

535/1
PHYSICS
Paper 1
2024
2½ hours



UGANDA NATIONAL EXAMINATIONS BOARD

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.*

SECTION A

Answer **all** the items from this section

Item 1.

A brass band was invited to play during a celebration near a tall building, a distance slightly more than 17 m away. Two friends standing in the same direction and in line with the playing band, heard the sound from the band at different intervals of time which attracted them to go and attend the celebration. On arrival, the sound they heard was unclear, confused and indistinct. Later in the night during the celebration, coloured lights flashing red, blue and green made the colours of their clothes look different from the original colours which puzzled them.

Hint: Speed of sound in air = 330 ms^{-1} .

The two friends heard sound after 4 s and 5 s, respectively.

The friends were originally wearing yellow clothes.

Task:

As a physics student, help the two friends to understand why;

- (a) they heard the sound at different intervals.
- (b) the sound they heard was unclear, confused and indistinct.
- (c) the colour of their clothes kept changing when coloured lights flashed on them.

Item 2.

In a certain town, people are concerned about the waste disposal from the factory into the nearby lake which is their source of water for home use. They raised this issue to the chairperson Local Council 1 (LC1) who directed the management of the factory to stop disposing waste into the lake. A scientist was contacted to investigate the presence of radioactive material in the water. The scientist found out that the water was indeed radioactive as shown in Table 1.

Table 1

Time/days	0	5	10	15	20	25	30
Activity/counts per minute	1200	740	440	260	160	90	60

Although the water from the lake remains radioactive for a long time, the scientist recommended that water will be safe for use again when the activity is less than 38 counts per minutes.

Task:

As a student of physics;

- (a) Advise the chairperson LC1 about the time the community will wait for the water to be safe for use again.
- (b) Sensitise the members of the community about the risks associated with radioactive materials and how such materials should be handled.

Item 3.

In a certain country, a Television (TV) reporter was reporting live near the ocean about the high tides during night time. Viewers in another country were watching the live broadcast of the news bulletin during day time. The viewers wondered how it could be day and night at the same time, and how the event in one country could be watched live on TV in another country.

Task

Using your knowledge of physics to help the viewers to understand;

- (a) the possibility of it being day in one place and night in another place.
- (b) the occurrence of high ocean tides.
- (c) how an event in one place can be broadcast live in another country.

SECTION B**PART 1**

Answer one item from this part

Item 4.

A certain home owner intends to put up a metallic tank of height 4 m with a maximum volume of 5000 l fitted with an electrical heater which supplies 20,000 kJ of heat energy as shown in figure 1.

