ST. JOSEPH'S COLLEGE, PRAYAGRAJ
HALF YEARLY EXAMINATIONS – OCTOBER 2023
PHYSICS
CLASS X

Duration: 2 Hrs **Maximum Marks: 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* **any four** *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.)

Question 1.

Choose the correct answers to the questions from the given options. [15]

(i) The moment of a force about a given axis depends:

    (a) only on the distance of force from the axis

    (b) only on the magnitude of the force

    (c) both on the force and the distance of force from the axis

    (d) both on the force and its perpendicular distance from the axis

(ii) The energy conversion, when an oscillating pendulum moves from extreme to mean position is:

    (a) kinetic to potential   (b) potential to kinetic

    (c) potential to kinetic to potential   (d) kinetic to potential to kinetic

(iii) To detect the obstacles in their path, bats produce:

    (a) Infrasonic waves   (b) Ultrasonic waves

    (c) Electromagnetic waves   (d) Radio waves

(iv) From the power rating of any electrical appliance, we can find:

    (a) The resistance of the appliance

    (b) The safe limit of current which can flow through the appliance

    (c) both (a) and (b)   (d) none of these

(v) A convex lens forms a virtual, erect and magnified image if the object is placed:

    (a) at infinity   (b) between F and 2F

    (c) between optical centre and focus   (d) at focus

(vi) A ray of light suffers refraction through an equilateral prism. The deviation produced by the prism does not depend on the:

    (a) angle of incidence   (b) colour of light

    (c) material of prism   (d) size of prism

(vii) Which of the following nuclear radiations is least penetrating?

    (a) Alpha   (b) Beta   (c) Gamma   (d) None of these

(viii) When a body vibrates under a periodic force, the vibrations of the body are:

    (a) natural vibrations   (b) damped vibrations

    (c) forced vibrations   (d) resonant vibrations

(ix) The lens of power +1.0 D is:

    (a) convex of focal length 1.0 cm   (b) convex of focal length 1.0 m

    (c) concave of focal length 1.0 cm   (d) concave of focal length 1.0 m

(x) The most energetic electromagnetic radiations are:

    (a) microwaves   (b) ultraviolet waves   (c) X-rays   (d) gamma rays

(xi) **Assertion** :Infrared radiations travel long distances through dense fog and mist.

    Reason: Infrared radiations undergo minimal scattering in earth's atmosphere

    (a) assertion is false but reason is true (b) assertion is true reason is false

    (c) both assertion and reason are true (d) both assertion and reason are false

(xii) In parallel combination of resistances :

    (a) potential difference is same across each resistance

    (b) total resistance is increased

    (c) current is same in each resistance

    (d) all above are true

(xiii) A single fixed pulley is used because it:

    (a) has mechanical advantage greater than 1

    (b) has velocity ratio less than 1

    (c) gives 100% efficiency

    (d) helps to apply the effort in a convenient direction

(xiv) In β- emission from a radioactive substance, an electron is ejected. This

    electron comes from :

    (a) the outermost orbit of atom   (b) the inner orbits of atom

    (c) the surface of substance   (d) the nucleus of atom

(xv) A movable pulley is used as :

    (a) a force multiplier   (b) a speed multiplier

    (c) a device to change the direction of effort   (d) an energy multiplier

Question 2

(i) (a) A body is acted upon by a force. State two conditions when the work done is zero. [3]

   (b) Why do we use a long handle with a screw jack?

(ii) Two bodies A and B have masses in the ratio 5 : 1 and their kinetic energies are in the ratio 125 : 9. Find the ratio of their velocities. [2]

(iii) A fire tongs has its arms 20 cm long. It is used to lift a coal of weight 1.5 kgf by applying an effort at a distance of 15 cm from the fulcrum. Find: (i) the mechanical advantage of the fire tongs, and

     (ii) the effort needed. [2]

(iv) An α-particle captures (a) one electron, (b) two electrons. In each case, what does it change to? [2]

(v) Complete the following nuclear changes. [2]

  (a) $_{x}^{a}P \longrightarrow Q + _{-1}^{0}\beta$

  (b) $_{92}^{238}U \longrightarrow _{90}^{234}Th + \text{----------} + \text{Energy}$

(vi) An electric press is rated '750 W, 230 V'. Calculate the electrical energy consumed by the press in 12 hours. [2]

(vii) What is meant by an echo? State two conditions necessary for an echo to be heard distinctly. [2]

Question 3

(i) State the factor that determines [2]

  (a) the loudness of the sound heard, and (b) the quality of the note.

