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PHYSICS

Paper 1

Assessment, 2025

2hrs and 30 minutes

ALLIANCE JOINT EXAMINATIONS BOARD (AJEB)

Uganda Certificate of Certificate

PHYSICS

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Assessement

2hrs and 30 minutes

INSTRUCTIONS TO CANDIDATES:

➢ **This 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. Answer one item from each part.**

➢ **Answer five items in all.**

➢ **Any additional item(s) answered will not be scored.**

➢ **All answers must be written in the booklets provided.**

Item 1.

During a cultural festival in Kampala, a group of drummers performed near a large concrete wall. Two spectators standing at different distances from the wall noticed that the sound of the drums reached them at different times. Later, they observed that the drumbeats echoed, making the music sound distorted. As the sun set, the stage lights changed colors, causing their white shirts to appear in different shades.

Hint:

Speed of sound in air = 340 m/s.

The spectators heard the sound after 3 s and 4 s, respectively.

Task:

As a physics student, explain to the spectators:

(a) Why they heard the sound at different times.

(b) Why the drumbeats sounded distorted.

(c) Why their white shirts appeared to change color under the stage lights.

Item 2.

A village in Eastern Uganda relies on a river for drinking water. Recently, a nearby mining company was accused of releasing harmful chemicals into the river. A scientist tested the water and recorded the radioactivity levels over time, as shown in the table below:

Time (days)	0	10	20	30	40	50	60
Activity (counts/min)	1500	900	540	320	190	110	70

The scientist declared the water safe when the activity falls below 50 counts/min.

Task:

(a) Calculate how long the villagers must wait before using the water again.

(b) Educate the villagers on the dangers of radioactive contamination and safe handling of such materials.

Item 3.

During a live broadcast from Entebbe, a weather reporter explained that it was midday with clear skies, while viewers in South Africa watched the same broadcast at night. Some viewers wondered how this was possible and how the broadcast reached them instantly.

Task:

Using physics principles, explain:

(a) Why it can be day in Uganda and night in South Africa simultaneously.

(b) The role of satellites in live television broadcasts.

(c) How time zones affect global communication.

SECTION B

PART I

Answer one item from this part.

Item 4.

A school in Mbarara installed a 3000-liter water tank on a 5-meter-high stand. The tank is fitted with an electric heater at the bottom, supplying 15,000 kJ of energy. The plumber drilled the outlet pipe at the base, but the head teacher questioned whether it should have been placed higher.

Use:

- Density of water = 1000 kg/m³.
- Specific heat capacity of water = 4200 J/kg·K.
- Acceleration due to gravity = 10 m/s².

Task:

(a) Explain:

(i) Why the heater is placed at the bottom and how it heats all the water.

(ii) Why the outlet pipe is drilled at the base.

(b) Determine if the heater can raise the water temperature from 18°C to 50°C.

(c) Suggest measures to ensure the tank stand remains stable.

Item 5.

A restaurant in Jinja serves coffee at 65°C. Each customer receives 250 mL of coffee, but the manager notices it cools too quickly. The restaurant stores boiled water in a large insulated container on the ground floor and uses a pump to deliver it to the kitchen upstairs.

Use:

- Density of water = 1000 kg/m³.
- Specific heat capacity of water = 4200 J/kg·K.

Task:

(a) Calculate how much cold water (at 20°C) must be mixed with hot water (at 90°C) to serve coffee at 65°C.

(b) Suggest ways to improve the insulation of the water container.

(c) Explain how the pump ensures water reaches the kitchen efficiently.

PART II

Answer one item from this part.

Item 6.

A maize farmer in Gulu discovered small iron particles in his harvested grains. He lacks a commercial magnet but has copper wires, a 9V battery, and an iron rod.

Task:

(a) Design a method to remove the iron particles using the available materials.

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(b) Evaluate the effectiveness of your design if a current of 3A is required for a strong electromagnet.

Item 7.

A shop owner in Fort Portal wants to power four 220V, 50W bulbs using a 110V supply. An electrician recommended a transformer, but the owner is unsure how it works.

Task:

(a) Explain the function of a transformer in this scenario.

(b) Calculate the required transformer specifications.

(c) Advise the owner on minimizing power loss during transmission.

END