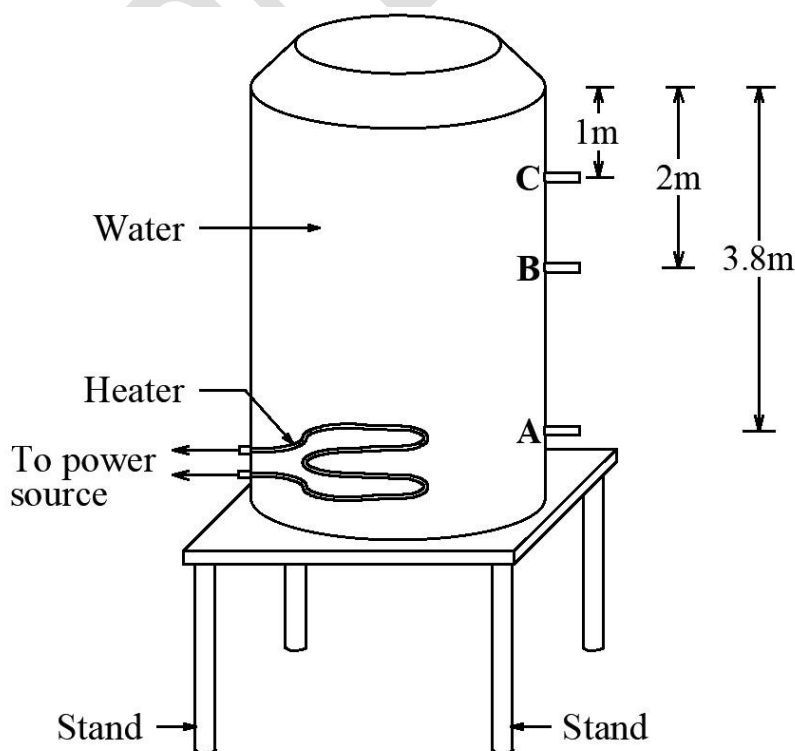


Fig. 1

The home owner found out that the heater was fitted at the lower part of the tank but he did not understand why it was done like that. Just before the hole for the outlet pipe was drilled at point **A**, the home owner told the person with the drill that the correct position was either **B** or **C**.

Task:

As a learner of Physics;

- (a) Explain to the home owner why;
 - (i) the electrical heater was fitted at the lower part of the tank and how eventually all the water gets hot.
 - (ii) the outlet pipe was drilled at point **A**.
- (b) If the initial temperature of the water in the tank is 20 °C, help the home owner to find out if the heater is working.
- (c) Advise the home owner on measures that can be taken to ensure that the tank stand can withstand the weight of the tank and water for a long time.

Use:

$$\begin{aligned}
 \text{Density of water} &= 1000 \text{ kgm}^{-3}. \\
 \text{Specific heat capacity of water} &= 4200 \text{ J kg}^{-1} \text{ K}^{-1}. \\
 \text{Acceleration due to gravity} &= 10 \text{ ms}^{-2}
 \end{aligned}$$

Item 5

A certain hotel has its bathrooms situated on the 3rd floor of a building. A customer of the hotel expects to bathe water at 32 °C. The hotel provides 10 litres of water at 20 °C to each customer. A boiler on ground floor heats water to 80 °C for the customers to use. The hotel management does not allow its workers to carry the hot water via the staircase.

Task:

Having studied physics;

- (a) help the hotel management to determine the quantity of hot water to be given to a customer for bathing.
- (b) advise the hotel management on how to keep the boiled water hot for a long period of time without keeping the boiler on.
- (c) explain to the management how the water from the boiler can reach the third floor safely.

Use:

$$\begin{aligned}
 \text{Density of water} &= 1000 \text{ kgm}^{-3}. \\
 \text{Specific heat capacity of water} &= 4200 \text{ J kg}^{-1} \text{ K}^{-1}. \\
 \text{Acceleration due to gravity} &= 10 \text{ ms}^{-2}
 \end{aligned}$$

PART II

Answer one item from this part.

Item 6.

Small pieces of metal which are unsafe to be eaten by chicken were found in feeds that had just been bought from a milling company by a poultry farmer. The small pieces of metal were later identified as iron. The farmer thought of disposing off the feeds but remembered that the pieces of metals could be sorted with a magnet which he did not have.

Hint:

A nail, connecting wires of resistance $0.5\ \Omega$, two dry cells each of $1.5\ \text{V}$ were available to the farmer.

Task:

As a student of physics;

- (a) Help the farmer to remove the pieces of iron from the feeds.
- (b) Comment on the effectiveness of what you have designed, given that current of $4\ \text{A}$ is enough to create a strong magnet.

Item 7.

In a certain place, electricity is transmitted at $120\ \text{V}$. A business person intends to connect 4 bulbs in a house rated $240\ \text{V}$, $60\ \text{W}$ each, and other domestic electrical appliances such that there is minimum power wastage. The business person has been advised to purchase a transformer of suitable specifications to achieve the objectives. The business person does not know what a transformer is, how it works and is bothered by the type of transformer that should be purchased.

Task:

As a student of physics, help the business person to solve the problems he/she is faced with.

535/1
PHYSICS
Paper 1
2024



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS
Theory

Paper 1

New Lower Secondary Curriculum

SCORING GUIDE

535/1 - PHYSICS SAMPLE PAPER SCORING GUIDE

SECTION A

1. (a) First 4s and 2nd 5s.