(ii) Calculate the minimum distance required between the source of sound and the obstacle to hear an echo. Take speed of sound in air is 350 ms⁻¹. [2]

(iii) Two waves A and B have wavelength 0.01 Å and 9000 Å respectively. [2]

  (a) Name the two waves.

  (b) Compare the speeds of these waves when they travel in vacuum.

(iv) The magnification by a lens is -3. Name the lens and state how are u and v related? [2]

(v) The diagram given below shows the refraction of a ray of light from air to a liquid. [2]

  (a) Write the values of angle of incidence and angle of refraction.

  (b) Use Snell's law to find the refractive index of liquid with respect to air.
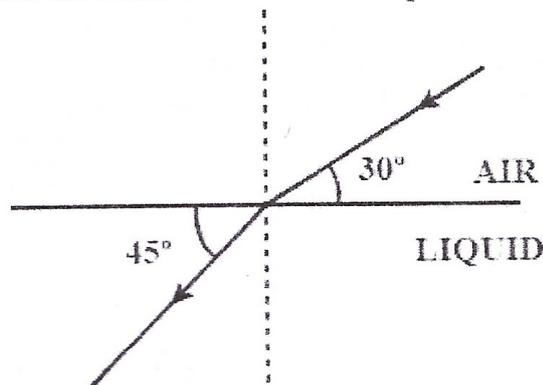
SECTION – B [40 MARKS]

## (Attempt any four questions from this Section)

Question 4

(i) How does the angle of deviation produced by a prism change with the 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]

(ii) A convex lens has a focal length of 20 cm. Calculate at what distance from the lens should an object be placed so that it forms an image at a distance of 40 cm on the other side of the lens. State the nature of the image formed. [3]

(iii) A ray of light strikes the surface of a rectangular glass block such that the angle of incidence is (a) 0^0 and (b) 42^0. Sketch a diagram to show the approximate path taken by the ray in each case as it passes through the glass block and emerges. [4]

Question 5

(i) A block and tackle system has 5 pulleys. If an effort of 1000 N is needed in downward direction to raise a load of 4500 N, calculate : [3]
(a) the mechanical advantage (b) the velocity ratio, and
(c) efficiency of the system.

(ii) A man fires a gun and hears its echo after 5 s. The man then moves 310 m towards the hill and fires the gun again. This time he hears the echo after 3 s. Calculate the speed of sound. [3]

(iii) A uniform half metre rule can be balanced at the 29 cm mark when a [4]
mass 20 g is hung from its one end.
(a) Draw a diagram of the arrangement.
(b) Find the mass of the half metre rule.
(c) In which direction would the balancing point shift if 20 g mass is shifted inside from its one end?

Question 6

(i) A spring is kept compressed by a small trolley of mass 0.5 kg lying on a trolley is released, it is found to move at a speed $v = 2$ m s^{-1}. What potential energy did the spring possess when compressed? [3]
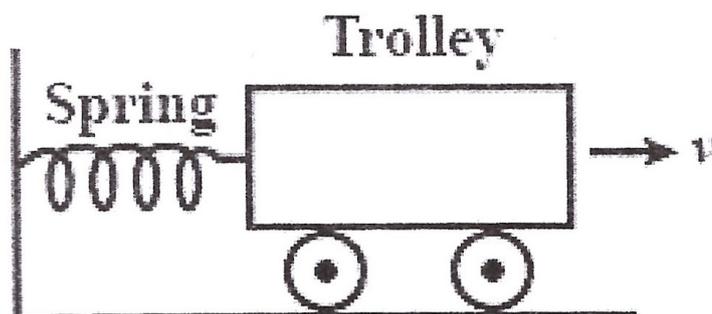
(ii) What device other than a plane mirror can be used to turn a ray of light through 180^0 ? [3]

(a) Draw a diagram in support of your answer.

(b) Name an instrument in which this device is used.

