535/1

PHYSICS

Paper 1

July 2024

2½ hours

RESOURCEFUL MOCK

Uganda Certificate of Education

PHYSICS

Paper 1

Theory

2 hours 30 minutes

INSTRUCTION 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** question 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.*

TURN OVER

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SECTION A

*Answer **all** the items from this section*

1. In a certain cafe, space viewers were watching a YouTube live broadcast when an astrophysicist was conducting research from the International Space Station where he observed various weather patterns and human activities taking place during the day but found it challenging to gather data at night due to reduced visibility. The astrophysicist utilized a satellite orbiting Earth to maintain consistent data flow. The viewers were so excited about the relevancy of satellites in bridging the gap between day and night observation to allow data exchange. Some viewers commented that the International Space Station is a key in space exploration while others criticized the information they got that many countries invested a lot of resources to build the Space Station. The viewers questioned the source of energy being used by electrical gadgets like computers in the space station.

   Task: As a physics learner, help the viewers understand;

   a) How satellites are relevant in space exploration.

   b) (i) Why countries invested a lot of resources in building the International Space Station.

   (ii) The source of energy used in the International Space Station.

   c) The cause of reduced visibility that made it challenging to gather data at night.

2. Upon embarking on a leisurely biking trip through a forest on a hot midday, the biker encountered a puzzling phenomenon in which something like a pool of water repeatedly appeared and disappeared in front of him as he rode along the tarmac road which affected his pace significantly. Unexpectedly, the biker noticed a tall building adjacent to the spot where the pool of water reappeared and recalled that echoes can be utilized to determine the exact distance between himself and the tall building where the pool of water mysteriously appeared again. He timed the echo of a sound, resulting in 0.9 seconds though he couldn't recall all the steps to determine the distance between himself and the tall building so that he can clear the confusion from the phenomena.

Hint:

> ➤ The speed of sound in air is 320m/s.

Task: As a student of Physics, assist the biker;

a) Comprehend the peculiar occurrence of the disappearing pool of water.

b) (i) Clarify the method to measure the distance using the sound echo.

 (ii) Understand why the tall building was necessary in determining the position where the pool of water reappeared.

c) Know the actual position where phenomena reoccurred to confirm it's a mere illusion.

3. In a certain mine known for extracting copper and cobalt, as well as small amounts of uranium ore, the radioactive substance from the uranium ore had contaminated the stormwater runoff from the mines, which locals were unknowingly using for their daily needs. This led to a health crisis in the community as people started experiencing symptoms of radiation poisoning. To address the situation, the factory was closed as a team of scientists was called to investigate the situation. The initial concentration of the radioactive substance in the stormwater was measured to be 1000 millisieverts per liter. Based on their research, the scientists discovered that the half-life of the radioactive substance was 50 years.

Hint:

> ➤ storm water will be safe for use if the concentration of the radioactive substance in the stormwater is less than 16 millisieverts per liter

Task: As a learner of Physics, help the locals understand;

a) When the water will first be safe for consumption.

c) The potential health risks for the individuals who had been exposed to the contaminated water.

d) The safety precautions they should follow while dealing with those have been affected.

e) The impacts of the uranium ore contaminating the storm water runoff.

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SECTION B

PART I

*Answer **one** item from this part*

4. The manager of a certain workshop that makes handcrafted wooden toys recently purchased a new machinery, rated 17 V ∼ 20 V. However, it did not function efficiently upon testing on a socket that supplies a voltage of 6 V. When the manufacturer was consulted, the manager was advised to purchase a transformer with 50 turns in the primary coil and 150 turns in the secondary coil to solve the problem of low voltage for the machinery without dissipating heat at a rate more than 19 W but, the manager was hesitant about the suggestion complaining that the manufacturer sold to him a malfunctioned machinery.

Hint:

➢ The machinery draws current of 1 A from the A.C source.

➢ Assume the transformer is ideal (no energy losses).

Task:

Using the knowledge of physics, help the manager understand the manufacturers advise by;

a) Computing the voltage expected across the secondary coil to be used by the machinery.

b) Finding the rate at which the machinery will be heated.

c) Explaining the structure and operation of the transformer recommended.

5. In a certain factory, there are 10 electric motors operating at 80 % efficiency. These motors consume an average of 5 kW of power per hour. The factory runs for 8 hours a day, 5 days a week. The operators have raised concerns about the high-power consumption by the motors. However, the engineers have suggested upgrading to motors with 90 % efficiency, though the manager is hesitant due to concerns about wasting resources on new motors.

Hint:

➢ The cost of a unit of electricity is 1050/=

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Task: As a student of Physics, help the manager;

a) (i) Confirm the complains raised by the operators while running the 10 electric motors in a week.

(ii) Know how much the factory spends on electricity to run the electric motors for a week.

b) Understand that upgrading to more efficient motors can benefit the factory both financially and environmentally.

c) Understand how an electric motor works and its importance in the production process.

PART II

*Answer **one** item from this part*

6. Two groups of students embarked on a mountain climbing adventure to reach the summit and measure the height of the mountain. The first group to reach the top decided to make tea on a portable charcoal stove. Some of the hikers, feeling cold, gathered near the stove to warm themselves but wondered how a small stove could provide warmth for all of them without being physical contact. On the other hand, the second group at the mountain's base opted to make their tea before climbing to take to the summit of the mountain. Their friends contacted them and told that cooking at the base would consume more time compared to cooking at the top, but they found it hard to believe. Unfortunately, some climbers started experiencing nosebleeds and fainted, leaving their friends unsure of what to do next and ended up not climbing as they rushed to look for rescue team.

Support information:

> Air pressure at the mountain's top: 65.8 cmHg, temperature: 5°C

> Air pressure at the mountain's base: 75 cmHg, temperature: 25°C

> Density of air: 1.25 kg/m^3

> Acceleration due to gravity: 10 m/s^2

> The rescue cable car can be driven at a maximum speed of 15 kmhr^{-1}

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Tasks: As a student of Physics, help the climbers;

a) Determine the time the rescue cable car will take to travel from the mountain base to the summit.

b) (i) Understand why some members suffered from nosebleeds.

   (ii) Comprehend what they would have done to stop the nose bleeding.

c) Understand whether cooking at the summit or base takes less time.

d) Understand how the stove was able to provide warmth to the hikers without direct contact.

7. A group of engineers are designing a water pump system to transport water from a lower reservoir to a higher reservoir using mechanical means. However, they encounter challenges due to the anomalous behavior of water at certain temperatures. The engineers have calculated that the pump will need to lift 1000 kg of water from a depth of 10 m to a height of 20 m at 4 °C and discovered that the efficiency of the pump decreases at temperatures close to 4°C. The chairperson of the village communicated to the community members about this situation which may affect the cost of water they couldn't understand.

Hint:

- The densities of water at 4 °C and 20 °C are 1000 kgm^{-3} and 998.2 kgm^{-3} respectively.

- Acceleration due to gravity is 10 ms^{-2}

Task:

As a leaner of Physics, assist the chairperson;

a) Explain to the community members the anomalous behavior of water.

 b) Educate the people about the impact of anomalous behavior of water on the efficiency of the water pump system.

c) Know the additional work required to pump the water from 10 m to 20 m at 4 °C compared to a standard temperature of 20 °C.

END