First Distance = speed \times time.

$$= 330 \times 4 = 1320\text{m.}$$

$$2^{\text{nd}} \text{ Distance} = 330 \times 5 = 1650 \text{ m.}$$

They heard sound at different time intervals because they were standing at different distances away from the playing band.

- (b) Unclear, confused, indistinct sound:

- Reverberation.
- Echoes.
- Noise from the environment.

- (c) Colour changes of the clothes are due to appearance of coloured objects in coloured light.

- Due to colour mixing.
 - In red, appeared red.
 - In green, appeared green.
 - In blue, appeared black.

2. From the graph, the water will be safe for use after 38 days. (32–38 days).
If no more waste was allowed in the lake.

OR: Using half-life = 7 days.

$$1200 \xrightarrow{7 \text{ days}} 600 \xrightarrow{7 \text{ days}} 300 \xrightarrow{7 \text{ days}} 150 \xrightarrow{7 \text{ days}} 75 \xrightarrow{7 \text{ days}} 37.5 \xrightarrow{7 \text{ days}} \dots$$

– A number of small doses received over time radioactive materials build up cumulatively in the body system and may **lead to leukaemia or cancer**.

– Strong doses of radiations from radioactive materials will lead to **burning of the skin and body tissues**.

– Extreme radiation penetration will lead to **damage deep in the body tissues** and particularly **to the body nuclei**.

– This may affect **chromosomes** and **make cells abnormal** and the **genetic effects** arising may be passed onto future generations.

– Radioisotopes are handled by mechanical tongs operated by **remote control equipment** from behind this **wall made of lead, concrete** or other suitable material that **absorb the dangerous radiations e.g. radiation badges**.

– **Thick-walled lead containers** are used.

– **A decay curve plotted with:**

- Axes labelled,
- Shape (with correct plotting),
- Reading the corresponding number of days (35 days).

3. (a) The possibility of day in one place and night in another. This is caused by the rotation of the earth about its axis (spinning). A point directly facing the sun will experience day while the one on the other side of the earth will be experiencing darkness (night).
As the earth rotates, the point ceases to be directly under the sun hence becoming dark. At this time, the other side of the earth will be experiencing day time.
- (b) Occurrence of the high ocean tides.
High tides are caused by the **moon's gravitational pull**. The **tidal forces** cause the earth and its water **to bulge out** on the side **closest** to the moon and the side **furthest** from the moon. These bulges are the high tides.
- (c) • **Images are picked by cameras** and changed to a frequency (signals) suitable for satellite transmission.
- The signals are transmitted from a ground based satellite dish (station transmitter) to a satellite in a geo-stationary orbit.
 - The signals are then amplified/modulated another frequency to satellite dishes on the earth's surface at TV stations.
 - The received signals are decoded by a decoder and then sent to the television for display.

SECTION B: Part I

4. (a) (i) Heater fixed at the bottom so that water in the tank is warmed faster.
Heat transfer in liquids is by convection.
Convection currents from the heater take place upwards.
Water near the heater warms up first, expands, becomes less dense and rises. Dense cold water near the top of the tank sinks to the bottom of the tank where it is also heated.
Convection currents are set up and continue until all the water is heated, warmed up.
- (ii) At point A water comes out at a high pressure.
Pressure increases with depth.
($P = \rho g \times h$).
Accept calculation method to arrive at the conclusion.
- (b) Heater is working if there is a temperature increase.
Heat Quantity = $mc\theta$.
Heat supplied = Heat gained. Formula
 $20,000 \times 10^3 = 5000 \times 4200 (\theta - 20)$.
 $\theta = 20.95^\circ\text{C}$.
Since temperature increased to 20.95°C , then heater is working.
- (c) Using: more struts / ties / girders.
Metallic stand put up in concrete slab.
5. (a) Heat lost by hot water = Heat gained by cold water.
 $M_h \times 4200 (80 - 32) = 10 \times 4200 (32 - 20)$.
 $M_h = 2.5 \text{ kg. or } 2.5 \text{ litres}$.

