535/1
PHYSCS
Paper 1
2 hours 30 mins

SURE A EXAMINATION COUNCIL.

SURE A EXAMINATIONS

Uganda Certificate of Education

PHYSICS

Paper 1 (Theory)

Duration: 2hours 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.*

Email: sureaexaminationcouncil@gmail.com **Tel: 0756-265671 / 0773-554329**

SECTION A

(All items in this section are compulsory)

ITEM 1

During a school sports day, a public address system was set up near a large classroom block. Two students standing in the same line with the loudspeaker, but at different distances, heard the announcements at different times. Some words sounded mixed up and unclear during the afternoon. Later in the evening, when the temperature dropped, the announcements sounded clearer and more distinct.

At night, coloured flash lights (red, blue, and green) were switched on around the field. A student wearing a yellow T-shirt and another wearing a cyan dress noticed that their clothes appeared to change colours under the different lights. Unfortunately, no one could explain the observation on getting home

Hint:

- Speed of sound in air = 330 m s^{-1}
- One student heard the sound after 3 s and the other after 4 s

Task:

Use your knowledge of physics to explain:

a) Why the two students heard the sound at different times.
b) Why the sound was unclear and mixed up in the afternoon and became clearer in the evening.
c) Why the colours of their clothes change under the coloured flash lights and how they appeared.

ITEM 2

At a health centre, a laboratory technician uses an X-ray machine that emits electromagnetic waves of frequency 8×10^{18} Hz. Two patients are to be examined but their parents are worried and against using there machine on their children:

One with a suspected fracture in the leg

Another requiring a detailed scan of the jaw for dental alignment

The technician can adjust the wavelength of the X-rays produced.

Hint:

Wavelength of X-rays	4×10^{-11} m	4×10^{-10} m	4×10^{-9} m
Image Resolution	Very High	Medium	Low

Task: As a learner of physics:

a) State which wavelength would be most suitable for examining the fractured leg and explain why
b) Explain how frequency and wavelength affect the penetrating power of X-rays.
c) Suggest safety precautions the technician must observe while using the X-ray machine.

ITEM 3

A fresh university student has enrolled in an Aerospace engineering course Oklahoma University, in the USA. After a few days of settling in, she called her parents in Uganda by 9 am local time in that country. However, in Uganda, it was 8 pm. Her parents had watched the news that the full moon had been sighted, indicating the start of fasting for the holy month. During the phone conversation, she mentioned that her first lecture was about the life cycle of a star. This interested the parents who wondered how a star could have a life cycle and they were also curious about the significant time difference between the two countries.

Task:

As a physics learner, help the parents to understand;

a) What causes the differences in time between the two countries.
b) The different phases of the moon.
c) The life cycle of a star.
d) How it is possible to talk to her parents

SECTION B
PART I
(Answer only one item from this section)

ITEM 4

In a certain home, it is the children's responsibility to draw water for cooking and also to boil it for drinking. They draw the water from an underground well using a rope and a bucket. The children have raised a complaint to their father that pulling water using a rope and a bucket is tiresome. They use an aluminum saucepan of mass 2 kg to boil 10 liters of water from a temperature of 24 ^{0}C to 90 ^{0}C. The father is planning to address his children's concern but is not certain of how to solve it, and is looking for guidance.

Task:

Using the knowledge of physics, help the father to;

a) Design a simple machine that can be used and explain how it works.
b) Understand how to improve on efficiency of the machine designed in (a) (i).
c) Understand how much heat energy is used daily by the family to boil drinking water.

Use;

- Specific heat capacity of aluminum = $900Jkg^{-1}K^{-1}$
- Specific heat capacity of water = $4200Jkg^{-1}K^{-1}$
- Density of water = $1000kgm^{-3}$

ITEM 5

In a certain family, they use mosquito repellants to chase away mosquitoes in the room and in the house ceiling by help of the ordur from the burnt repellant.

They use a candle for lighting whose wax melts at a rate of 2cm for every 30 minutes. A student wishes to use a candle of such type of length 10cm for revision and intends to start from 8:00pm to 11:00pm.

During the study trip, the students moved out of the school bus to see the paint train from a distance and they felt like the train was attracting them. This left the students wondering if the train had magnetic powers that attracted them.

