

**ST. JOSEPH'S COLLEGE, PRAYAGRAJ**
HALF-YEARLY EXAMINATION 2025-26**PHYSICS**
CLASS - X**TIME: 2 Hours****MM: 80****Instructions:**

You will not be allowed to write during first 15 minutes. This time is to be spent in reading the question paper. The time given at the head of this Paper is the time allowed for writing the answers. Section A is compulsory. Attempt all questions from Section B. The intended marks for questions or parts of questions are given in brackets []

SECTION - A [40 MARKS]

(Attempt all questions from this section)

Q 1)**[15]**

(i) A steering wheel of diameter 50 cm is rotated clockwise by applying a couple with each force of magnitude 7 N. The moment of couple applied is:

- (a) 7.0 Nm (b) 3.5 Nm (c) 50 Nm (d) 25 Nm

(ii) A man does 800 J of work in lifting a 40 kg bucket from a well. The depth of the well is ($g = 10 \text{ ms}^{-2}$):

- (a) 1 m (b) 0.5 m (c) 2 m (d) 0.2 m

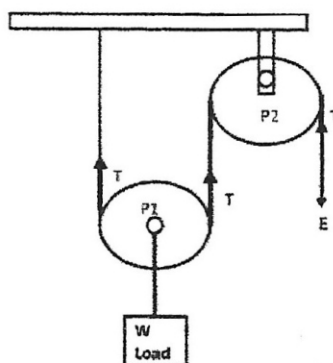
(iii) The centre of gravity of a cricket ball is at:

- (a) its geometric centre (b) its bottom touching the ground
(b) its top-most point (d) any point on its surface

(iv) The moving parts of a machine get heated due to friction, thus, a part of mechanical energy changes into:

- (a) chemical energy (b) magnetic energy
(b) heat energy (d) none of these

(v) The diagram given below shows the combination of two pulleys P_1 and P_2 used to lift a load W . If the free end of the string moves through a distance x , by what distance is the load raised?



- (a) x (b) $x/3$ (c) $x/2$ (d) $2x$

(vi) The refractive index of air relative to glass is $2/3$ and that of diamond relative to air is $12/5$. The refractive index of glass relative to diamond is:

- (a) $\frac{5}{18}$ (b) $\frac{8}{9}$ (c) $\frac{5}{8}$ (d) $\frac{18}{5}$

(vii) When a ray of light moves from one medium into another there is no change in its:

- (a) wavelength (b) frequency (c) speed (d) direction

(viii) A convex lens forms an image which is real, inverted and equal to the size of the object, if the object is placed:

- (a) at infinity (b) between F and $2F$
(c) between optical centre and focus (d) at $2F$

(ix) How many strands are supporting the load in case of block and tackle system of 5 pulleys?

- (a) 4 (b) 5 (c) 6 (d) 7

(x) The electromagnetic wave having the shortest wavelength is:

- (a) X-rays (b) infrared rays (c) radio waves (d) γ -rays

(xi) Which of the following colour of light undergoes the maximum deviation while passing through a glass prism?

- (a) Violet (b) Green (c) Blue (d) Red

(xii) **Assertion:** The focal length of a lens does not change when red light is replaced by blue light.

Reason: The focal length of a lens depends on the refractive index of material of lens.

- (a) Both Assertion and Reason are true.
(b) Both Assertion and Reason are false.
(c) Assertion is false and Reason is true.



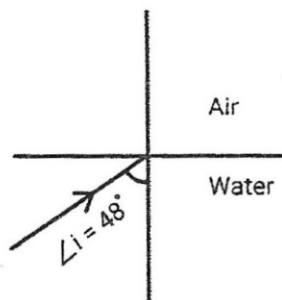
- (d) Assertion is true and Reason is false.
- (xiii) If 1 J of work is done in 1s, the power spent is said to be:
(a) 1 HP (b) 1 kW (c) 1 W (d) 746 W
- (xiv) A pendulum with bob of mass m is oscillating on either side from its resting position P between the extremes Q and R at vertical height h above P. On which position of bob, kinetic energy is minimum?
(a) At P (b) At Q (c) At R (d) Both (b) and (c)
- (xv) In a circular motion:
(a) the velocity of the body is variable (b) the speed of the body is uniform
(c) it is an accelerated motion (d) all of these

Q 2)

- (i) Complete the following by choosing the correct answer from the bracket. [4]
(a) In _____ (bottle opener/sugar tongs), load is situated between effort and fulcrum.
(b) A _____ [class I/ classII/ classIII] lever will always have mechanical advantage less than 1.
(c) In a block and tackle system, increase in the weight of the movable block _____ [decreases, does not affect, increases] the efficiency of the pulley system.
(d) The focal length of a thin convex lens is _____ [more/less] than that of a thick convex lens.
- (ii) A ray of light is incident normally on a rectangular glass slab. Draw a ray diagram showing the path of the ray till it emerges out the slab. What is the angle of incidence and angle of refraction at each surface at each surface of slab? [2]
- (iii) Why is it easier to open the cap of a pen with two fingers than with one finger? [2]
- (iv) Two bodies of equal masses move with the uniform velocities v and $3v$ respectively. Find the ratio of their kinetic energies. [2]

Q 3)

- (i) A uniform metre scale can be balanced at the 70.0 cm mark when a mass of 0.05 kg is hung from 94.0 cm mark. [2]
(a) Draw a diagram of the arrangement.
(b) Find the mass of the metre scale.
- (ii) A crane 'A' lifts a heavy load in 5 seconds, whereas another crane 'B' does the same work in 2 seconds. Compare the power of crane 'A' to that of crane 'B'. [2]
- (iii) A type of single pulley is very often used as a machine even though it does not give any gain in mechanical advantage. [2]
(a) Name the type of pulley used.
(b) For what purpose is such a pulley used?
- (iv) Derive relationship between kWh and joule. [2]



