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P510/1

Physics

Paper 1

2½ hours



Apex Examination Council

PRE-ENTRY EXAMINATIONS SET TWO 2026

Uganda Advanced certificate of education

Physics

Paper 1

2 hours 30 Minutes

INSTRUCTIONS TO STUDENTS:

- This paper has two sections A and B;
- Answer any two items from section A and any other two from section B
- Respond to four items in total
- Use of relevant diagrams and calculations may score marks

SECTION A

*Respond to any two items from this section***Item 1**

In a financial budget of a certain year, it is stipulated to strengthen the security department of the country by purchasing new modern security weapons on market. The responsible ministry of defence has learnt that the bullets to be bought have to be first tested for their quality. During the test, the following have been discovered about the bullets.

- A bullet of mass 10g fired horizontally at a speed of 100ms^{-1} strikes a block of wood of mass 900g suspended by a light vertical string and embeds in it and the block subsequently swings.
- When the same bullet is fired from a spot 30m from a vertical pole with a velocity of 20ms^{-1} at an angle of 30° to the horizontal, it just clears the pole on its way down.

According to the technician, the bullet is of the quality required if:

- It spends a total time greater than 2.0s in air.
- It falls 5.33m behind the pole on the ground.
- It passes the pole with a velocity greater than 18.0ms^{-1}
- The vertical height through which the block rises is 6.2cm.

The technician of the ministry is seriously sick and is not in position to comment on the quality of the bullets and the ministry has approached you.

Task

As a learner of physics:

- Determine whether the bullets should be bought by the ministry of defence.
- Show that mechanical energy is conserved in a trajectory.

Item 2

A motorist travelling at a constant speed of 50kmh^{-1} passes a motorcyclist just starting off in the same direction. The motorcyclist maintains a constant acceleration of 2.8ms^{-2} and after a while he overtakes the motorist. On reaching a nearby lake where they are to have a boat cruise, the motorist uses boat A and the motorcyclist boat B. A and B are initially 20km apart with B on a bearing of $\text{N}67^\circ\text{E}$ from A. A is moving at 18kmh^{-1} in a direction $\text{S}20^\circ\text{E}$ and B is moving at 12kmh^{-1} due South. A nearby constructor notices that it's easier to push a loaded wheelbarrow on a flat surface than a sloping surface. The head official needs to know;

- Distance and time taken by the motorcyclist to overtake the motorist.
- Least distance apart of the ships in their subsequent motion and time at which the position is reached.

Task; As a physics learner:

- Address the head official's challenges

- b) Show that the distance moved by the car is equal to the area under its velocity time graph.
- c) Explain to the constructor why it is easier to push the wheel barrow on a flat surface than a slope.

Item 3

A footballer of a certain team has his part time job of painting. He climbs a uniform ladder of weight 80N freely hinged at its lower end on the ground when its upper end leans on a smooth vertical wall he is painting. When he is quarter way up the ladder, the angle between the ladder and the vertical wall is 30° . This footballer has a technique of flexing his knees whenever landing on the ground.

Hint:

- The weight of the footballer is 500N.
- The ladder can't slide if the total reaction at ground is above 500N.

The footballer is in fear that the ladder may slide off on the ground and he falls down causing harm onto him.

Task

As a learner of physics;

- a) Advise the baller whether he will fall down or not.
- b) Explain the importance of the footballer's technique.

SECTION B

Respond to any two items from this section

Item 4

A certain man wants to buy a plane mirror to be used as a dressing mirror in his bedroom. He wants to buy a mirror in which he can see the whole of his body but with minimal cost. The man who is 1.6m tall has realized that when the mirror is pivoted so that it can be rotated about the horizontal axis through its centre is facing the window, a beam of sun light through the window is reflected on to his bed. The man is amazed that if the mirror is rotated the beam on his bed is also rotated and he wonders the relationship between the angle of rotation of the mirror and the reflected beam. He wonders the nature of images formed when he views himself through a shaving mirror and as well a driving mirror and realizes that there should be a relationship between the image distance and object distance from the mirror.

Task:

As a scientist and using the laws of reflection, help the man to;

- (a) Determine the length of the mirror he required
- (b) Determine the relationship between the angle of rotation of the mirror angle of rotation of the reflected ray.
- (c) Describe any one real life application of the situation in (b) above.

- (d) Obtain the relationship between the object distance and image distance from the shaving mirror.
- (e) Given that the radius of curvature of the driving mirror is 50cm, help the man to determine where a tree behind the car is if the its image appears to be 20cm in the mirror and its magnification.

Item 5

A group of young scientists kept on wondering as to why

- When a stick dipped in water appears bent
- The sun appears reddish as it sets in the evening
- An object dropped in a transparent liquid appears raised. They have made studies about the incidences but failed to obtain clear explanations

They poured a liquid is poured in to a concave mirror to a depth of 2.0cm and held an object above the liquid which coincided with its own image when its 27.0cm above the liquid surface. They used a mirror of radius of curvature 40.0cm but failed to obtain the refractive index of the liquid.

Task

You have been chosen to clear the queries of these scientists as to why;

- (a) A stick appears bent when dipped in water
- (b) The appearance of the sun during setting in the west
- (c) Build the relationship between the refractive index of the liquid and the displacement of the object as viewed from above the transparent liquid.
- (d) Determine the refractive index of the liquid.

Item 6

In an attempt to determine the magnitude of charge on a pith ball, two pith balls P and Q each of mass 0.1g were separately suspended from the same point by threads 30cm long. When the balls were given equal charges, they repelled each other and come to rest 18cm apart. This observation lacked explanation and decided to research about what takes place at sharp points exposed to charge.

Task:

You have been identified to take part in research and give better presentation on;

- (a) The effect of charge on a sharp point of a conductor.
- (b) Describe any one application of action at sharp points of a conductor.
- (c) Determine the magnitude of charge attained by a pith ball.
- (d) Explain why the pith balls repelled each other.

END

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