higher temperatures. During lunchtime, the classroom is likely warmer due to the presence of students and their activities leading to increased air temperature and more vigorous motion of the dust particles. This results in the dust particles spreading more easily during lunchtime than during or in the morning.

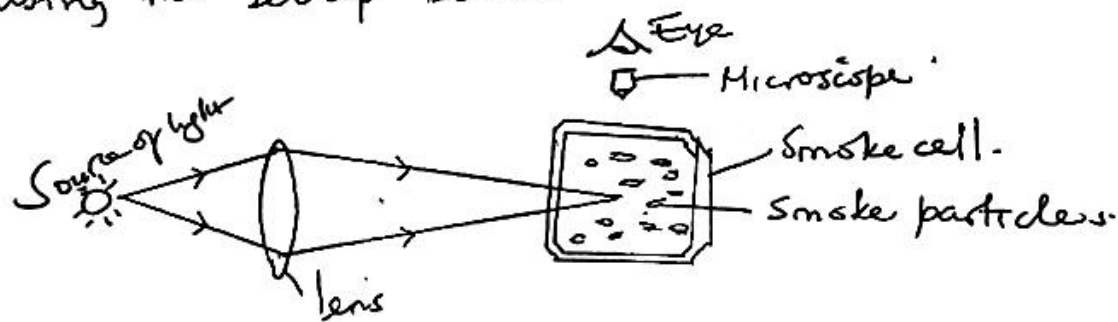
b) The process is called Brownian motion and this is the ^{continuous} random movement of molecules of fluids.¹

Factors affecting Brownian motion.

- Temperature: Higher temperatures lead to more vigorous Brownian motion.
- Particle size: Smaller particles experience more pronounced Brownian motion.
- Fluid viscosity: Higher viscosity (thickness) of the fluid reduces Brownian motion.

c)

I would demonstrate Brownian motion using the set up below.



- Smoke particles are put in the smoke cell.
- The smoke particles are illuminated by a source of light from one side of the smoke cell.
- The smoke particles are then viewed using a microscope placed above the smoke cell.
- The smoke particles are seen moving in a continuous random motion.

ITEM 3

a)

Volume of each cube

$$= 2\text{cm} \times 2\text{cm} \times 2\text{cm} \\ = 8\text{cm}^3.$$

Mass of each cube

$$= 0.04\text{kg} \\ = (0.04 \times 1000)\text{g} \\ = 40\text{g}.$$

$$\text{Density} = \frac{\text{mass}}{\text{Volume}}$$

$$= \frac{40\text{g}}{8\text{cm}^3}$$

$$= 5\text{gcm}^{-3} \text{ or } 5000\text{kg/m}^3.$$

b)

The cubes are not gold nuggets because their density is much lower than the density of gold.

c)

$$10 \text{ cubes} = 10 \times 40\text{g} \\ = 400\text{g}.$$

of the
1g cube costs Ugx. 40,000

$$\begin{array}{lcl} 400\text{g} & \text{cost} & 40,000 \times 400 \\ & & = \text{Ugx. } 16,000,000. \end{array}$$

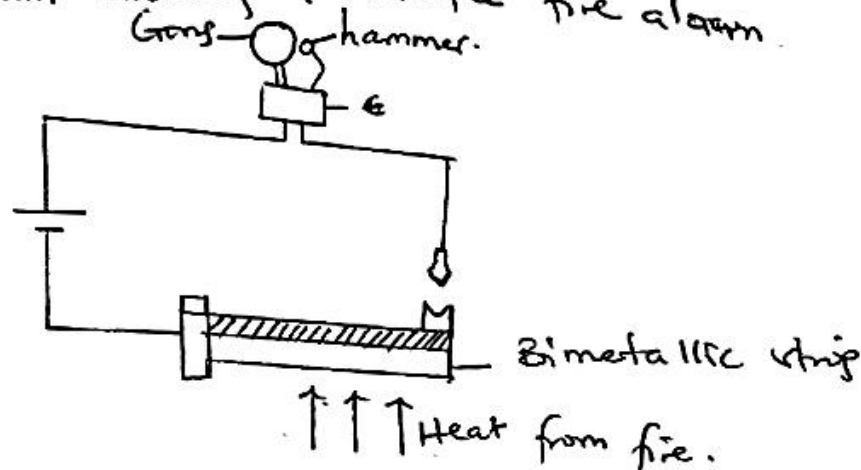
They would cost Ugx. 16,000,000 if they were gold nuggets.

ITEM 4.

a) The device is a fire alarm.

How a fire alarm works.

Diagram showing a simple fire alarm.



- When there is a fire outbreak in a room or place the bimetalllic strip is heated by fire. This causes it to bend (expand) outwards thus completing the circuit.
- When the electric circuit is complete, current flows to the electric bell and the hammer hits the gong and the electric bell produces sound.
- This sound produced alerts a person that there is a fire outbreak in a small time before the fire has spread.

b)

Let l_0 be the length of the mercury thread at the ice point.

l_θ be the length of the mercury thread when in contact with the tyre

l_{100} be the length of the mercury thread at steam point.

$$\theta = \frac{l_\theta - l_0}{l_{100} - l_0} \times 100^\circ\text{C}$$

$$\theta = \frac{40 - 10}{80 - 10} \times 100^\circ\text{C}$$

$$\theta = \frac{30}{70} \times 100^\circ\text{C}$$

$$\theta = 42.9^\circ\text{C}.$$