535/1
PHYSICS THEORY
Paper 1
Jul. /Aug. 2025
2 ½ hours

JINJA JOINT EXAMINATIONS BOARD

Uganda Certificate of Lower Secondary Education

MOCK EXAMINATIONS – AUGUST 2025

PHYSICS

Paper 1

2 hours 15 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 question(s) answered will not be scored.

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

Turn Over

SECTION A

*Answer **all** the items in this section.*

Item 1

Local raw materials for production of thermal energy are scarce in your desert-stricken community. As part of your school project, you and your classmates have installed the device in figure **1 (a)** to be an alternative in cooking in every home in some hours during day time to address the problem. The community members are told that the device uses the sun and its mode of operation relies on the laws of reflection of light.

Figure 1 (a)

This new development is announced on a loud speaker late in a still night rather than day time for the message to be heard clearly by everyone in the community. Due to the exposure of the community to the sea, too many waves of water have resulted into endless flooding, causing fear in people. The radar system, built in your area that monitors the movement of water displays the analysis graph in figure 1 (b)
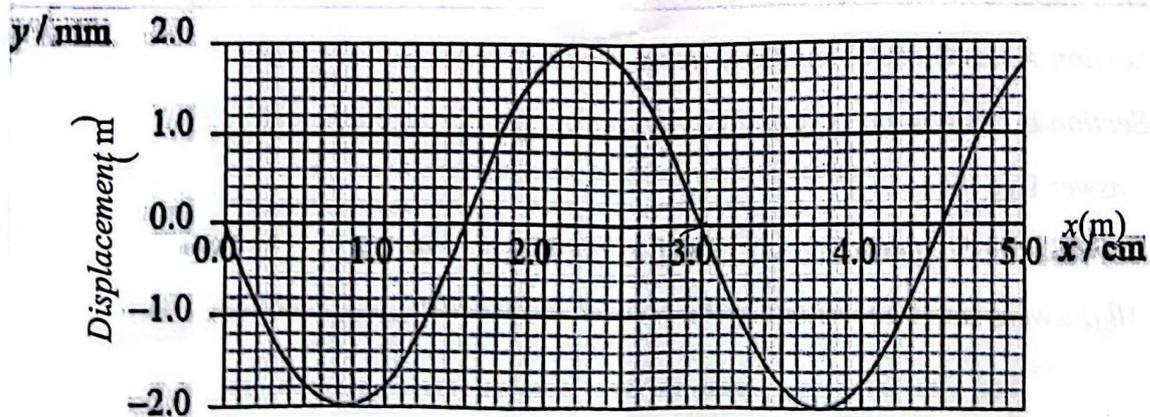

Figure 1 (b)

Hint:

The speed of the water waves is 144 km h⁻¹. The radius of curvature of the reflector is 160 cm

Task:

You are the only person in the community, who has studied physics. Help the community to;

(a) (i) understand the meaning of **light** and **radius of curvature** of a reflector.

(ii) understand the **laws of reflection** of light.

(b) (i) determine the distance the sauce pan must be placed from the reflector center for food to boil.

(ii) understand, with illustration how it is possible for food in (b) (i) above to boil.

(iii) identify any other field in daily life where the reflector in figure **1 (a)** is used.

(c) (i) find the number of water waves that reach the shore of the sea every second.

(ii) describe the technique used to reduce on the water flooding at the sea shores.

(iii) explain why sound on the loudspeaker is clearer in still night than day time.

Item 2

After *six months* of mineral extraction by an investor in your village, workers in the mine have started complaining of severe headache and skin burns. Ministry of health has been tasked to investigate the problem. The mine is put on lockdown and a sample is taken to the laboratory for testing.

The computer monitor displays the following equation:

$$_{92}^{x}Y \rightarrow {}_{88}^{234}Z + bp + 4m + electromagnetic\ radiation$$

After *six hours*, one of the officials says that the element is undergoing radioactivity because its mass is now 7.8125 grams.

The officials are concerned that if the mass of the element was below 10.6 grams after 5.25 hours, then the mine has to be shut down.

One of the workers alleged to have fallen during work and broke his arm (*no sign of bleeding*), was rushed to a nearby hospital for a radiography before administering treatment.

Hint:

The mass of the element at the start of the test was 125 grams and p is an alpha particle while m is a beta particle.

Task:

Using your knowledge of physics,

(a) help the villagers and the investor to

  (i) understand the term radioactivity.
  (ii) find the value of x.
  (iii) differentiate between **p** and **m**

(b) (i) determine for the investor whether the mine will be shut down.
  (ii) explain how the exact area of the broken bone in the arm is identified using the radiographic machine in the hospital.

(c) (i) identify **one** agricultural and **one** archeological use of radioactivity.
  (ii) what precautionary measures do you give the villagers who would wish to work in such mines in the future?

Item 3

Your school has gone for a study trip to the newly opened Space Observatory Station (**SOS**) in your country and every student is allowed to go with one parent as a way of engaging the communities in knowledge enlightenment.

