Name: .....Centre/Index No:...../.....

Signature: ..... School .....

535/1
PHYSICS
Paper 1
Jul/Aug.2024
2½ hours

UGANDA TEACHERS' EDUCATION CONSULT (UTEC)

Uganda Certificate of Education

PHYSICS

Paper 1

Theory

2 hours 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*

1. During lunch in the dining hall, learners observed heavy rains, fog, and floods in another country on a live TV broadcast. These floods occurred at night, risking lives as many people were asleep. Learners were curious about how it could be night and raining in one area while it was sunny and day at their school. They also wondered how TV signals could broadcast from such a distant place and how the Sun produces so much energy to shine and heat the Earth.

Task:

As a physics student;

(i) Explain to the learners why it is night and raining in one part of the world while it is day and sunny in their area.

(ii) Describe how TV signals can broadcast live from a distant country.

(iii) Explain the source of the Sun's energy and how it heats the Earth.

2. The community is experiencing eye problems, which some residents attribute to witchcraft. The L.C.I chairman announced that an eye care organization would visit for tests and provide free spectacles, but residents opposed the move, thinking it would not help. The announcement was made using a mobile speaker, which malfunctioned in front of a church, making the L.C.I repeat his words.

Task:

As a scientist;

(i) Write a message to the community explaining that eye problems are health disorders and can be treated medically.

(ii) Explain to the L.C.I why the speaker malfunctioned.

(iii) Advise the priest on whether the church will be demolished.

3. The Namanve factory was halted from manufacturing smoke detectors containing radioactive elements, which caused significant discontent among traders. The factory asserted that these detectors were safe for 60 years, but a scientist verified their radioactivity. This issue has been a significant problem in the Namanve community, Seeta, and Bukerere village, raising concerns about long-term health and safety.

The table below shows time and count rate of the detectors;

Time (years)	0	22	42	62	82	102	122	142	162
Count rate(year^{-})	106	83	66	56	47	36	31	26	15

Task:

(i) Advise the authority, with evidence, on whether the smoke detectors should be used.

(ii) Sensitize the traders to appreciate the authority's decision.

(iii) Use the table above to a graph that justifies your defense.

(iv) Suggest methods to improve the technology of the smoke detectors to ensure safety.

4. In the Mbarara community, a construction site relies on an electric lifter to transfer mortar to a height of 17.0 meters. One day, a power failure disrupts their work, compelling the builders to improvise. They use a rope and a pail to design a simple machine with a grooved rim to continue lifting the mortar. The mortar's temperature is 25°C, and the rope's thermal strength is 98kJ. This unexpected challenge has put the community under physical and emotional strain as they scramble to find a solution.

Task:

As a physics student,

(i) Design a simple machine using the rope and pail. Provide detailed guidance on its operation to ensure efficient lifting of the mortar.

(ii) Evaluate whether the rope can withstand the heat generated during the lifting process. Consider the thermal properties and calculate the potential heat exposure.

(iii) Suggest additional properties that the rope should possess to ensure it can handle the task safely and efficiently.

5. At Butegaya Parish Company, a worker uses an electric motor to draw water from a deep borehole. On a particularly cold day, the motor breaks down, and the worker notices that the drawn water is slightly warm. With limited electricity available, the worker faces the challenge of boiling the water for tea. This situation has created significant physical strain and emotional stress for the worker and the community, who rely on this water for their daily needs.

Task:

(i) As a physics student, help the worker devise a method to draw water without the electric motor. Provide detailed instructions to ensure efficient water extraction.

(ii) Explain the scientific reasons behind why the water was warm despite the cold weather.

(iii) Advise whether the available electricity is sufficient to boil the required amount of water, taking into account the specific heat capacity of water and the total energy available.

6. In Nabinonya village, a house connected to a 240V main supply needs to connect appliances rated at 120V, including a TV set and a flat iron. The house owner also bought a Power King extension with a 5A fuse for these appliances. Additionally, they need to connect multiple bulbs and an electric bell to alert the owner of visitors. GTT Electric Company Ltd. services the area, but due to recent electrical issues, some neighboring villages are discouraged from installing electricity in their homes. This situation has created physical and emotional stress within the community, as they grapple with electrical safety and reliability.

Task:

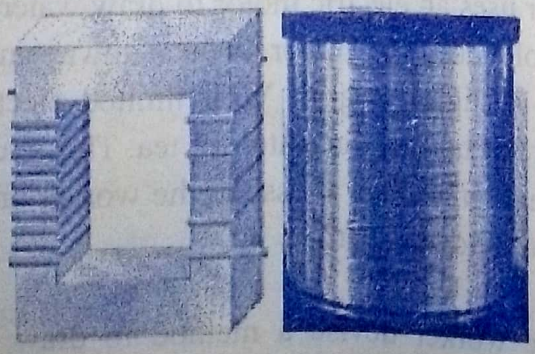
As an electrician,

(i) Comment on the effectiveness of the 5A fuse in the Power King extension for the TV and flat iron.

(ii) Advise the house owner on the optimal way to connect the bulbs for effective lighting.

(iii) Explain how sound is produced when the electric bell is pressed.

7. Chemutai, a refugee from DRC Congo, has recently been relocated to Buvuma District. He received a rechargeable radio from the USA, which operates on a different voltage than the local supply. Chemutai, unsure about using the radio due to these differences, has discouraged the Buvuma District community from using similar gadgets. This has led to physical and emotional stress as the community relies on radios for news and communication.



Task:

As a student of physics,

(i) Explain how the radio produces sound.

(ii) Design a device to safely connect the radio to the local voltage supply.

(iii) Calculate the cost of electricity to run the radio.

END