- (v) A ray of light travels from water to air as shown in the diagram given below: [2]
(a) Copy the diagram and complete the path of the ray. Given that the critical angle for water is 48°
(b) State the condition so that total internal reflection occurs in the above diagram.
- (vi) (a) Name a prism required for obtaining a spectrum of Ultraviolet light. [2]
(b) Name the radiations which can be detected by a thermopile.
- (vii) A lens of focal length 20 cm forms an inverted image at a distance 60 cm from the lens. [3]
(a) Identify the lens.
(b) How far is the lens present in front of the object?
(c) Calculate the magnification of the image.

SECTION – B [40 MARKS]

(Attempt all questions from this section)

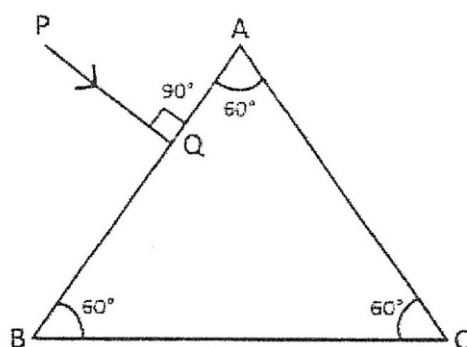
- Q 4) (i) A stone of mass m is rotated in a circular path with a uniform speed by tying a strong string with the help of your hand. Answer the following questions. [3]
(a) Is the stone moving with a uniform or variable speed?

[2]

- (b) Is the stone moving with a uniform acceleration?
(c) What kind of force acts on the hand and state its direction?
(ii) State the energy changes in the following cases while in use: [3]
(a) Microphone (b) Electric cell (c) An electric bulb
(iii) A pump is used to lift 500 kg of water from a depth of 80 m in 10 s. Calculate: [4]
(a) work done by the pump.
(b) the power at which the pump works.
(c) the power rating of the pump if its efficiency is 40%.

Q 5)

- (i) (a) 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). [3]
(b) The pulley system drawn lifts a load of 150 N when an effort of 60 N is applied. Find its mechanical advantage.
(c) Is the above pulley system an ideal machine or not?
(ii) (a) How does the angle of deviation produced by a prism change with increase in the angle of incidence. Draw a curve showing the variation in the angle of deviation with the angle of incidence at a prism surface. [3]
(b) Using the curve in part (a) above, how would you infer that for a given prism, the angle of minimum deviation is unique for light of a given wavelength?
(iii)

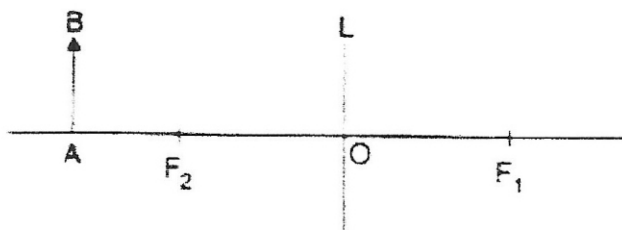


In the above given figure, a ray of light PQ is incident normally on the face AB of an equilateral glass prism. Complete the ray diagram showing its emergence into air after passing through the prism. Take critical angle for glass = 42°

- (a) Write the angles of incidence at the faces AB and AC.
(b) Name the phenomenon which the ray of light suffers at the face AC and BC. [4]

Q 6)

- (i) The diagram below shows an object AB placed on the principal axis of a lens L. The two foci of the lens are F_1 and F_2 . The image formed by the lens is erect, virtual and diminished. [3]
(a) Draw two rays to locate the position of the image.
(b) State the position of the image formed.

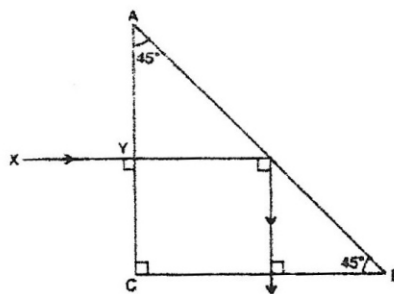


- (ii) (a) Can the absolute refractive index of a medium be less than one?
(b) A coin placed at the bottom of a beaker appears to be raised by 4.0 cm. If the refractive index of water is $4/3$, find the depth of the water in the beaker. [3]
(iii) A type of electromagnetic wave has wavelength 50 Å. [4]
(a) Name the wave.
(b) What is the wavelength range of the wave named in part (a).
(c) What is the speed of the wave in vacuum?
(d) State one use of this type of wave.

Q 7)

(i) A ray of light XY passes through a right-angled isosceles prism as shown below.

[3]



- (a) What is the angle through which the incident ray deviates and emerges out of the prism.
- (b) Name the instrument where this action of prism is put into use.
- (c) Which prism surface will behave as a mirror?

(ii) (a) The power of a lens is $-5D$.

[3]

(i) Find its focal length.

(ii) Name the type of lens.

(b) State the position of the object in front of a converging lens if it produces a real and same size image of the object.

(iii) (a) A uniform metre scale of mass 80 g is to be balanced at the 70 cm mark. Find, from where must a mass of 60 g be suspended to do so.

(b) What is lateral displacement? Draw a ray diagram showing the lateral displacement of a ray of light when it passes through a parallel sided glass slab.

(c) Can a machine act as a force multiplier and a speed multiplier simultaneously?

[4]