GREENLAWNS SCHOOL, WORLI

First Semester Examination 2023-24

PHYSICS

STD: X **Marks: 80**

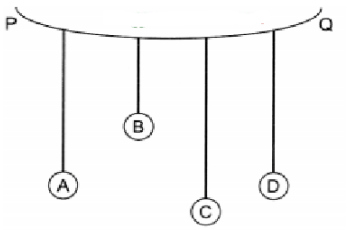
Date:07/10/2024 **Time: 2hrs**

SECTION – I (40 Marks)

Attempt all questions from this Section.

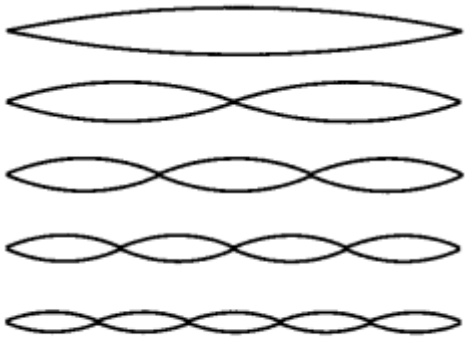
Question 1 Choose the correct answers to the questions from the given options. (Do not copy the question, write the correct answers only.) [15]

(i) Pendulums A, B, C and D are tied to a flexible string PQ and are at rest. Pendulum C is disturbed. Which of the following statements is true.



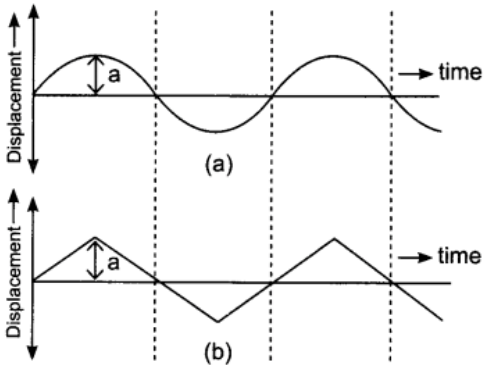
(a) Only pendulum C will start vibrating.
(b) Pendulums A, B, and D will also start vibrating but A and D will vibrate with the maximum amplitude.
(c) Pendulums A, B, and D will also start vibrating.
(d) Vibrations of pendulum C are forced vibrations.

ii. The frequency of the topmost wave is 100 Hz. What is the frequency of the bottom most wave?



(a) 100 Hz (b) 400 Hz
(c) 500 Hz (d) 600 Hz

iii. Consider the following two figures of two different waves.



How figure (a) and figure (b) differs?
(a) They differ in waveform
(b) They differ in amplitude
(c) They differ in frequency
(d) They are identical graphs

iv. A machine in which displacement of load is more than displacement of effort, then velocity ratio is
(a) greater than 1 (b)zero (c) equal to 1 (d) less than 1

v. In Class III levers there is gain in
a) force b) energy c) speed d) both (a)and (c)

vi. Match the following:

Column I	Column II
a. Light Wave	1. Satellite signals
b. Sound Wave	2. TV remote controls
c. Infrared rays	3. Cannot travel in outer space
d. Radio waves	4. Can travel in vacuum

(a) a-1, b-3, c-2, d-4 (b) a-1, b-2, c-3, d-4
(c) a-4, b-3, c-2, d-1 (d) a-4, b-2, c-3, d-1

vii. The work done by all the forces (external & internal) on a system equals to change in
(a) Total Energy (b) kinetic energy (c) Potential Energy (d) Not

viii. When a body is thrown vertically upwards, then
(a) Potential energy changes into Kinetic energy
(b) Kinetic energy changes into potential energy
(c) Heat energy changes into light energy
(d) None of the above.

ix. The MA of an ideal single movable pulley is
(a) 1 (b) 2 (c) < 2 (d) < 1

x. An object in a denser medium when viewed from a rarer medium appears to be raised. The shift is maximum for
(a) Red light (b) Violet light (c) Yellow light (d) Green light

xi. The refractive index of glass is 1.5. What is the critical angle for glass air interface? (sin 42^0 = 2/3)
(a) 24^0 (b) 42^0 (c) 37.5^0 (d) 21^0

xii. If the magnification of a lens has negative value, the image is:
(a) Virtual and erect (b) Real and inverted (c) A or B any (d) Neither A nor B

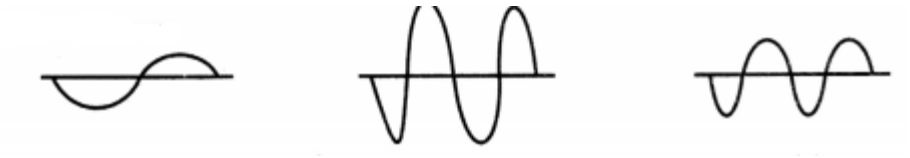
xiii. A radiation X is focused by a proper device on the bulb of a thermometer due to which mercury in it shows a rapid increase. The radiation X is:
(a) Infrared radiation (b) Visible light (c) Ultraviolet radiation (d) X-rays

xiv. **Assertion (A):** A heavier object placed at a far distance from the pivot point will have the same moment as a lighter object placed close to the pivot point.
Reason (R): The moment of force is determined by the magnitude of the force along with its distance from the pivot point.
(a) Both A and R are true. (b) Both A and R are false.
(c) A is false but R is true. (d) A is true but R is false.

xv. **Assertion (A):** An empty test tube placed in water in a beaker with its mouth outside the water surface appears silvery when viewed from a suitable direction.
Reason (R): The substance in water appears silvery due to refraction of light.
(a) Both A and R are true. (b) Both A and R are false.
(c) A is false but R is true. (d) A is true but R is false.

