TERM ONE EXAMINATIONS 2024

S.2 PHYSICS

TIME: 2 HOURS

INSTRUCTIONS

❖ Attempt any **THREE** questions only.

❖ You may use silent, non-programmable calculator.

❖ Show all your workings clearly step by step using **paragraphs**.
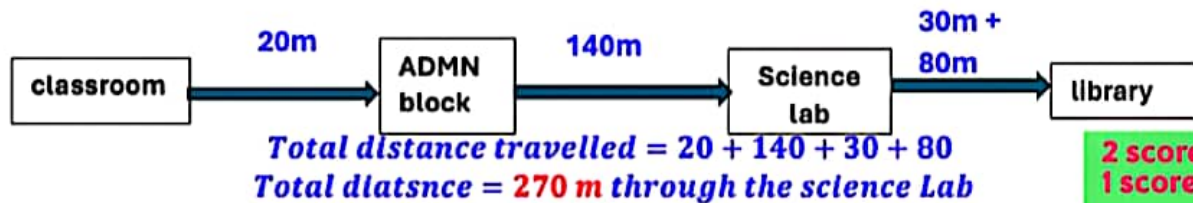
QUESTION ONE

One of the students in a certain school in Hoima, is a class captain who is responsible for picking books from the library to the classroom during every lesson conducted. This student gets tired by the end of the day due to many lessons from various subjects taught each day. There are only two possible routes the students are allowed to use during class hours. The students of this class normally sweep their classrooms during lunchtime on hot sunny days. This has made many students to complain about the too much dust particles moving in the air in the classroom making them uncomfortable.
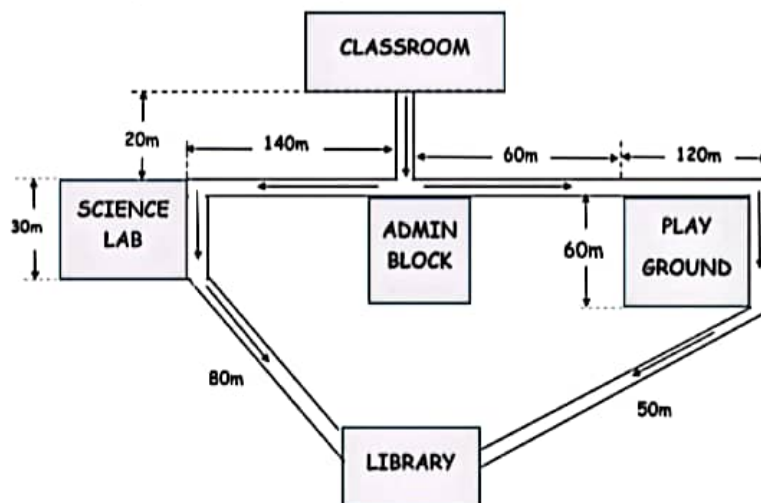
TASK
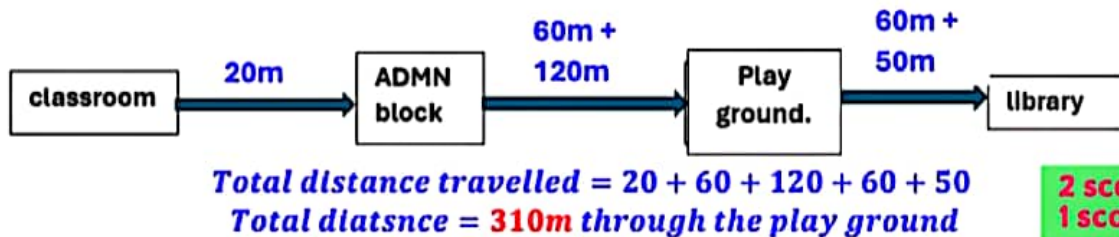
a) Write a workout of how you can help this class captain identify the **shortest** route from the library to the classroom and **why is it necessary** to do so.

b) Explain to the members of this classroom **why** dust particles too much during that time of the day?

c) What **advice(s)** would you give to members of this class regarding the too much dust particles during that time of the day. What would be the **best time** to sweep and **why**?