(iii) (a) State three differences between a single fixed pulley and a single movable pulley. [4]

(b) State one reason why mechanical advantage is less than the velocity ratio for an actual machine.
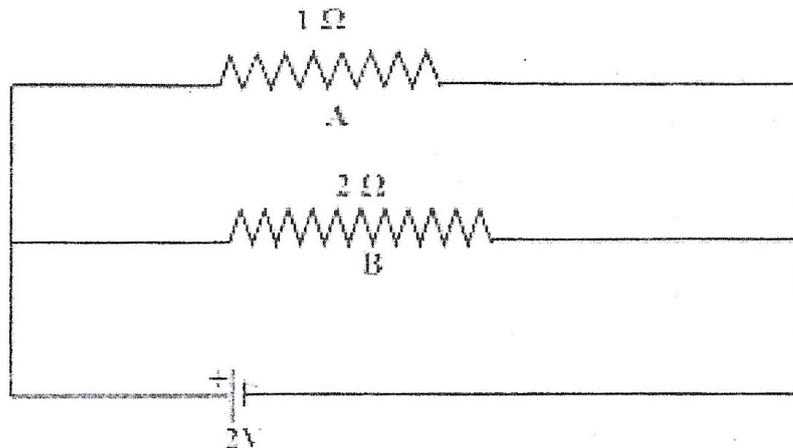
Question 7
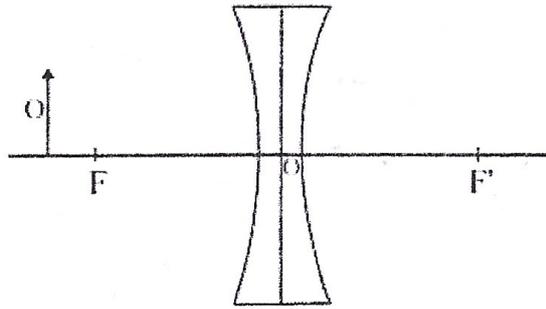
(i) In the above diagram, [3]

(a) What are the points F and F' called?

(b) Complete the diagram to form the image of the object.

(c) State three characteristics of the image.

(ii) (a) Which colour of the white light is deviated by a glass prism [3]

(1) the most , and (2) the least?

(b) **Give reason**: The lower block of a block and tackle pulley system must be of negligible weight.

(iii) The diagram given below shows the displacement –time graph of a vibrating body. [4]
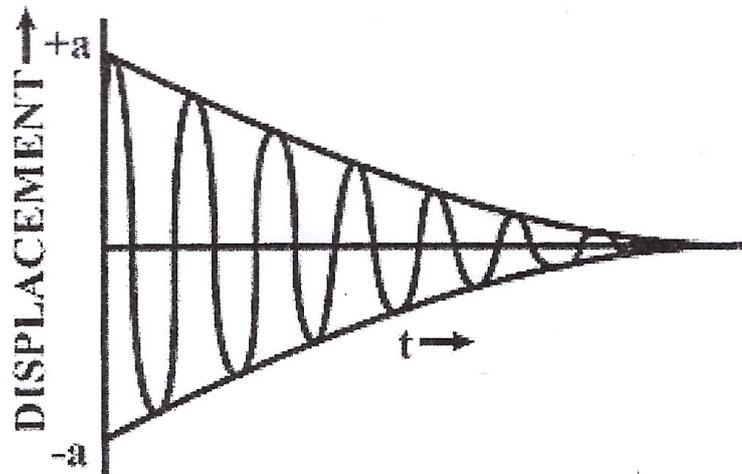
(a) Name the kind of vibrations.

(b) Give one example of such vibrations.

(c) Why is the amplitude of vibrations gradually decreasing?

(d) What happens to the vibrations of the body after some time?

Question 8

(i) Calculate the current flowing through each of the resistors A and B in the circuit shown below. [3]

(ii) What happens to the (1) atomic number, (2) mass number of the nucleus of an element when [3]

(a) an α – particle, (b) a β – particle, and (c) γ – radiation, is emitted?

(iii) Define: (a) Mass number   (b) Isobars [4]

           (c) Moment of couple   (d) Efficiency

Question 9

(i) At what point is the centre of gravity situated in: [3]

    (a) a triangular lamina   (b) a circular lamina   (c) a hollow cone

(ii) Name the three classes of levers and state how are they distinguished. Give two examples of each class. [3]

(iii) (a) Define the term refractive index of a medium. Can it be less than 1? [4]

     (b) Define the term specific resistance and state its S.I. unit.

     (c) A circuit consists of a resistor of 1 ohm in series with a parallel arrangement of resistors of 12 ohm and 6 ohm. Calculate the total resistance of the circuit. Draw a diagram of the arrangement.

*****************************ALL THE BEST*****************************