E-PHYSICS CLASS

HOLIDAY REVISION – 2025

Item 1

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 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:

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

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 2

Your school has gone for a study trip to 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 X: What causes a rise and falls of water levels in the seas and oceans? What are the results of this to the economic activity?

Parent Y: 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*** $\mathbf{3.30 \times 10^5}$ ***times that of the earth***".

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

Hint:

- The average density of the earth is **5500 kgm^{-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 X and parent Y.

(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.

Item 3

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 **Fig. 1** 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 law of reflection of light.

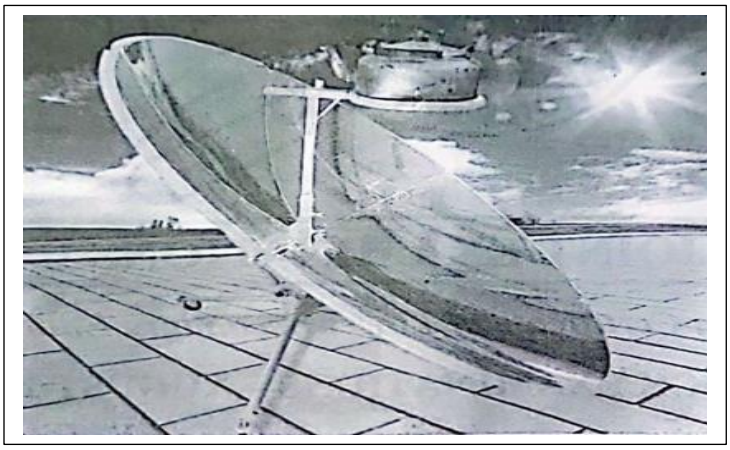

Figure 1: Solar concentrator

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, build in your area that monitors the movement of water displays the analysis graph in **Fig 2**.

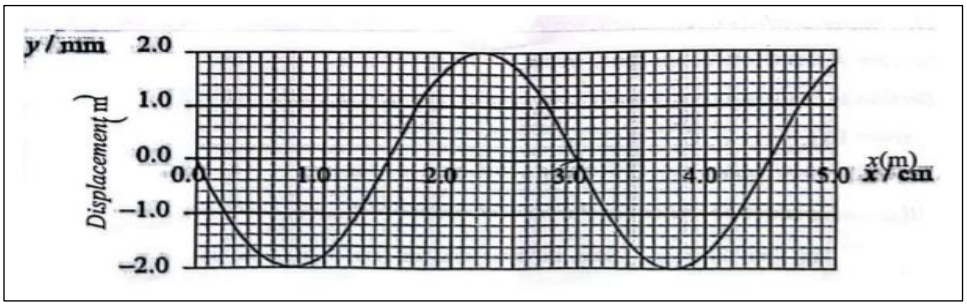

Figure 2: Waves

Hint:

- The speed of the water waves is 144 km/hr
- 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 saucepan 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 reflector in Fig 1 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 water flooding at the sea shore.

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