a) To obtain the shortest route, we need to calculate the total distance travelled in each of the two routes possible.

classroom	→20m→	ADMN block	→140m→	Science lab	→30m + 80m→	library

Total distance travelled = 20 + 140 + 30 + 80
Total dlatsnce = 270 m through the science Lab

2 scores @fully
1 score@ partly

classroom	→20m→	ADMN block	→60m + 120m→	Play ground.	→60m + 50m→	library

Total distance travelled = 20 + 60 + 120 + 60 + 50
Total dlatsnce = 310m through the play ground

2 scores @fully
1 score@ partly

The shortest route to the library is the route <u>through the science LAB</u> (270m). Its important to use the shortest route because <u>it saves time</u> which can be used for other productive work like revision, or lessons.

2 scores @fully
1 score@ partly

b) According to particle theory of matter, matter is made up of tiny particles which are in a state of constant random motion and the <u>speed of motion increases with increase in temperature.</u>
This means that by lunch time, on a hot sunny day, there is <u>high temperature</u> which cause <u>increase in the speed (kinetic energy)</u> of motion of dust particles thus making dust to move randomly in the room when it is hot.

2 scores @fully
1 score@ partly

c) I advise that sweeping should be done in the <u>early morning</u> hours because it's still <u>cold (low temperature)</u> by that time, so dust particles move randomly at a <u>low speed (low kinetic energy)</u> in the early morning hours.

2 scores @fully
1 score@ partly

$$\text{TOTAL SCORE} = \frac{10}{10}$$

CamScanner

QUESTION 2

A group of students were developing a **Hydro Electric Power (HEP) generator** project to conserve the environment by producing clean energy. The power rating of the water pump used is **2 kW**. The pump can draw **1200kg** of water in **one minute**. However, they are not sure of the required height of the water pipe above the ground if their project is to be successful.

SKETCH OF HYDOR ELECTRIC POWER (HEP) GENERATOR

Water pipe · Dynamo · Turbine spins · Transformer · Socket/switch. · Water · Water Pump
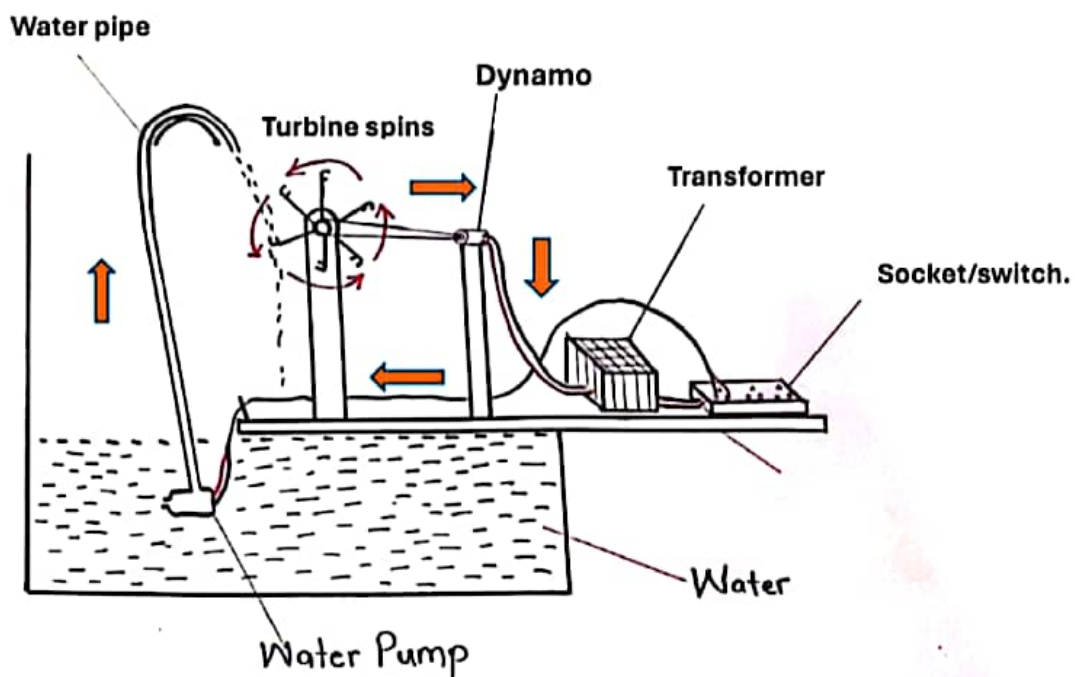
Hint: *acceleration due to gravity,* $g = 10 \ ms^{-2}$

hint; Force = weight of the object (mg)