Each customer will need 2.5kg or 2.5 litres of hot water to mix with the cold water to achieve bathing water temperature.
- (b) Using vacuum flasks, Process – lagging by insulating materials.
[Hot water tied at one end of the inextensible string that passes over a pulley. Effort is applied at the other end at the 3rd floor. In this way the bucket of hot water will be
Identify a method + Explanation.]
Heat loss, by conduction
– Minimised by enclosure in insulating materials.
– Keeping water in poor water conducting materials, for example by using vacuum flasks.

Heat loss, by convection

- By covering the container with an insulating cover.
- Filling up the container with hot water.

- (c) Pulley system - for example lifts.
Wheel and axle.
Pumping.
Hot water supply system.

Part II

6. (a) An electrical method for making

- A magnet is required.
- A circuit diagram.
- Description:-
 - current flowing,
 - Polarity,
 - Dipoles,

The current flowing creates a magnetic field which aligns the nail dipoles in the same direction making the nail magnetised

The magnetised nail is then moved on top of the feeds continuously to pick all the pieces of iron by attracting them away from the mixture (feeds and metals) .

(b) $V = IR$

$$3 = I \times 0.5$$

$$I = \frac{3}{0.5} = 6A.$$

Since I proportional to β .

And $6A > 4A$, then the magnet formed will be highly effective.

7. A transformer is a device that steps up (increases) or steps down (reduces) the input voltage (e.m.f.).
A device the changes voltage.

A diagram of the transformer with two labels (Secondary source and a Primary source. (a score)

If an alternating current is passed through the Primary coil, an alternating magnetic flux will be set up and will induce an alternating e.m.f. in the Secondary coil.

The magnitude of this induced e.m.f. will depend on the e.m.f. applied to the primary and on the relative numbers of turns in the two coils.

- A step up transformer is required.
- Because the voltage must be increased from 120V to 240V for this bulb and appliances to work, $\frac{N_p}{N_s} = \frac{V_p}{V_s}$.

- $\frac{N_p}{N_s} = \frac{120}{240}$,

- $N_s = 2N_p$.

- A step up transformer of number of turns on Secondary twice as that on the Primary will change 120V to 240V.
- The bulbs and other appliances will be connected in parallel from so that they operate at the same voltage, and a fault in one does not affect the working of the other.

535/2&3
PHYSICS
Paper 2&3
2024
2 hours



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2 & 3
Practical

2 hours

INSTRUCTIONS TO CANDIDATES:

This paper consists of two examination items.

*Answer **one** item in all.*

*Any additional items answered will **not** be scored.*

*Candidates are **not** allowed to start working with the apparatus for the **first quarter of an hour**. This time is to enable candidates; read the items thoroughly, checking for the apparatus they will need and plan appropriately.*

A graph paper will be provided.

Mathematical tables and silent non-programmable calculators may be used.

Item 1

In a certain trading centre, empty mineral water bottles were littered everywhere causing blockage of trenches and other environmental hazards. A trader came to the trading centre with the intention of buying empty water bottles of mass 15 g each. A student had gathered a pile of 20000 empty identical mineral water bottles (500 ml each) but was not sure about the mass of each bottle. There was no instrument to determine the mass of the bottles and the student did not know the amount of money to be earned from the sale of the bottles.

Task:

As a student of physics, carry out a scientific investigation to help the student determine the mass of an identical empty bottle provided to you in order to ascertain how much the student will earn.

Hint:

- ✓ The trader pays UGX.400 per kilogram of such bottles.

