HALF YEARLY EXAMINATION

SESSION (2024-25)

Subject – Physics

Std. X

Maximum Marks: 80
Time allowed : 120 minutes.

Answer to this paper must be written on the paper provided separately.
You will not be allowed to write during the first 10 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.
Attempt **all** questions from **Section A** and **any four** questions from **Section B.**
The intended marks for questions or parts of questions are given in the brackets [ ].

Section – A [40 Marks]

[Attempt all questions from this section]

Question 1:

Choose the correct answers to the questions from the given options: - **[1×15=15]**

(i) Out of the following, which one is an example of dynamic equilibrium?
1. Moon revolving around the earth
2. A pebble fixed at the end of a string whirling in a circular path.
3. An aeroplane moving at a constant height
4. A beam balanced in a horizontal position

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

(ii) The moment of force for anticlockwise moment is taken as ..... and for clockwise moment is taken as.....

(a) Positive, negative (b) Negative, positive
(c) Positive, positive (d) Negative, negative

(iii) The correct expression for force is:

(a) $\vec{F} = m\vec{a}$ (b) $\vec{F} = m\vec{v}$ (c) $\vec{F} = mp$ (d) $F = mp$

(iv) The centre of gravity of a body is the point about which the algebraic sum of moments of weights of all the particles constituting the body is:

(a) 1 (b) > 1 (c) < 1 (d) 0

(v) In vector form, work done W is written as:

(a) $\vec{W} = \vec{F} \cdot \vec{S}$ (b) $W = \vec{F} \cdot \vec{S}$ (c) $W = \vec{F} \times \vec{S} \sin\theta$ (d) $\vec{W} = F \times S \cos\theta$

(vi) The kinetic energy K and momentum P are related as:

(a) $P = \sqrt{2K}$ (b) $P = \sqrt{2gK}$ (c) $K = \frac{P^2}{2m}$ (d) $K = \sqrt{2mP}$

(vii) Class II levers are designed to have:

(a) M . A = V . R (b) M . A > V. R (c) M . A > 1 (d) M . A < 1

(viii) If there are n movable pulleys with one fixed pulley, the mechanical advantage is given by:

(a) 2^n (b) 2^{n-1} (c) 2^{n-1} (d) 2^{n+2}

(ix) For a system of n pulleys, the weight of the lower block along with pulleys is 'W'. then its efficiency is given by:

(a) $\eta = 1 - \frac{W}{nE}$ (b) $\eta = 1 + \frac{W}{nE}$ (c) $\eta = \frac{W}{nE}$ (d) $\eta = n - \frac{W}{E}$

(x) The refractive index of water is $\frac{4}{3}$ and that of glass is $\frac{3}{2}$. The refractive index of glass with respect to water is:

(a) $\frac{9}{8}$ (b) 2 (c) $\frac{8}{9}$ (d) 1

(xi) The relation between wavelength (λ), velocity (v) and frequency (f) is:

(a) $v = \lambda f$ (b) $v = \frac{\lambda}{f}$ (c) $v = \frac{f}{\lambda}$ (d) $v \times f = 1$

(xii) The angle of deviation becomes minimum when:

(a) $i_1 = r_1$ (b) $i_1 = r_2$ (c) $i_1 = i_2$ (d) $r_2 = i_2$

(xiii) The correct lens formula is:

(a) $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$ (b) $f = \frac{u+v}{uv}$ (c) $\frac{1}{u} - \frac{1}{v} = \frac{1}{f}$ (d) $f = \frac{uv}{u-v}$

(xiv) The correct order of angle of deviation of indigo, green, yellow and red colours is:

(a) $\delta_I > \delta_G > \delta_Y > \delta_R$ (b) $\delta_G > \delta_I > \delta_Y > \delta_R$

(c) $\delta_R > \delta_G > \delta_Y > \delta_I$ (d) $\delta_R > \delta_Y > \delta_G > \delta_I$

(xv) If l is the length of the string stretched between its ends, the wavelength of different modes in figure (1), (2) and (3) will be:

(1) (2) (3)

(a) $\frac{2l}{2}, 2l, \frac{2l}{3}$ (b) $\frac{2l}{3}, \frac{2l}{2}, 2l$ (c) $2l, \frac{2l}{2}, \frac{2l}{3}$ (d) $2l, \frac{2l}{3}, \frac{2l}{2}$

Question 2:

Answer these Questions: - **[15]**

(i) State whether the moment of force is a scalar or vector qauantity? [2]

(ii) Define the term 'centre of gravity' of a body? [2]

(iii) A body is acted upon by a force. State two condition when the work done is zero. [2]

(iv) State the work-energy theorem? [2]

(v) Write down expression to give mechanical advantage of a lever? [2]

(vi) State the Snell's law of refraction of light? [2]

(vii) (a) What is total internal reflection? [2]

(b) State two conditions necessary for total internal reflection?

(c) Draw a diagram to illustrate total internal reflection. [3]

Question 3:

Answer these Questions: - **[10]**

(i) What is meant by the statement "the critical angle for diamond is 24°"? [2]

(ii) Name two factors on which the refractive index of medium depends? State the dependency? [2]

(iii) Name two examples in which the mechanical energy of a system remains constant? [2]

(iv) What do you mean by degradation of energy? Give one example? [2]

(v) What is a lever? State its principle. [2]

Section – B [40 Marks]

[Attempt any four questions.]

Question 4:

(i) A nut is open wrench of length 25 cm. If the least force required is 10 N. Find the moment of force needed to turn the nut. [3]

(ii) A stone of mass 500 g is thrown vertically upwards with a velocity of 15 m/s. Calculate:

(a) the potential energy at the greatest height.