Hint: *The transformer increases (steps up) the voltage of the electricity so that it may travel through the power lines to homes and businesses.*

TASK.

a) How **high** should the water pipe be above the ground if their project is to be successful?

b) Suppose you were one of the presenters of this project, **explain** using the law of conservation of energy the **energy changes** taking place in this project and **verify (prove)** if indeed energy is conserved.

a) $\text{power} = \dfrac{\text{workdone}}{\text{time}} = \dfrac{\text{Force}\times\text{distance}}{\text{time}} = \dfrac{mgh}{t}$ where force = weight of water
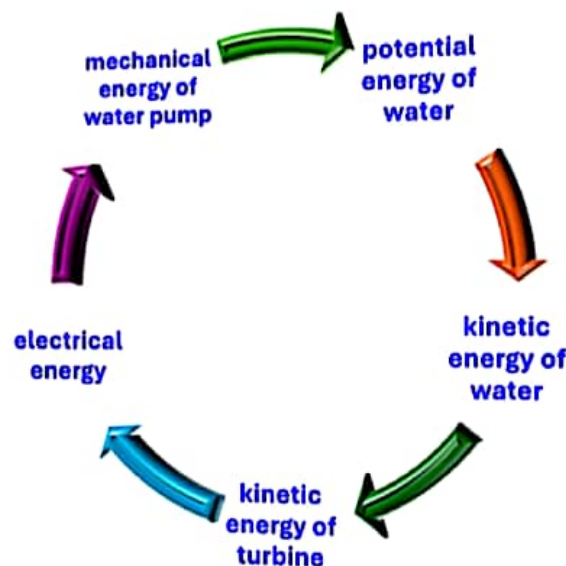
$$2000 = \frac{1200 \times 10 \times h}{1 \times 60} = \frac{12,000h}{60}$$

$h = 10\ m.$ **The water pipe should be 10m high.**

**4 scores @fully
2 scores @ partly**

b) Using a water pump, the height of water above the ground is increased.
   - As water rises to a height of 10m, its <u>potential energy increases</u>. At maximum height, it has maximum potential energy. **1 scores**
   - As water descends, its <u>potential energy changes to kinetic energy</u> which causes the <u>turbines to spin</u> at a high speed. **1 scores**
   - The dynamo then converts the <u>mechanical energy (kinetic energy) to electrical energy.</u> **2 scores**
   - The electrical energy is then passed through the transformer so that its voltage is stepped up (increased) for distribution.
   - This same electrical energy can again be <u>used to power the water pump</u> so that the whole process of power generation <u>repeats itself</u> hence achieving energy conservation according to the law of conservation of energy which states that <u>energy can neither be created nor destroyed but can be changed from one form to another</u>. **2 scores**