At the station, is the station manager, but the station instructor travelled with his assistant abroad for space exploratory workshop.

The instructor's manual at the **SOS** gives two parents, each a chance to ask one question and were allowed to ask the following questions.

Parent A: what causes a rise and fall of water levels in the seas and oceans?

Parent B: how is it possible for someone in Uganda to talk to a relative in USA through a cell-phone?

In the same manual, things to talk about are; an astronomical unit (**AU**), a light year and life-cycle of stars.

People are shocked on seeing a statement "*the sun's radius is 109 times that of the earth*" and the "*sun's mass is 3.30×10^5 times that of the earth*".

The station manager does not have the knowledge on space physics and communications.

Hint:

The average density of the earth is 5500 kg m⁻³.
The volume of a sphere is $\frac{4}{3}\pi R^3$.

Task:

You have been asked to volunteer as a station instructor to guide the tourists since you have the knowledge on space physics.

(a) (i) distinguish between a light year and an astronomical unit (**AU**).

    (ii) respond to the questions asked by **parent A** and **parent B**.

(b) describe the life-cycle of stars.

(c) help the tourists to establish the;

    (i) average density of the sun.
    (ii) importance of studying astrophysics.

SECTION B
Part I
*Answer **one** item from this section.*

Item 4

On A-B express-highway, the recommended average velocity of cars is between 72 km h⁻¹ and 96 km h⁻¹ inclusive. A road toll has been installed along the highway to charge Ugx. 2000 per kilometer for anyone caught driving at an average speed outside the recommended range. This is to curb the rampant road accidents on the highway.

KC Automotive Company has signed a contract with the revenue authority and ministry of works, to export to your country, cars with chips, when connected to the velocity indicator at the road toll, the computer displays the graph of motion of the car.

Your family driver is taking your sick sister, with you to **NH** hospital using a car that was bought from **KC** Company. The computer displays a graph in figure 2.
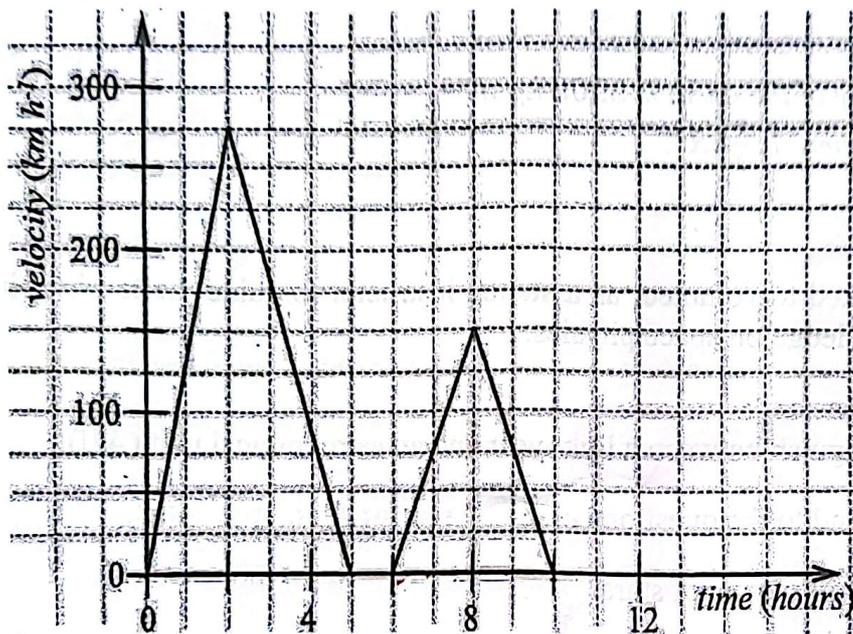

Figure 2

The emergence room in **NH** hospital is **eighty-nine** stair cases from the ground floor and your driver is told that he needs some power to do some work of carrying your sister to the room with some good acceleration, because the hospital lift has a mechanical fault. Your driver has no knowledge about everything above.

Hint:

Your sister weighs 68 kg and each stair case is 4 cm high.
Acceleration due to gravity is 10 m s⁻².
It takes 2 minutes for the driver to reach the emergence room.

Task:

As a student pursuing UCE course and physics is one of the subjects you are studying. Help the driver to

(a) (i) understand the meaning of acceleration.
   (ii) understand the motion of the car from home to the road toll.

(b) Find out if he is to pay the fine and how much.

(c) (i) Differentiate between **work** and **power**.
   (ii) Determine the power he requires to do the work of taking your sister to the emergence room.

Item 5

Due to weather changes, your region has been struck by heat waves resulting into scarcity of water for farming and too much heat inside the houses. A meteorological team from the ministry of disaster and preparedness informs the population that the time to cultivate land for crop farming, is when the atmospheric pressure is below 740 mmHg.