(b) the kinetic energy on reaching ground. and

(c) the total energy at its half-way point. [3]

(iii) A ray of light is normally incident on one face of an equilateral glass prism. Answer the following:

(a) What is angle of incidence at first face of prism?

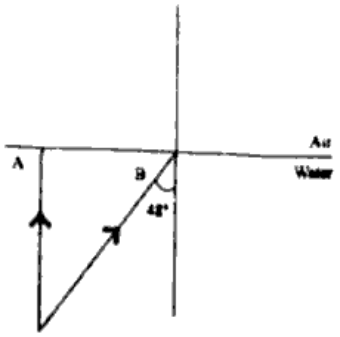
(b) What is angle of refraction from first face of prism?

(c) What will be the angle of incidence at second face?

(d) Will light suffer minimum deviation? [4]

Question 5:

(i) In the given figure alongside shows two rays A and B travelling from water to air. If the critical angle for water-air. If the critical angle for water-air surface is 48°, complete the ray diagram showing the refracted rays for each. State the conditions when the ray will suffer total internal reflection. [3]



(ii) Prove that: Refractive index $= \frac{\text{real depth}}{\text{apparent depth}}$. [3]

(iii) Draw a diagram to show the wave pattern of a high pitch note and a low pitch note, but of the same loudness. [4]

Question 6:

(i) What is meant by gravitational potential energy? Derive an expression for it for a body placed at a height above the ground. [3]

(ii) In figure a uniform bar of length '*l*' in is suspended with support at its ends and loaded by a weight W kgf at its middle. In equilibrium, find the reactions R_1 and R_2 at the ends. [3]

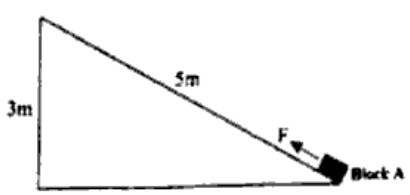
(iii) Out of the two lenses, one concave and the other convex, state which one will show divergent action on a light beam. Draw diagrams to illustrate your answer. [4]

Question 7:

(i) Describe how you would determine focal length of a converging lens using a plane mirror and one pin. Draw a ray diagram to illustrate your answer? [3]

(ii) What are damped vibrations? How do they differ from free vibrations? Give one example of each. [3]

(iii) A block A, weighing 100 N, is pulled up a slope of length 5 m by means of a constant force F (= 100N) as illustrated in figure. [4]



(a) What is the work done by the force F is moving the block A, 5 m along the slope?

(b) What is the increase in potential energy of the block A?

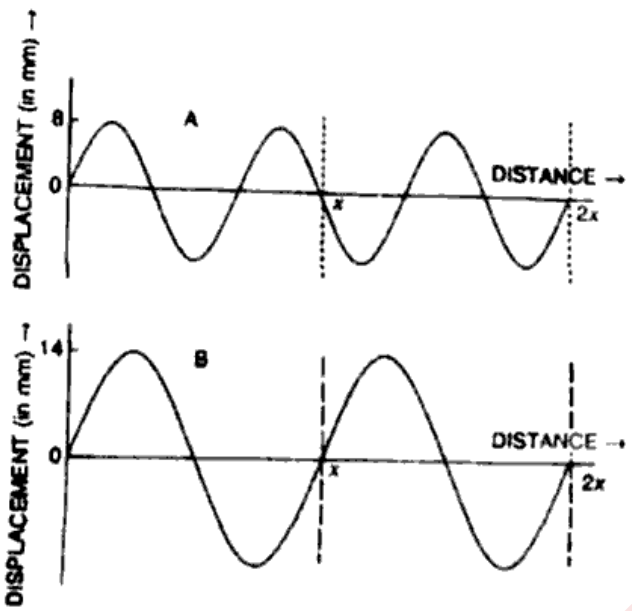
(c) Account for the difference in the work done by the force and the increase in potential energy of the block?

Question 8:

(i) A lens forms the image of an object placed at a distance of 15 cm from it. Find:
(a) the focal length
(b) the magnification
(c) the nature of image [3]

(ii) (a) Show with diagram the refraction of light through a rectangular glass block.
(b) State the factors on which lateral displacement depends. [3]

(iii) In figure A and B represent the displacement-distance graphs of two sound waves when they pass through air.



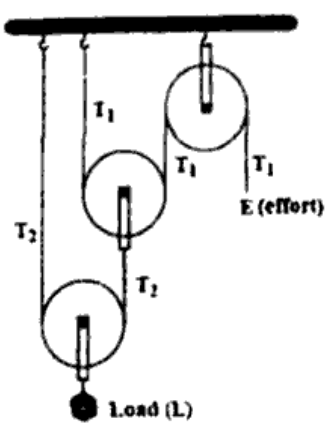
(a) What is the relation between there velocities, wavelength, pitch and loudness?
(b) How do the differ in quality? [4]

Question 9:

(i) Calculate the minimum distance between the source and reflector in water so that the echo is heard distinctly? (speed of sound in water = ~~14m-s^{-1}~~ 1400 m s^{-1}) [3]

(ii) Derive the lens formula? [3]

(iii) In mentioned diagram of three pulleys A, B and C. The load is marked as L and effort as E. [4]



(a) Name the pulleys A, B and C.
(b) How are the magnitudes of L and E related to the tension T_1?
(c) Calculate mechanical advantage and velocity ratio of arrangement.
(d) What assumptions you made in the parts (b) and (c)?

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