mechanical energy of water pump → potential energy of water → kinetic energy of water → kinetic energy of turbine → electrical energy → (back to mechanical energy of water pump)
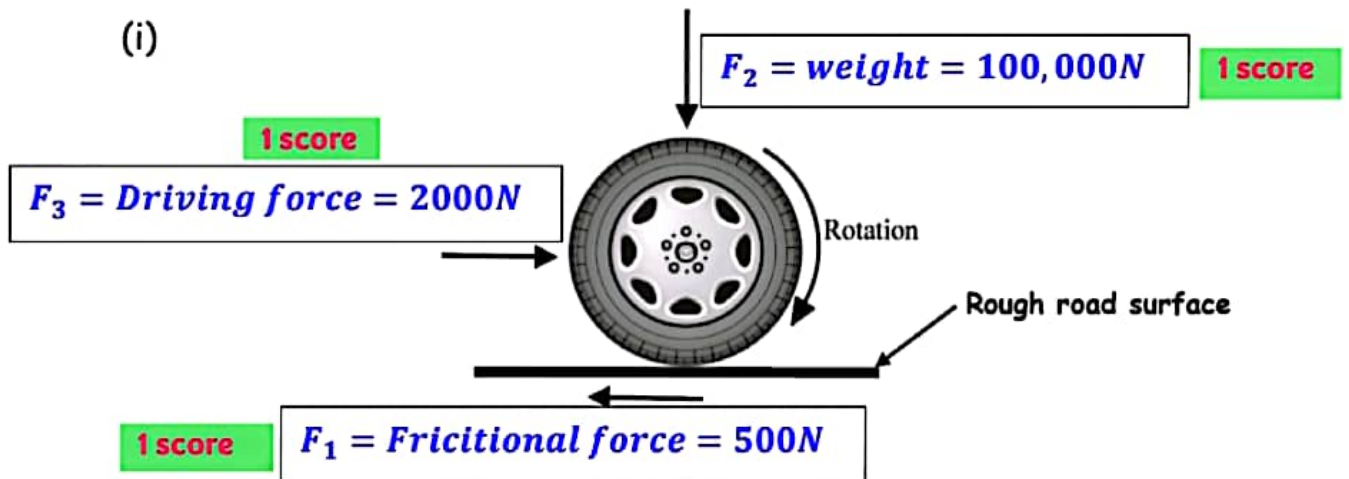
$$\text{TOTAL SCORE} = \frac{10}{10}$$

QUESTION THREE

A school bus of average **weight 100,000N** was transporting the school team for the football competition to a neighbouring school. The engine of the bus applied a forward **driving force** of **2000N** against a constant **frictional force** of **500N**. As the school bus was negotiating a corner, the tyres failed to grip the ground firmly and the vehicle slipped and overturned. Some students sustained minor injuries due to the accident. On further investigation, the traffic police discovered that the **tyres** of the school bus **were worn out**, the moving parts of the school bus were **not well lubricated/oiled/greased**.