Task:

As a student of physics;

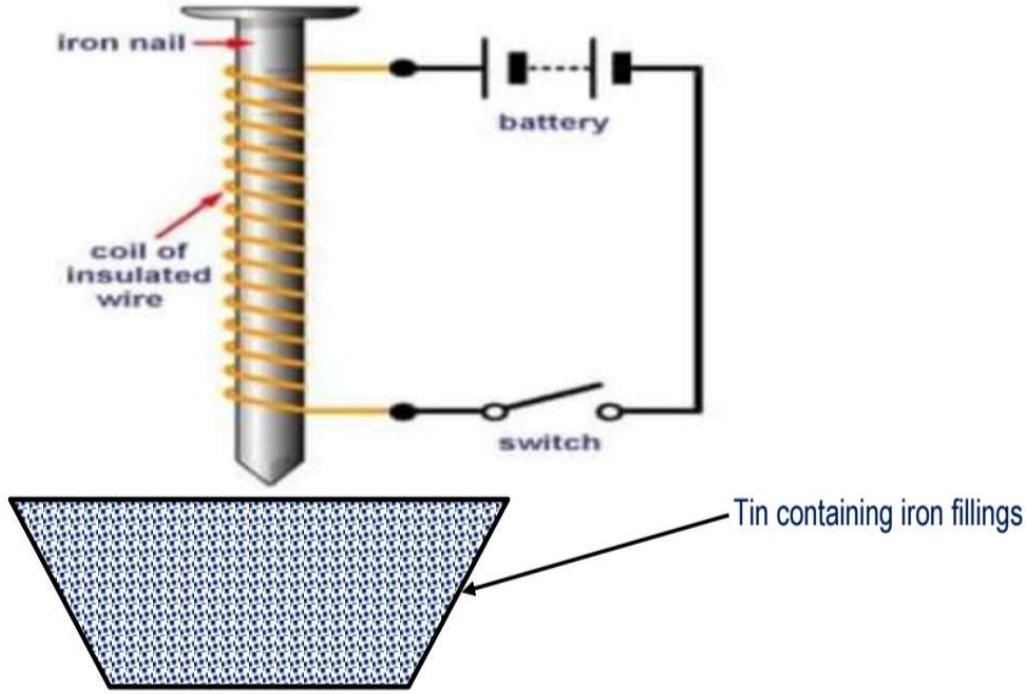
a) Explain how the repellant is able to chase away the mosquitoes from the house and ceiling
b) Help the student to know if the available candle length will be enough for his study time.
c) Explain to the students why they were attracted towards the passing train.
d) If they put the candle in a water pool to float after lighting it, determine if the candle was going to float given that it's mass was 38g and if had a circular base of area $5cm^2$

PART II

(Answer only one item from this section)

ITEM 6

A group of learners in a S.4 class was given materials to construct an electromagnet and make a number of observations. So they started by winding a wire around an iron nail of resistance 0.5Ω, connecting it to a battery of four cells of e.m.f 1.5V each, and then placing it above a tin containing iron fillings. When they connected the switch, the iron fillings were seen to be attracted to the nail. When it was disconnected, most of them fell off. Now they replaced the iron nail with an identical steel nail of the same size. The learners observed that the pins were attracted at a slower pace. But in this case, when the e.m.f source was disconnected, just a few of the iron fillings fall off. These observations surprised the learners so much; unfortunately, they could not explain to their classmates how they came about



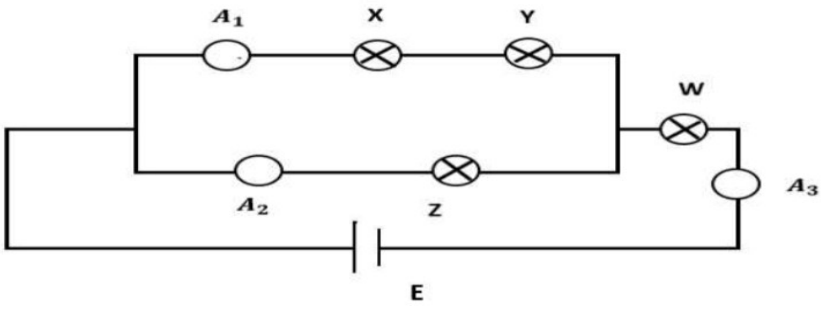
Task

Use your physics knowledge to the group of S.4 learners to:

a) Explain how the electromagnet which they made operates.
b) Make a write up about the difference in the time taken before the steel and iron nails started attracting small pins.
c) Explain what would happen if a battery of 2 cells of the same e.m.f was used instead of one of 4 cells.
d) Identify other factors that could contribute to an increase in the number of nails being attracted.

ITEM 7

A certain home owner intends to put bulbs of similar resistance 3 Ω in different rooms. The maximum current 0f 4.5 A is obtained when the bulbs are connected to the source of electromotive force E. the reading of ammeter ***A1*** was obtained as 2.5 A. The home owner was given the circuit in figure as the most appropriate circuit to light up the different rooms. The home owner is interested in installing the best bulb in a reading room. An analog meter was installed in a room with bulb W which reads 09259.4 and the digital meter was installed in the room 6 which has bulb Z reads 45967.1. At the end of the month, the meters now read 09389.1 and 46074.4 respectively and the cost of each unit is 780/=



Task:

As a learner of physics,

a) Advise the home owner which of the bulbs W, X, Y and Z would be installed in the reading rooms and why?
b) Help the home owner understand the value of source the required for the circuit to work.
c) Explain to the house owner, in rooms with bulbs Z and W which will pay a higher cost and what advice would you give to the house owner so as to pay less at the end of the month.

END