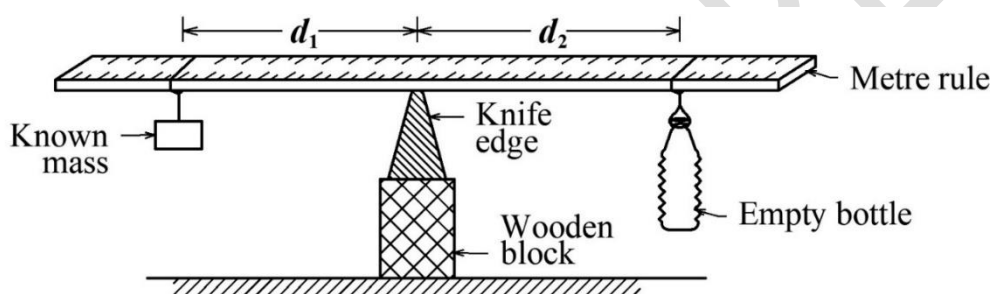


Fig. 1

- ✓ Other experimental set ups may be used.

Item 2

A student complained about pain in the eyes and could not see nearby objects clearly. After visiting a hospital, a doctor recommended that the student uses spectacles with a lens of focal length 10 cm. The student visited an eyeglass shop, presented the doctor's prescription/report and bought spectacles. The student, however felt uncomfortable while using the spectacles and the problem persisted.

Task:

You are provided with lens, **X** that has same properties with that of the lens in the spectacles a student bought. Verify the accuracy of the lens in the spectacles the student bought.

Hint:

- ✓

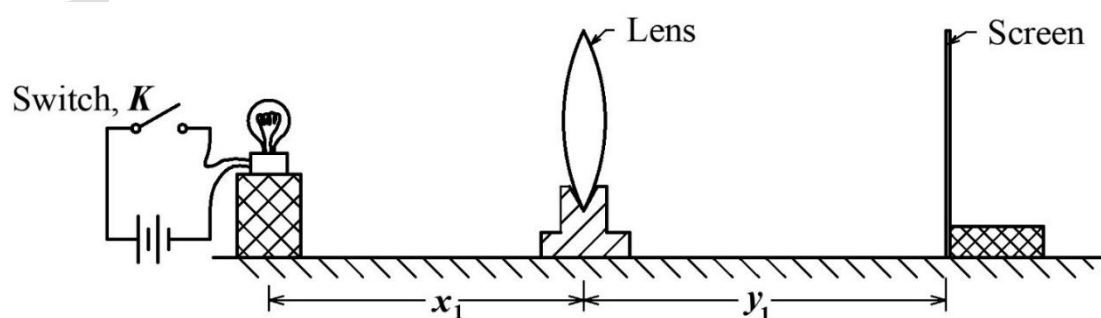


Fig. 2

- ✓ Other experimental set ups may be used.

**535/2&3 Inst. Sch.
PHYSICS
PRACTICAL
INSTRUCTIONS
2024**



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS PRACTICAL INSTRUCTIONS

535/2 &3 Inst. Sch.

CONFIDENTIAL

Great care should be taken that the information given below does not reach the candidates either directly or indirectly.

INSTRUCTIONS FOR PREPARING APPARATUS

The candidates will be allowed to write out a detailed description of the apparatus. The teacher responsible for preparing the apparatus must give details (on the report form attached) about some of the items or apparatus he /she has supplied. The form should be signed by the invigilator, teacher responsible for preparing the apparatus and the Head teacher.

NB: The Head teacher **must** ensure that the teacher responsible for preparing the apparatus hands in his/ her trial results, properly sealed in a separate envelope and **firmly** fastened (attached) to the candidates' scripts envelope(s).

In addition to the apparatus ordinarily contained in a Physics Laboratory, each candidate will require;

Item 1

1 metre rule.

1 piece of knitting thread 110 cm long.

1 100 g mass.

1 knife edge.

1 a block or wooden block ($20\text{ cm} \times 10\text{ cm} \times 5\text{ cm}$).

1 empty mineral water bottle capacity 500 ml.

Item 2

1 a convex lens in a holder (focal length 10 cm).

1 a torch (2.5 V, 0.3 A) in a holder.

2 fresh dry cells of emf 1.5 V each of size D in a holder.

1 switch labelled K.

1 white screen.

4 pieces of connecting wires (about 50 cm long).