F_2

F_3

Rotation

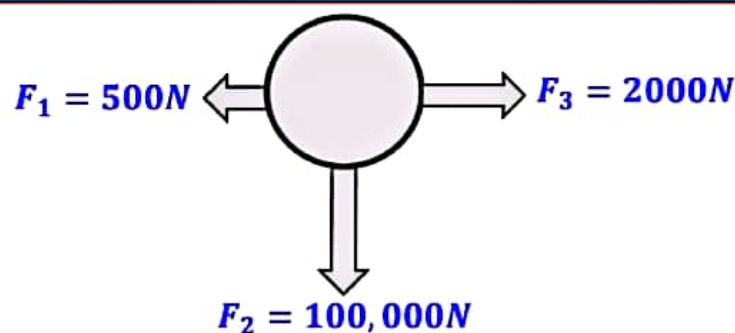Rough road surface

F_1
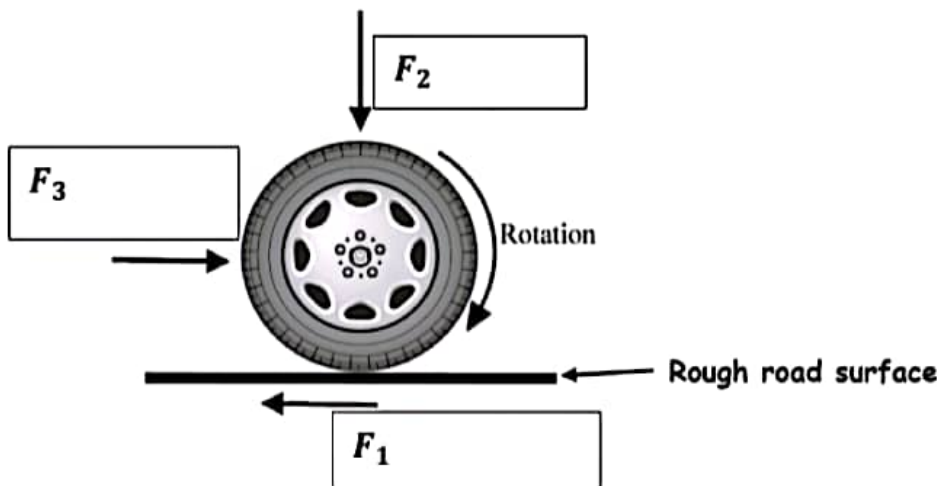
Task

a) If you were the investigation journalist addressing the cause of this accident, how will you be able to
   (i)   **Indicate** the forces acting on the tyres at that time.
   (ii)   Determine the **resultant/net force** acting on the tyres at that time.
   (iii) Explain the main **cause(s)** of this accident according to the information provided in the scenario above and in each cause explained, provide a suitable **recommendation**.
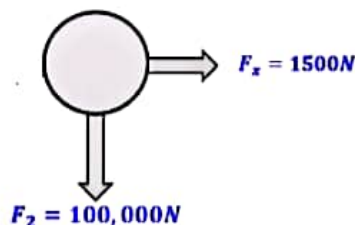
(i)

$F_2 = weight = 100,000N$ 1 score

1 score

$F_3 = Driving\ force = 2000N$

Rotation

Rough road surface

1 score $F_1 = Fricitional\ force = 500N$

(ii)

$F_1 = 500N$ ⇐   ⇒ $F_3 = 2000N$

$F_2 = 100,000N$

Resultant horizontal force on the tyre, $F_x = F_3 - F_1 = 2000 - 500 = $ **1500N** to the right   1 score

Resultant vertical force on the tyre, $F_2 = 100,000N$ downwards

$F_x = 1500N$

$F_2 = 100,000N$

Using Pythagoras' theorem

$a^2 + b^2 = c^2$

$F^2 = F_x^2 + F_2^2$

$F^2 = 1500^2 + 100,000^2$ 1 score

$F^2 = 10,002,250,000$

$F = 100,011.2\ N$ downwards to the right.   1 score

(iii) Worn out tyres cause decrease in friction between the tyres and the ground hence leading to overturning/toppling of the bus. I recommend brand new tyres since they have treads to increase friction between the tyres and the round surface hence difficulty in overturning.   2 scores

❖ Lack of lubrication/oiling/greasing in moving parts of the bus cause increase in friction hence hindering smooth running of the school bus. I recommend regular lubrication/oiling and greasing.   2 scores

TOTAL SCORE $= \dfrac{10}{10}$

QUESTION FOUR

Workers in a certain farm normally rest under temporary, structures made of carpets which is painted **black**. During **daytime**, when it is **hot** and **sunny**, they normally feel **uncomfortable** to rest under these structures, so they instead prefer resting **under trees**. When their manager heard about their complaint, he measured the temperature of the air inside the structure during daytime, and he observed that the length of the mercury thread of the thermometer was **35cm**. However, at **night** the workers prefer to rest under these structures to keep them warm and **comfortable**.

More support information.

- The length of the mercury thread at upper fixed point is 98 cm.
- The length of the mercury thread at lower fixed point is 4 cm.
- The normal room temperature of surrounding air is 25 ^{0} C.

TASK

a) Write down an **explanation** to these workers why they are **uncomfortable** during **daytime** and **comfortable** at **night**.
b) What was the exact value of the **temperature** of the air inside of the tent/structure? And what does this value mean compared to the normal room temperature?
c) What possible **adjustment (s)** can you make to these structures in order to make it comfortable for resting even during **daytime.**

a) Black painted carpets/structures are <u>good absorbers</u> of solar radiation. This leads to <u>increase in the temperature</u> inside the structure hence causing discomfort to the workers during hot sunny days.

2 scores

At night the <u>earth loses heat</u> and becomes cold due to absence of solar radiation from the sun. as the earth is becoming cold (loosing heat) at night, the structure <u>traps some heat</u> inside and keeps the workers warm and comfortable.

