535/1
PHYSICS
Paper 1
(Theory)
Oct./Nov. 2025
2½ hours

UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 1
(Theory)

2 hours 30 minutes

INSTRUCTIONS TO CANDIDATES:

This examination paper consists of **two** *Sections;* **A** *and* **B**.

It has **seven** *examination items.*

Section **A** *has* **three compulsory** *items.*

Section **B** *has* **two** *Parts;* **I** *and* **II**. *Respond to only* **one** *item from* **each** *part.*

Respond to **five** *items in all.*

Any additional item(s) responded to will **not** *be scored.*

All *responses* **must** *be written in the answer booklet(s) provided.*

Responses to each item should start on a fresh page.

Indicate the item number you are responding to, clearly at the top of the page.

Graph paper is provided.

Mathematical tables and silent non-programmable calculators may be used.

SECTION A

Respond to **all** *the items in this section.*

Item 1

Kyle's house is enclosed by a perimeter wall. His bathroom mirror labelled **mirror A**, makes one appear bigger while using it, especially when a person stands close to it. He also has some pieces of mirror labelled **mirror B**, in which the size of the image is the same as that of the object, no matter how far an object is placed in front of it.

The planning authority in Kyle's area passed new guidelines requiring that all perimeter walls less than 10 m away from the roadside must be broken down. Kyle's perimeter wall near the road seems to be in danger of being broken down. Kyle lacked any measuring instrument to establish the actual distance of that wall from the roadside. Kyle's neighbour across the road advised him to use echo method. His neighbour's wall is 60 m from the side of the road opposite that of Kyles residence. The road is 8 m wide. Kyle stood alongside his perimeter wall that is close to the road and clapped two pieces of wood, once. He heard the reflected sound from the neighbour's wall 0.5 seconds later. However, Kyle and his neighbour did not know how to use the information obtained.
Of late, some young men have been consistently converging along the road near Kyle's perimeter wall. He wants to be watching them closely without the young men seeing him, but Kyle lacks installed security cameras at his residence.

Kyle has contacted you for help.

Hint:

- The speed of sound in air is 330 ms^{-1}.
- Kyle's perimeter wall near the road, the road and the perimeter wall of the neighbour across the road are parallel to each other.

Task:

(a) Help Kyle to:
  (i) understand why images in **mirror A** appear as observed (include an illustration).
  (ii) determine whether his perimeter wall will be among those to be broken down.

(b) Describe how Kyle can design an optical instrument using two pieces of **mirror B** to watch the young men closely (include an illustration).

Item 2

The government has identified land in a certain area for establishing a nuclear power plant. As a standard procedure, the government has informed the people living in that area that they have to be relocated, since they cannot co-exist with the nuclear power plant. However, majority of the people have insisted that they cannot leave their land and think they can co-exist with the nuclear power plant. The

government has promised that after a specific period of time the community members will be allowed to return.
Due to this, data about the activity of the radioactive materials to be used in the nuclear power plant has been provided to the people in table **1**.

Table 1

Count rate (per minute)	800	525	335	215	150
Time (1×10^9 years)	0	4	8	12	18

Unfortunately, none of the community members can make sense of the data.

The community members also want to know if there are any benefits of radioactive materials, in general.

You have been contacted by the community members for help.

Hint:

The environment would be safe from waste radiation when the count rate falls below 35 counts per minute.

Task:

(a) Help the community members to;
   (i) understand the need for them to be relocated as soon as possible.
   (ii) determine the time that has to pass before they can return to settle around the power plant again (use the data in table **1**).

(b) Describe any **two** benefits the community members are interested in.

Item 3

During dry season, a sailor in an ocean embarked on a journey to transport fish to a certain island for packaging. The sailor was not sure of the direction to take in order to reach the destination (Island) safely without getting lost. The sailor contacted her friend who was already at the destination. In a bid to help the sailor, her friend sent a *Google map* link and guided the sailor on how to use it. The sailor followed it up to reach the destination (Island) without getting lost. However, the sailor did not understand how the google map works.
On arrival at the destination (Island), the sailor noticed that the level of water started rising in the ocean at night; where the waves carried large volumes. This could cause any sailor's boat to become unstable and eventually capsize. The sailor wondered whether there are any benefits of such rising water levels, to the communities living around such water bodies, during dry season.

While at the Island, the sailor also noticed that, the Island is equipped with an automatic security light system that switches on at night and off during day time, as seen in figure **1**.