1 metre rule (half metre rule can do).

This form MUST be completed and returned in a separate envelope firmly attached to the scripts envelope

UGANDA CERTIFICATE OF EDUCATION

2024

REPORT ON PHYSICS PRACTICAL 535 /2&3

Section I:

Any information which the teacher responsible for preparing the apparatus thinks may be useful to the scorers should be given on this sheet. The teacher must try all the scenario items and submit his/her results in the space provided below.

N.B: Teachers who DO NOT submit their trial results will be held responsible for the candidates' performance.

Results:

SAMPLE

Section II:

The invigilator, in consultation with the teacher responsible for preparing the apparatus, should give details below of any difficulties experienced by particular candidates, giving their names and personal numbers. These should include reference to :

(a) difficulties due to faulty apparatus,

(b) accidents to apparatus or materials,

(c) physical handicaps of candidates

(d) Any other information.

Other cases of hardship e.g. illness, disability, should be reported directly to UNEB in the normal way.

A plan of work benches, giving details by personal numbers of the places occupied by the candidates for each shift, must be enclosed with the scripts.

DO NOT STAMP ANYWHERE ON THIS DOCUMENT.

Invigilator's Name _____ Signature _____

Signature of the teacher responsible for preparing the apparatus _____

Signature of the head teacher _____

Random Number _____

535/2
PHYSICS
Paper 2
2024



UGANDA NATIONAL EXAMINATIONS BOARD

Uganda Certificate of Education

PHYSICS

Paper 2
Practical

New Lower Secondary Curriculum

SCORING GUIDE

535/2 - PHYSICS SAMPLE PAPER SCORING GUIDE

EXPECTED RESPONSES:

1. **Aim:** To determine the mass of the empty bottle provided in order to ascertain how much the student will earn.
2. **Variable:**
 - Distances from the pivot to the masses.
 - (Independent Vs dependent).
 - Controlled variables(**depends on the type of the Expt**).
3. **Hypothesis:**

The mass of the bottle provided is not between (10 – 20) g or is between (10 – 20) g.
4. **List of Apparatus:**
 - Expected list.
 - Wooden block / Retort stand.
 - Knife Edge / Clamp.
 - Metre rule.
 - 2 pieces of thread /3 pieces of thread.
 - Known mass.
 - Empty bottle
5. The metre rule is balanced on a knife edge and the point of balance noted and recorded, **G**.

A known mass is hung/suspended from one end of the metre rule at a known distance **x** from the **G**.

The bottle whose mass is required is suspended from the other end of the metre rule and its position from **G** is adjusted until the metre rule balances again at **x**.

The distance **y** of the bottle from **G** is recorded.

The experiment is repeated for atleast 2 more values of **x** to obtain corresponding values of **y**.
6. **Possible sources of errors:**
 - Parallax errors.
 - Working surface not smooth/flat /rough enough.
 - Air resistance / wind.

7. Precautionary measures:

Correct use of instrument to avoid parallax errors.
Ensuring that working surface is flat enough.
Ensuring that the experiment is done in a conducive environment/
controlled to minimise air resistance/ wind interference.

8. Presentation of Data:

Table

Line graph/bar graph

- axes labelled with quantities and units,
- suitable scales,
- plots occupying at least half the graph paper
- correct plots
- well-judged line of best fit.

Or Pie chart(*depending on the experiment*)

9. Accuracy of data:

Appropriate number of decimal places/Standard form.

10. Data Analysis and Interpretation:

- (i) Plotting graph of x versus y .

$$\text{Slope, } S = \frac{M_b}{M}, M_b = SM,$$

$$Mx = M_b y.$$

$$x \text{ versus } y, \text{ Slope} = \frac{M_b}{M}.$$

$$M_b = M \times \text{slope}.$$

- (ii) Using Averages; (Average of x) $M =$ (Average of y) M_b

M_b can be obtained.

12. Advice given:

$$(M_b \times 400 = \text{Amount})$$

The student will havekg of bottles and will earnamount
of money.