2 scores

b) $\theta = \left[\dfrac{l_\theta - l_0}{l_{100} - l_0}\right] \times 100^0$ **1 score**

$\theta = \left(\dfrac{35 - 4}{98 - 4}\right) \times 100^0$ **1 score**

$\theta = 32.98^0$ **1 score**

The temperature inside the structure/tent is 32.98 ^0C which is <u>above</u> the normal room temperature which is 25 ^0C. This value is <u>not bearable</u> to workers. It's not healthy to live under such high temperature conditions.

1 score

c) The possible adjustments to ensure low temperature in the structure/tent include the following.

➢ Painting the structure <u>white/shiny/silvered</u>. This is because they are <u>poor absorbers</u> of solar radiation which lead to low temperatures inside the structure/tent during hot sunny days.

2 scores

➢ Covering the roof of structure with <u>poor heat conductors such as grass</u> and other materials like leaves. These poor conductors of heat create a comfortable temperature inside during the hot sunny days.

➢ Constructing the structure/tent <u>under shades of large trees</u>. The trees will provide fresh air conditions to the people resting inside the structure. The trees will also protect the structure from direct sunlight hence creating a comfortable environment inside the tent.
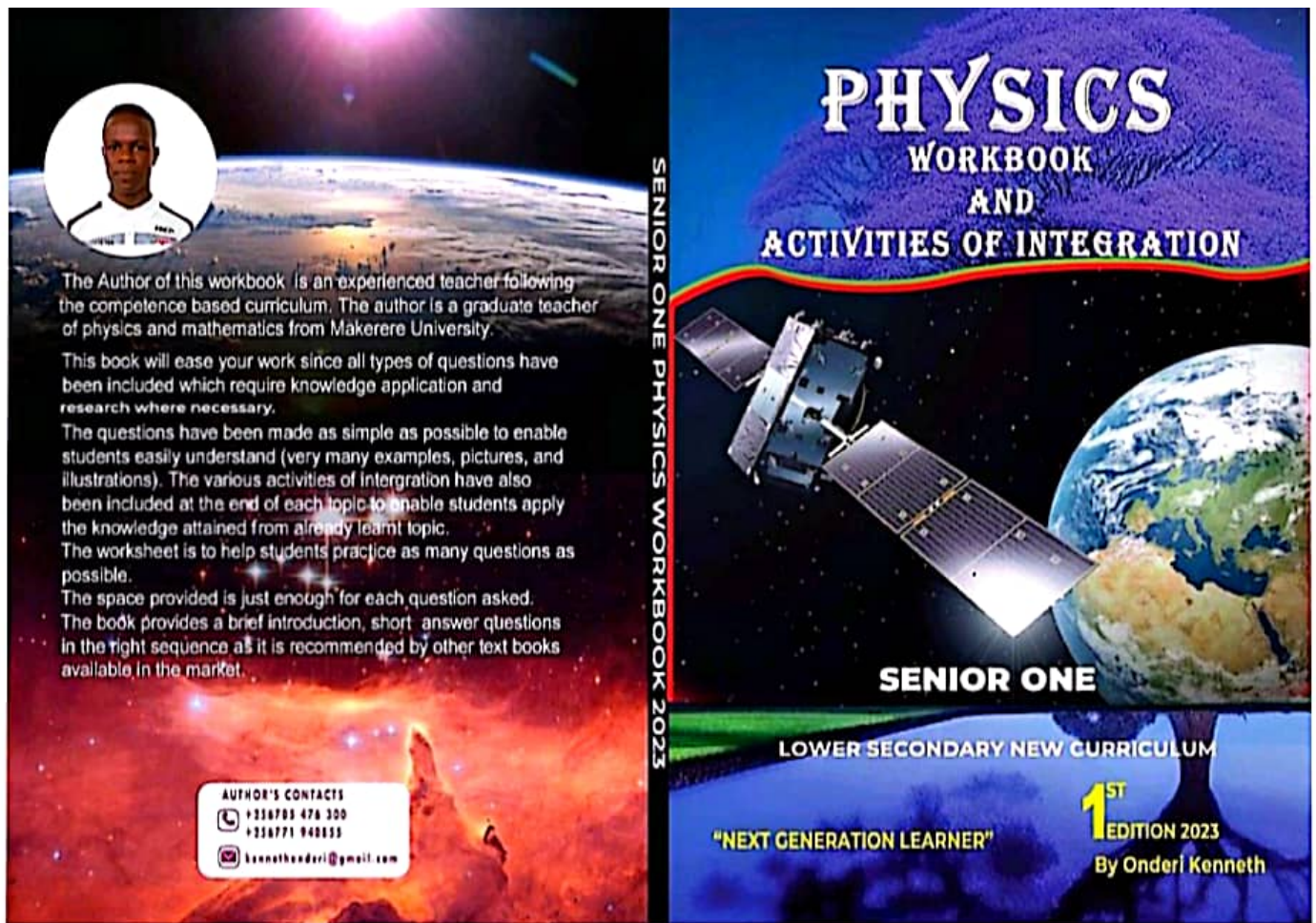
$$\textbf{TOTAL SCORE} = \dfrac{\textbf{10}}{\textbf{10}}$$