The government has advised your region to make kettles and pots using clay and use them with metal sheets to address the issue of clean water for drinking, hang moist sisal or banana fiber curtains on the inside walls to reduce the heat inside the houses and also build high water tanks out of repurposed plastic containers locally made to act as water reservoirs.

The population has also been advised to extract groundwater using hand pumps to raise the water into the tank so as to bring water to residences, making sure that there is sufficient pressure at the taps for irrigation and household use, however, this water is not clean for drinking.

Hint:

The amount of heat required to vaporize 2 kg of water for drinking from 60 °C is
$4.55 \times 10^6 J$

Specific heat capacity of water is $4200 \, J \, kg^{-1} \, {}^oC^{-1}$

The total pressure sufficient for taps and irrigation is 15 kPa

Task:

As a student of physics

(a) carry out a scientific investigation to help the region establish if they can cultivate land for farming.

(b) explain how

  (i) clean water is obtained using the kettle, pot and metal sheet.

  (ii) the banana fibers cool the houses.

(c) determine the specific latent heat of vaporization of water.

(d) (i) find the height to which the tank must be raised to supply water at the required pressure.

  (ii) describe how water is ably pumped to the elevated storage tank.

  (iii) what long term solutions to these problems do you recommend these people to adopt?

Part II
Answer **one** item from this section.

Item 6

In your area, many households rely on electricity but often face power outages and high electricity bills because of unsafe wiring and lack of knowledge on how electricity works.

The residents have noticed that the connecting wires get very hot when operating on electricity and wonder why this happens. They also complain that their devices often get burnt because the electricity from power lines comes at high voltage and must be lowered before it reaches homes.

Many families struggle to understand their monthly electricity bills and how different wiring parts in their homes help protect them and keep the power flowing safely.

Hint:

Dodoviko has a fridge rated (7.5A, 240V), eight light bulbs each rated (4A, 5Ω) and three smart phones each rated (4500 mA, 240V).

Each unit of electricity is equivalent to 1kWh.

Task:

As a learner of physics, your work is to

(a)   (i) Carry out a scientific investigation to show how the voltage across the devices is related to the current through them.

       (ii) Explain to the villagers why connecting wires become hot when operating.

(b)   Identify the device used to lower the voltage and describe how it works and the importance of lowering the voltage.

(c)   (i) Help Dodoviko understand the meaning of the rating 7.5A, 240V.

       (ii) Establish the cost of one unit of electricity if in a month Dodoviko pays a total of Ugx 121050, for which the fridge operates four hours every day for 15 days, each bulb works for twelve hours each day for 30 days and the phones spend one and a half hours charging every day for 30 days.

(d)   Identify the common house wiring components and explain to the villagers how each protects them.

Item 7

It's a common problem in many villages in Uganda: the lights dim, the radio cuts out, and sometimes there's no power at all. This happens a lot in places far away from the power plant at the dam in Jinja.

This electricity then travels through very long wires to reach homes in different villages. Along the way, the power gets weaker and people in your village have noticed that their appliances, like electric cookers, flat irons, fans, and lights, sometimes don't work properly. Some appliances are connected in a way that if one stops, the others do not work at all.
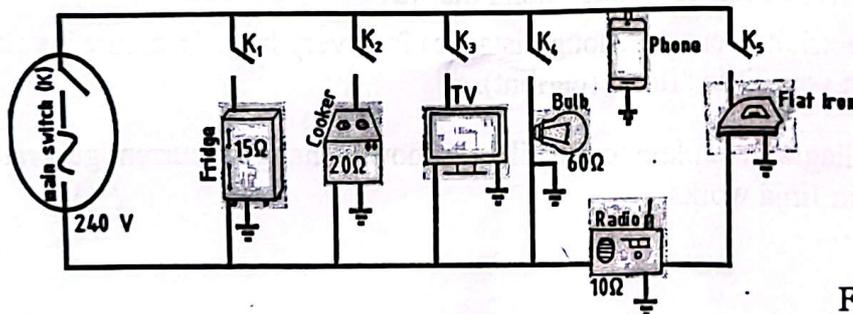
Support diagram

Circuit connection in the house of one of the villagers

Figure 3

The people in your village are really puzzled and want to understand why their electricity supply is weak, how machines that make electricity (the changing current generator) affect the power they receive, how they can figure out how much electricity (current) is flowing through their own appliances at home and why electricity is sometimes sent over long distances using very high "pressure" (voltage) but very little "flow" (current).

Hint:

The phone, TV and flat iron have resistances of 10Ω, 20Ω and 50Ω respectively.

Task:

You have been selected by a team from **UECDL** to help the villagers address their concerns.

(a) (i) Except the main switch, which switch when put off, makes more than one appliance fail to work and which appliances? Hence provide the best solution to address the problem.

  (iii) How much electricity flows through the TV?

(b) Help the villagers to establish why;

  (i) power becomes weaker along the way

  (ii) electricity sent over long distances is at very high "pressure" (voltage) but very little "flow" (current).

(c) Using a diagram, explain to the villagers how a changing current generator at the dam in Jinja works.