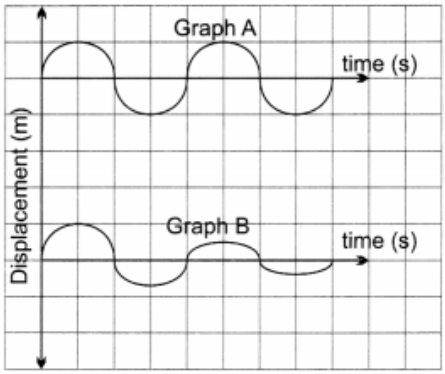
Question 2

a. Consider the following figure



(i) What is amplitude of a wave? Which one in the figure has the highest amplitude?
(ii) Which one has the lowest frequency? **[3]**

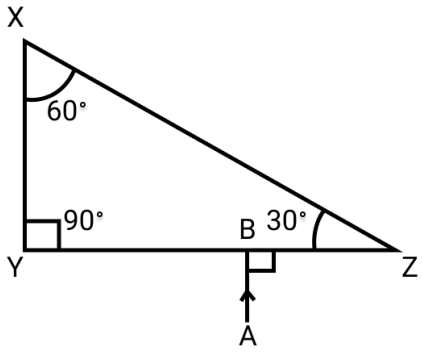
b. Which one of the following graphs A or B shows free vibrations in vacuum and which one shows free vibrations in a medium. **[2]**



c. boy uses blue colour of light to find the refractive index of glass. He then repeats the experiment using red colour of light. Will the refractive index be the same or different in the two cases? Give a reason to support your answer. **[2]**

d. (i) State the relation between the critical angle and the absolute refractive index of a medium.
(ii) Which colour of light has a higher critical angle? Red light or Green light. **[2]**

e. The following diagram shows a 60°, 30°, 90° glass prism of critical angle 42°. Copy the diagram and complete the path of incident ray AB emerging out of the prism marking the angle of incidence on each surface. **[2]**



f. An electromagnetic radiation is used for photography in fog.
(i) Identify the radiation.
(ii) Why is this radiation mentioned by you, ideal for this purpose? **[2]**

g. (i) If the lens is placed in water instead of air, how does it's focal length change?
(ii) Which lens, thick or thin has greater focal length? **[2]**

Question 3

a. If the power of a motor be 100 kW, at what speed can it raise a load of 50,000 N? **[2]**

b. How is the frequency of a stretched string related to: **[2]**

(i) it's length?

(ii) it's tension?

c. **(i)** A boy uses a single fixed pulley to lift a load of 50 kgf to some height. Another boy uses a single movable pulley to lift the same load to the same height. Compare the effort applied by them. Give a reason to support your answer.

(ii) How does uniform circular motion differs from uniform linear motion? **[2]**

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d. **(i)** Why is the ratio of the velocities of light of wavelengths 4000 Å and 8000 Å in vacuum 1 : 1 ?

(ii) Which of the above wavelengths has a higher frequency? **[2]**

e. State the position of the object in front of a converging lens if: **[2]**

(i) It produces a real and same size image of the object.

(ii) It is used as a magnifying lens.

SECTION II (40 Marks)

Attempt any 4 questions from this Section.

Question 4

a. A stone of mass 'm' is rotated in a circular path with a uniform speed by tying a strong string with the help of your hand. Answer the following questions:

(i) Is the stone moving with a uniform or variable velocity?

(ii) Is the stone moving with a uniform acceleration? In which direction does the acceleration act?

(iii) What kind of force acts on the hand and state it's direction? **[3]**

b. **(i)** Write a relationship between angle of incidence and angle of refraction for a given pair of media.

(ii) When a ray of light enters from one medium to another having different optical densities it bends. Why does this phenomenon occur?

(iii) Write one condition where it does not bend when entering a medium of different optical density. **[3]**

c. A pulley system with V.R. = 4 is used to lift a load of 175 kgf through a vertical height of 15 m. The effort required is 50 kgf in the downward direction.
($g = 10\ N\ kg^{-1}$)
Calculate:

(i) Distance moved by the effort.

(ii) Work done by the effort.

(iii) M.A. of the pulley system.

(iv) Efficiency of the pulley system. **[4]**

Question 5

a. A lens produces a virtual image between the object and the lens.

(i) Name the lens.

(**ii**) Draw a ray diagram to show the formation of this image.