‹‹‹‹‹‹‹‹THE END›››››››

‹‹‹‹‹‹‹‹Just do your best and success is guaranteed››››››››

For any errors please don't hesitate to inquire more for clarity....

SENIOR ONE PHYSICS WORKBOOK 2023

PHYSICS
WORKBOOK
AND
ACTIVITIES OF INTEGRATION

SENIOR ONE

LOWER SECONDARY NEW CURRICULUM

"NEXT GENERATION LEARNER"

1ST EDITION 2023

By Onderi Kenneth

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The questions have been made as simple as possible to enable students easily understand (very many examples, pictures, and illustrations). The various activities of intergration have also been included at the end of each topic to enable students apply the knowledge attained from already learnt topic.

The worksheet is to help students practice as many questions as possible.

The space provided is just enough for each question asked.

The book provides a brief introduction, short answer questions in the right sequence as it is recommended by other text books available in the market.

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SENIOR THREE PHYSICS WORKBOOK 2024

PHYSICS
Workbook
&
Activities of integration

S.3
O-Level

By Onderi Kenneth
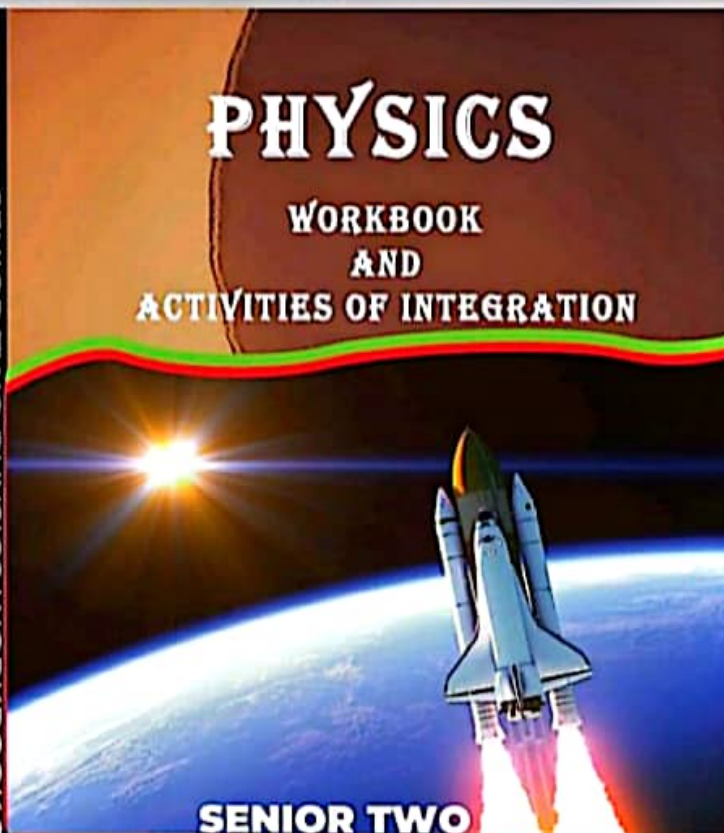0705476300 / 0771940855

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SENIOR TWO PHYSICS WORKBOOK 2023

PHYSICS
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AND
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SENIOR TWO
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