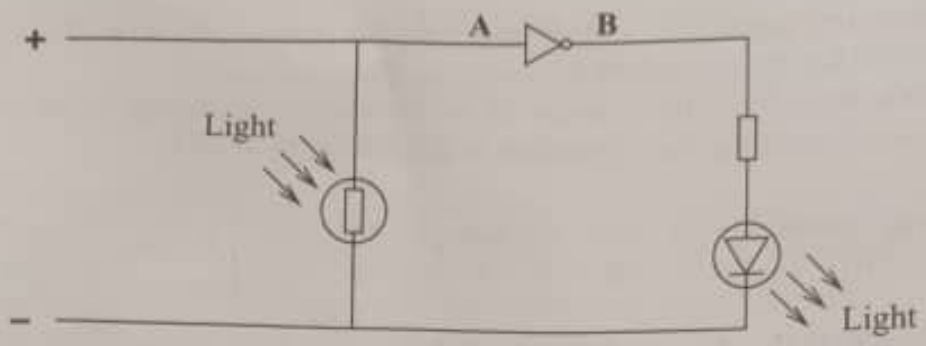

Fig. 1

The sailor was also amazed by the automatic lighting system.

The sailor wanted to be educated on these occurrences or observations made.

You have been contacted to be of help to the sailor.

Task:

(a) Help the sailor to understand:
  (i) why the water behaved the way it did.
  (ii) how the application sent by her friend works.

(b) Educate the sailor on how the security light system in the circuit, in figure **1** works (include truth table).

(c) Explain any **two** benefits the sailor needs to know about the water behaviour observed.

SECTION B

Part I

Respond to **one** *item from this part.*

Item 4

Abdu always rides a bicycle to school 10 km away from his home. One morning he packed tea in a metallic bottle and departed for school at 7:00 am. Abdu noticed that when he pedals the bicycle, whether travelling at low speed or not, it makes noise which is persistent and discomforting. He did not know why his bicycle behaved this way.

After covering 6 km, Abdu noticed that it was already 7:40 a.m., meaning that he would reach late. This brought about the need to accelerate so that he could arrive at school on time. Abdu increased his velocity from 5 ms^{-1} to 15 ms^{-1} and was able to cover the remaining distance to school to arrive on time. However, when Abdu's classmates asked him for his rate of change of velocity he completed the journey with, he had no idea.

At lunch time, Abdu took the tea he had packed and discovered that the tea was only warm, and was not that enjoyable at all. His friend advised him to buy a vacuum flask to keep the tea hot for a longer period of time. However, Abdu did not know how the flask could keep the tea that hot as stated. Abdu also wondered how the processes used to minimise heat loss in the device could be used in other aspects in real life.

Abdu has reached out to you for guidance.

Task:

(a) Help Abdu understand the likely cause of the discomfort he experienced while traveling to school and how it could be minimised.

(b) Determine Abdu's rate of change of velocity, so that he can respond to his classmates.

(c) With the aid of a diagram, help Abdu to understand how his friend's advice will solve the problem he faced at lunch time.

(d) Explain any **one** practical application of each of the processes the device uses to keep the liquid as desirable.

Item 5

Students from a certain school had a trip to the hydroelectric power plant. The person in charge at the plant took them around. They at first went to see the wall of the dam. The person in charge told the students that the wall of such a dam is always built thicker and wider at the bottom than at the top. The students did not know why the wall of the dam should be built that way and feared to ask the in charge, yet they were eager to know.

Later, the person in charge took the students to a nearby construction site. At the site, a mixture of sand, gravel, cement, water and steel bars was being made to erect

columns for a storeyed building. The person in charge told the students that each of the steel bars being used are of length 3.2 m, diameter of 2.5 cm, and would stretch by 0.2 mm when a tensile force of 7.7×10^5 N is applied. The students wondered whether the steel bars met the requirements for use in the structure, given the heavy weight of the building.

After lunch, the students visited a beach and noticed that while standing out of water, they felt a cool breeze compared to when they were sailing in a boat and wondered why the difference. One of the students quickly mentioned that there could be a number of applications of the breeze they experienced, in real-life. Majority of the students did not know any practical applications of the breeze they experienced, since they had not yet learnt but were interested in finding out.

On returning from the trip, the students approached you for help.

Hint

Steel bars are of good quality if the ratio of stress to strain exceeds 2.1×10^{11} Nm^{-2}.

Task:

(a) Explain to the students why the wall they observed was designed as they observed.
(b) Help the students to determine whether the steel bars were of good quality.
(c) Explain to the students any **two** practical applications of the breeze they experienced.

Part II

Respond to **one** *item from this part.*

Item 6

A business person owns a company that uses current electricity to operate machines and other appliances. One day, as the workers in the company were switching on the lights, they noticed that all the bulbs were dim. Subsequently, the business person called an electrician to assess the problem, who later established that the mains supply of 415 V was low and needed to be increased to 2,000 V.
The electrician assured the business person that for the problem to be solved, the business person must buy an efficient device such that the power loss does not exceed 5 W. The business person does not have any information on practical ways of how to minimise energy losses in the device.

You have been contacted by the business person for help.

Hint

Cables of resistance 2 Ω supply 2 kW of electrical power, if it is transmitted at 2,000 V.

Task

(a) Help the business man understand the design and mode of operation of the device needed to sort out the voltage issue.
(b) Determine whether the device is efficient, so that you can educate the business man.