535/1

PHYSICS

PAPER 1

$2\frac{1}{2}$ hours

UGANDA CERTIFICATE OF EDUCATION

PHYSICS

PAPER 1

THEORY

2HOURS 30MINUTES

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 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.

SECTION A

Answer all the items from this section.

Item 1

Two astronauts were conducting a simulation on how to communicate effectively while on the moon. They decided to test this by standing a short distance apart and attempting to talk to each other. To their surprise, they couldn't hear anything, even though they were shouting. Confused but determined, they tried using a telephone system designed for lunar communication. This time, they were able to hear each other perfectly. As they continued their experiments, a sudden flash of lightening followed by thunder occurred in the simulation environment. They noticed that the flash the flash of lightning was visible immediately, but the sound of thunder came a few seconds later, leaving them puzzled,. This led them to question why light seemed to travel faster than sound and why the sky appeared dark in space but blue on earth.

Hint:

- Wavelength of visible light is 500nm
- Frequency of visible light is $6x10^{14}Hz$
- **Wavelength of sound in air is 1.7m and sound frequency of 200Hz**

Task:

As a physics learner, help the two experimenters;

a) Understand why they couldn't hear each other when they tried to talk on the moon but were able communicate successfully using a telephone.
b) Understand why they were able to see light from the sun even though space appeared dark, yet on earth, the sky is blue during the day.
c) (i) Compare the properties of light waves and sound waves
(ii) Confirm that light travels faster than sound.

Item 2

While on a solo adventure along a remote stretch coastline, a passionate explorer noticed something unusual. As the day progressed, ocean tides rose higher than expected, flooding areas that were dry just hours before. After speaking with local fishermen, who mentioned the powerful influence of the moon, the explorer's curiosity was piqued even more. Determined explorer began researching the connection between ocean tides, phases of the moon and the broader influence of space. This journey of discovery led the explorer to uncover fascinating insights about how the moons gravitational pull controls the rhythm of the tides, how the changing phases of the moon affect our planets, and the critical role that space exploration plays in deepening our understanding of these natural phenomena.

Task:

As a physicist with the knowledge on earth and space science, help the explorer;

a) Explain how ocean tides occur, describing the role of the moon, earth and the sun in creating high tides and low tides.
b) Describe the phases of the moon and hoe these phases are linked to the appearance of the moon as seen from the earth.
c) Discuss the relevance of space exploration in understanding the phenomena like tides, moon phases and others.

Item 3

Two students A and B started an argument about how the sun gives out heat and light. Student A, says some two materials inside the sun combine resulting into another, which makes heat and light to be produced. Student B, says a material in the sun splits to form other small ones, then heat and light are produced. With no agreement reached, they started a fight. Student A, falls to the ground and cannot walk. On lookers rush him to the hospital where they told he has to go to a machine which uses electromagnetic waves to find out if any of his bones is broken.

Student B left scared, goes to ease himself accidently enters room prohibited from unauthorized hospital staff without noticing it and is rushed away to a quarantine room for examination. One doctor tells him that the room he entered had dangerous materials that release some things making them reduce in weight but Student B, could not believe it. The doctor brings one with 160g and after 140 seconds, it weighs 1.25g. The on lookers have no idea about electromagnetics wave machine and worried what it do to student.

Task:

As a learner, using knowledge of physics, help student A, student B, and the on lookers on the following

a) Explain the natural process that cause the argument.
b) Using a simple well labelled structure of electromagnetic machine, describe for them how the waves used in the machine are produced.
c) (i) Determine the time it takes for the mass of the material brought by the doctor to reduce to 20g.
   (ii) Mention the most likely dangers that student B may face.
d) What advice would you the people who would wish to work in the unauthorized room in the future

SECTION B

PART I

Answer one item from this part.

Item 4

Two men in a village are always contracted to dig deep holes in homes and in schools. They possess the following equipment; a hoe, wheel barrow, a tape measure, hammer, ropes, nails, axe, spades, bucket, tape measure and a pulley system of three pulleys. As they work, the hole deepens as a bucket tied on a rope is fixed on the pulley system to remove the soil.

After the day's work, the pulley system is found to be warm which they cannot explain.

Hint.

A bucket filled with soil weighs 12kg and the efficiency of pulley system is 80%

Task:

As a physics learner

a) Help the men categorize any five of their machines in accordance to the class of levers
b) Draw a diagram of the pulley system they use showing how strings are aligned in simplifying their work
c) Determine the effort applied
d) Explain to the men why the efficiency of their machine is less than 100%

Item 5

A company realized that it was making less sales because customers said that it was producing saucepans that required very much heat energy while cooking. As a way of improving, the company planned to make a new type of saucepans that could consume about $918\ Jkg^{-1}K^{-1}$.

The manager instructed his scientists to carry out an investigation to find the appropriate metal to be used in making the new type of saucepans.

The scientist selected a certain metal sample of uniform length 20 cm, mass 13.6 g and at a temperature of 20 ^{0}C. Then she used 1000 J to heat it and found out that the length, mass and temperature were now 37.5 cm, 13.6 g and 100 ^{0}C respectively.

Basing on these findings, the scientist concluded that the metal was fit for the new type of saucepans; but the manager failed to clearly understand her explanations and conclusion.

Task:

As a learner of Physics help the manager to;

(a) Understand the behavior of the mass of the metal during this investigation.

(b) Understand how the energy given to the metal affected its temperature.

(c) (i) Determine the quantity of heat energy that was required to raise the temperature of a unit mass of the metal by 1 ^{0}C.

(ii) Establish, with reasons, whether the metal which was picked was truly fit to make the new type of saucepans.

PART II

Answer one item from this part.

Item 6.

A certain home has a fence with a gate that is a distance away from the main house. Much as their visitors knock at the game several times, the people in the house sometimes do not hear the sound made by the knocks. In order to solve this this challenge, the father in the home has been advised to buy an electric bell.

The electronics shop attendant has told the father that the electric bell available is rated 35W and was manufactured with an in-built transformer whose output is 16V a.c supply.

The father does not recall how this electronic sound device works, why there is need for a transformer, and which current it will consume.

Task:

Having studied Physics help the father to;

(a) (i) Understand the working of the electronic sound device the father wants to buy.

(ii) Identify the ways of increasing the strength of the electromagnet in the device.

(b) Determine the amount of current which passes through the sound device.

(c) Understand how the transformer is useful to this device, if the input voltage from the mains supply is 240 V.

(c)The cost of using the electric bell for 3 hours every day for a month of 30 days, if each electrical unit costs UGX 1200.

Item 7

The member of parliament of a remote village is trying to connect each home to the main grid electricity 10km away from voltage of 1200V and 0.5A flowing. The homes need only 240V and 5A. The MP has secured poles, a transformer with a ratio of its turns 5:1 bought thin wires to transmit electricity but he is not certain whether items bought will work.

Task:

As a learner of physics,

a) Explain to the MP if the transformer secured is suitable.
b) Use the diagram to explain to the MP how a transformer works.
c) Explain the likely causes for the 80% efficiency and how it can be improved.
d) Advise the MP on the wires secured