(ii) Below ray diagram shows the formation of this image: **[3]**

b. **(i)** Name the unit of physical quantity obtained by the formula $2K / V^2$
Velocity.

(ii) The power of a lens is –5D.

(a) Find it's focal length.

(b) Name the type of lens. **[3]**

c. **i.** Give one example of each when:

(a) Chemical energy changes into electrical energy.

(b) Electrical energy changes into sound energy. **[2]**

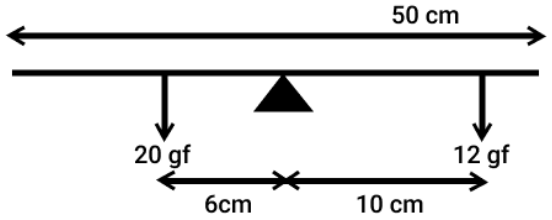
ii. Where should an object be placed in front of a convex lens in order to get:

(a) an enlarged real image,

(b) enlarged virtual image? **[2]**

Question 6

a. A half metre rod is pivoted at the centre with two weights of 20 gf and 12 gf suspended at a perpendicular distance of 6 cm and 10 cm from the pivot respectively as shown below.



(i) Which of the two forces acting on the rigid rod causes clockwise moment?

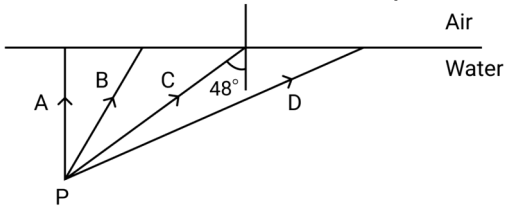
(ii) Is the rod in equilibrium?

(iii) The direction of 20 gf force is reversed. What is the magnitude of the resultant moment of the forces on the rod? **[3]**

b. **(i)** Draw a diagram to show a block and tackle pulley system having a velocity ratio of 3 marking the direction of load (L), effort (E) and tension (T).

(ii) If its MA is 2.5, Is the above pulley system an ideal machine or not? **[3]**
not ideal.

c. The diagram below shows point source P inside a water container. Four rays A, B, C, D starting from the source P are shown up to the water surface.



(i) Show in the diagram the path of these rays after striking the water surface. The critical angle for water air surface is 48°.

(ii) Name the phenomenon which the rays B and D exhibit.

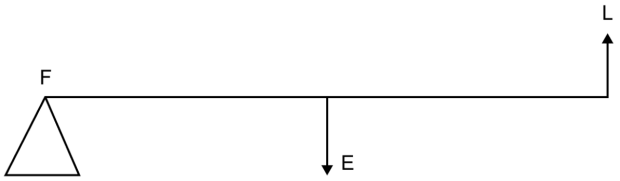
(ii) The ray B exhibits refraction while the ray D exhibits total internal reflection. **[4]**

Question 7

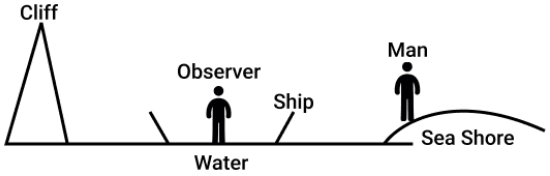
a. How does the angle of deviation formed by a prism change with the increase in the angle of incidence? Draw a graph showing the variation in the angle of deviation with the angle of incidence at a prism surface. **[3]**

b. **i.** A satellite revolves around a planet in a circular orbit.
What is the work done by the satellite at any instant?
Give a reason.

ii. How is it possible to increase the M.A. of the given lever without increasing its length? **[3]**

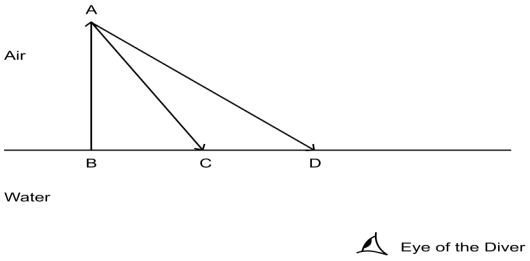


c. A person is standing at the sea shore. An observer on the ship which is anchored in between a vertical cliff and the person on the shore fires a gun. The person on the shore hears two sounds, 2 seconds and 3 seconds after seeing the smoke of the fired gun. If the speed of sound in the air is 320 ms^{-1} then calculate:
(i) the distance between the observer on the ship and the person on the shore.
(ii) the distance between the cliff and the observer on the ship. **[4]**



Question 8

a. A diver in water looks obliquely at an object AB in air.



(i) Does the object appear taller, shorter or of the same size to the diver?
(ii) Show the path of two rays AC & AD starting from the tip of the object as it travels towards the diver in water and hence obtain the image of the object. **[3]**

b. Give reasons for the following:
During the day:
(i) Clouds appear white. **(ii)** Sky appears blue. **[3]**

c. A convex lens of focal length 10 cm is placed at a distance of 60 cm from a screen. How far from the lens should an object be placed to obtain a real image on the screen? And find magnification and nature of image **[4]**

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