535/1
PHYSICS
Paper 1
Jun./Jul. 2024
$2\frac{1}{2}hrs$

ST. MICHAEL HIGH SCHOOL, MUKONO
Uganda Certificate of Lower Secondary Education
INTERNAL MOCK–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.*
- *Begin each answer on a fresh sheet of paper.*

For Examiner's use only

Items							Total
Section A (x/48): Section B (x/32):							(x/80)
1	2	3	4	5	6	7	

Section A

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

Item 1

A trainee learning to drive a car caused an accident because he saw something like a pool of water on the tarmac highway which made him afraid of falling into it. Fortunately, he did not get serious injuries and was rushed to the nearby hospital. He was diagnosed with radiation of wavelength $1 \times 10^{-10} cm$ to check if none of his bones had got a fracture. He got surprised to see the structure of the bones of his leg on an x-ray screen yet they had not cut his leg.

Hint:

The radiation is electromagnetic in nature.

The speed of light $= 3.0 \times 10^{8} ms^{-1}$

Task:

Using the knowledge of physics:

(a) Explain to the trainee the incident which caused the accident. **(05 scores)**

(b) Determine the frequency of the radiation that was used, and what would be the wavelength if the frequency of the radiation was $85 Hz$? **(07 scores)**

(c) What are the dangers of the radiation used in diagnosing the patient. State any precautions which should be taken to reduce on the dangers you have mentioned. **(04 scores)**

Sub-Total=16 scores

Item 2

A football match was being broadcast live from country A at 4:00pm. Viewers from another country B was watching this match live at 8:00pm with their television (TV) screen outside the house. It was bright like day because of the Moon. They started arguing about the Moon's size where one member posed a question asking why the moon is different in size always. This silenced everyone. The beauty of stars also caught the attention of the some viewers. They started wondering why some stars look brighter than others.

Task

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

(a) Why the moon is different in size throughout its cycle, naming each of the distinct sizes and how long this cycle take. **(08 scores)**

(b) The reason for the different brightness of the stars in the night sky. **(04 marks)**

(c) How football can be broadcast live in country B; and the possibility of it being 4pm in country A and 8pm in another country B. **(04 scores)**

Sub-Total=16 scores

Item 3

In a research laboratory, scientists are investigating the properties of atoms and the behaviour of electromagnetic radiation. Here are some observations and findings from their experiments:

- ***Observation 1****: scientists analyse the composition of different compounds. They find that regardless of the compound, elements combine in simple, whole number ratios by mass, consistent with Dalton's atomic theory*
- ***Observation 2:*** *using a particle accelerator, they shoot alpha particles at a thin gold foil. They observe that most alpha particles pass through the foil undeflected, but a few are deflected at large angles.*
- ***Observation 3:*** *scientists shine ultraviolet light on a metal surface and observe the emission of electrons.*

Task: As a learner of Physics;

(a) discuss Dalton's postulates; and how does the findings in Observation 1 support Dalton's postulates. **(07 scores)**

(b) explain how the experiment in observation 2 provides evidence for Rutherford's atomic model and what conclusions can be drawn about the structure of the atom from this observation. **(04 scores)**

(c) describe the phenomenon in Observation 3. Why do you think the production of x-rays is the inverse of the phenomenon in Observation 3? **(05 scores)**

Sub-Total=16 scores

Section B
Part I

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

Item 4

A friend of yours wants to buy a hybrid car. He was conducting a driving test to evaluate the efficiency of the car. During the test run, the $1500kg$ car accelerates uniformly from rest to a speed of $40ms^{-1}$. The car is considered efficient if the average power output exceeds $200kW$ over a distance of $100m$ on a straight track. All heat generated by the car's engine during acceleration (work done) is absorbed by the coolant.

Task

As a student of Physics, help your friend to;

(a) find out whether the engine of the hybrid car is working efficiently and advise him whether to buy it or not. **(10 marks)**

(b) Explain how heat is transferred from the engine to the coolant during the acceleration. **(03 marks)**

(c) If the initial temperature of the coolant was 25^0C. At what temperature was the engine operating during the acceleration before absorption by the coolant. **(03)**

Use

Specific heat capacity of water$= 4200Jkg^{-1}K^{-1}$

Sub-Total=16 scores

Item 5

Due to traffic jam in a certain town, the traffic section has set $60ms^{-1}$ to be **speed limit** in order to reduce accidents. On a certain day, truck A, of mass 1.2×10^3kg collided with another truck B, of mass $2000kg$ which was moving at a speed of $50ms^{-1}$ in opposite directions. The trucks got stuck together after collision and moved at a speed of $0.15ms^{-1}$ before coming to a complete stop with a deceleration of $2ms^{-2}$. The final kinetic energy of the trucks was converted into **heat energy.**

Support:

The ***heat capacity*** *of the material of the trucks is* $1.28 \times 10^6JK^{-1}$.

Task:

As a physics student, help the traffic section to determine;

(a) whether the cause of the accident was over-speeding of truck A. **(05 marks)**

(b) the distance moved after collision before coming to complete stop. **(06 marks)**

(c) the temperature difference of the trucks. **(05 marks)**

Sub-Total=16 scores

Part II

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

Item 6

The manager of a fully constructed estate faces a challenge of **high expenditure on electricity**. He hired an electrician to install a circuit breaker which allows a maximum of $5A$ to pass through it to restrict electricity supply to appliances. A tenant has a flat iron rated $240V, 1.1kW$, three electric bulbs each rated $240V, 15W$, and an electric kettle rated $240V, 1.5kW$. Tiny iron nuts fell into the grass as the electrician was installing the circuit breaker and he did not have a magnet to pick them.

Hint:

He had an iron rod, copper wires and two dry cells in his tool bag.

Task:

(a) Using the knowledge of physics, help the manager to establish whether the tenant will be able to use each of the appliances. **(07 marks)**

(b) Which bulb arrangement do you recommend for the rooms and why? State any other possible solution the manager can adopt to reduce on the challenge.
. **(04 marks)**

(b) Explain how you could help the engineer to recover his nuts. **(05 marks)**

Sub-Total=16 scores

Item 7

Your friend's mother complained of high expenditures on electricity bills of last month. She claims that she is supposed to pay $shs.40,000$. The mother uses a flat iron for $2hours$, lighting system $12hours$, and an electric kettle for $4hours$ **every day**. To check on the electric digital meter, your friend found the readings on the meter as 35847.1 for the previous month and 35944.4 for the current month. On his way back to the living room, he accidentally poured tiny iron pins near a copper wire connected to a battery; and to his surprise, the tiny iron pins were attracted to the wire forming a particular pattern.

Hint:

*A unit of electricity costs shs.*700.

Task:

As a learner of Physics, help your friend to;

(a) determine if the mother was being cheated on by UMEME. **(08 marks)**

(b) explain to the family how they would avoid high cost of electricity with focus on the mentioned appliances. **(03 marks)**

(c) understand why the tiny iron pins were attracted to the wire. **(04)**

Sub-Total=16 scores

THE END