

SECTION A

Answer all the items in this section.

Item 1

A child observes images formed when he looks at the two curved surfaces of a spoon. He realizes that the inner surface provides an image that is upside down whereas the outer surface produces an upright image. The child does not understand why the two images appear different, and approaches you for assistance.

Task

- (a) (i) Using relevant diagrams, explain to the child how each surface of the spoon forms an image.
- (ii) For each of the surfaces of the spoon, state two other properties of the image it forms.
- (b) A student places an object at the centre of curvature of a concave mirror of focal length 10.0 cm. A second student places an object at a distance of 8.0 cm from the same mirror. Compare the images obtained by the two students.
- (c) State and explain two applications of spoon-like shaped mirrors.

Item 2

While walking from one part of a concert hall to another, a student realized that the loudness of the sound from two loudspeakers was not the same. At some point, the sound was very loud but at some other point, the sound was low. To his amazement, the output of the individual loudspeakers remained the same. Using your knowledge of waves, help the student by;

Task

- (a) (i) Stating and explaining the phenomenon that caused the observation made by the student.
- (ii) Stating and explaining two other properties of waves.
- (b) Using examples, help the student to differentiate between
- (i) Longitudinal waves and transverse waves.
- (ii) Electromagnetic and mechanical waves.
- (c) During a thunderstorm, light and sound are produced at the same time.
- (i) What observation will a person standing 20 km away from the point where lightning struck make?
- (ii) Explain your observation in ^c(i) above.

Hint: The speed of light in a vacuum is $3.0 \times 10^8 \text{ ms}^{-1}$
The speed of sound in air is 330 ms^{-1} .

Item 3

Your sister read a book about planets and discovered that Mother Earth is one of the planets revolving around the sun which is at the centre of our solar system. Revolving around the Earth is the Earth's natural satellite known as the Moon. The information seemed confusing to her. Using your knowledge of light and the solar system;

Task

- (a) Explain to her the meaning of the terms planet and satellite.
- (b) Using a well-labelled diagram, show her (in order) the position of different planets in the solar system clearly distinguishing between the rocky (inner planets) and the Jovian planets (gaseous planets). And also show the position of the asteroid belt.
- (c) Explain to her why Pluto is no longer considered to be a planet.
- (d) Explain to her the importance of studying Earth and Space physics.

SECTION B**PART I**

Answer one item from this part

Item 4

An engineer at a construction site requires a team of 8 men to lift 10,000 litres of water through a height of 28.8 m in 4 hours. However, his foreman has advised that they hire a pump that can execute the same task in just 15 minutes. The foreman is tasked to explain why using the pump is better than using the 8 men and needs to rate the working of the men and pump power to be hired and has approached you to assist him.

Task

As a student of physics, help the foreman to;

- (a) Get average rate at which each man is working?
- (b)
 - (i) Get the power rating of the pump to be used as to execute the task in the stipulated time?
 - (iii) What assumption(s) have you made?
 - (iv) Give the meaning of the term power as used in this item?
In what SI units is it measured?

Item 5

At a vigil, mourners are usually treated to a cup of porridge as they gather around the fire to warm their bodies. During the cooking process, the heat from the fire passes through the saucepan; into the porridge; and is carried away by the steam. Mourners sitting at the fire point developed an argument about the heat transfer process and you are tasked to explain as a student of physics;

Turn Over

Task

- (a) Give the mourners the process by which heat;
 - i) Reach the mourners?
 - ii) Move through the porridge?
 - iii) Pass through the material of the saucepan?
- (b) Briefly explain the modes of heat transfer stated in (a) above.
- (c) With the help of well labelled diagrams, distinguish between a sea breeze and a land breeze.

PART II

Answer **one** item from this part.

Item 6

In an experiment to study the properties of magnets, a student suspends a bar magnet freely using a thread. The magnet comes to rest with its North Pole facing the geographic north and the South Pole facing the geographic south. The student repeats the experiment and gets the same result. She gets disturbed and wants to find out why the magnet keeps resting in that position.

Task:

As a student of physics;

- (a) Help the student understand why the bar magnet rests in the stated position.
- (b) Draw a diagram to show the interaction between the magnetic field of the bar magnet and the earth's magnetic field.
- (c) Give and explain two applications of magnets.

Item 7

We use cloth that is made of different materials. Some are natural, others are synthetic. In the evening while ironing a dress, a woman realizes that there are some sparks that come from her dress after ironing it. She wonders whether there is some kind of magic in the cloth.

Task:

As a student of S.3,

- (a) Help the woman understand what causes the cloth to produce sparks.
- (b) Explain two other ways by which static electricity can be produced.
- (c) With the aid of a labelled diagram, describe a structure that can be used to protect people from the dangerous effects of lightning.

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