80 marks   Full syllabus   2 Hours

SECTION-A
(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 gain in kinetic energy is given by:

(a) $k=\frac{1}{2}mv^2$
(b) $k=m(v^2-u^2)$
(c) $k=\frac{mv^2}{2t}$
(d) $k=\frac{1}{2}m(v^2-u^2)$

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

(a) Kinetic to potential
(b) Potential to kinetic
(c) Potential to kinetic to potential
(d) Kinetic to potential to kinetic

(iv) Which of the following nuclear radiations is most penetrating?

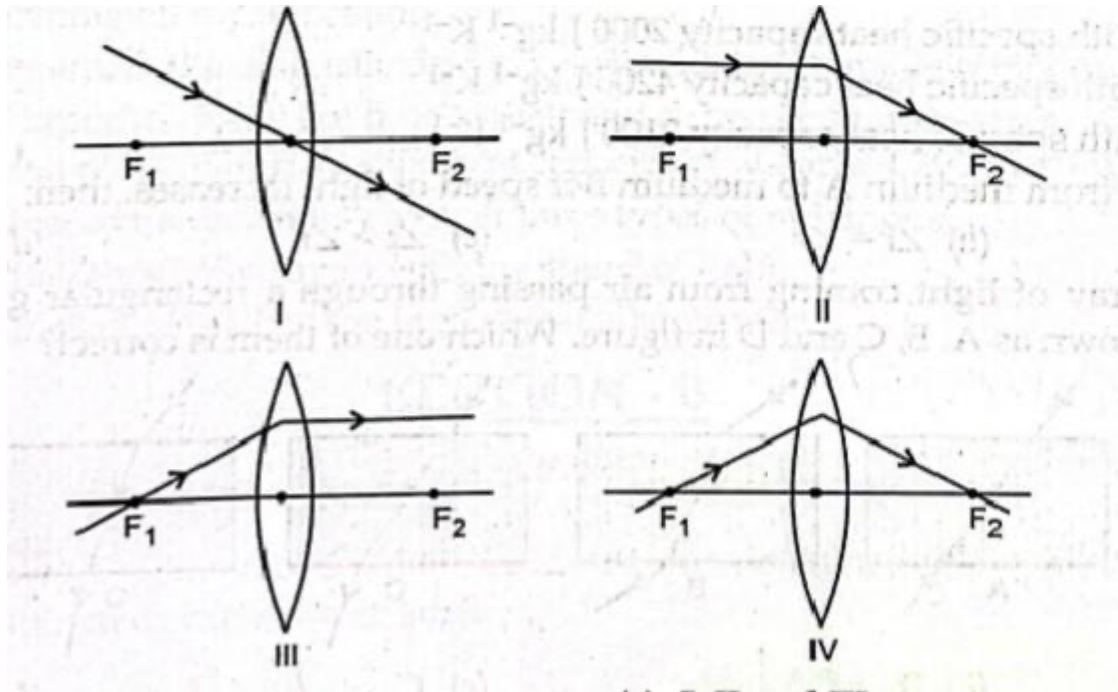(a) Alpha
(b) Beta
(c) Gamma
(d) None of these

(V) Out of the following which possesses the highest refractive index:

(a) crown glass

(b) flint glass
(c) water
(d) diamond

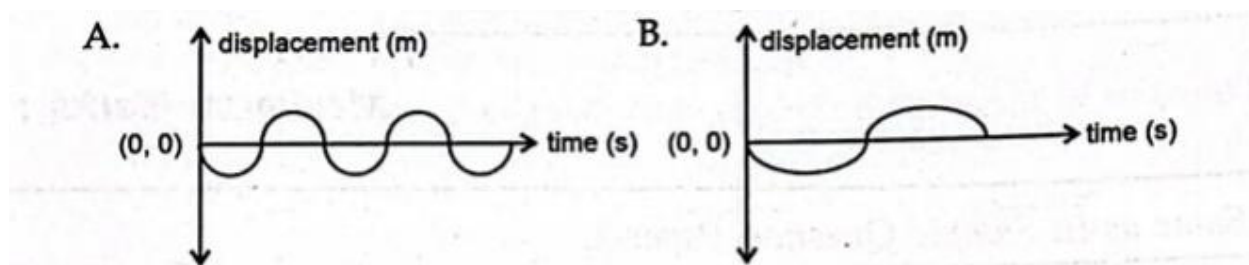(vi) The diagrams showing the correct path of the ray after passing through the lens are:

(a) II and III only
(b) I and II only
(c) I, II and III
(d) I, II and IV

(vii)The audible range for a normal human being is:
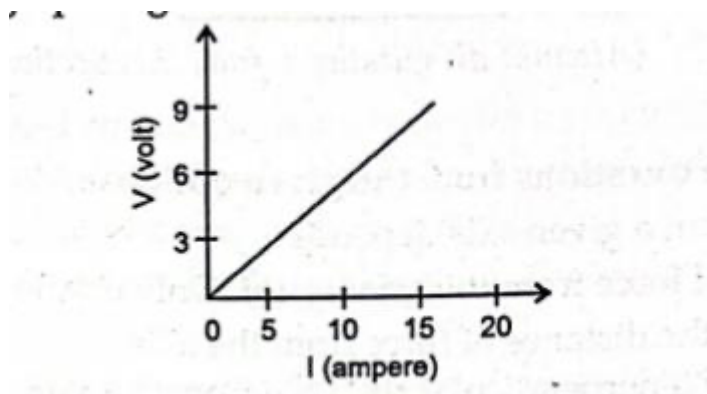
(a) 10 Hz to 20,000 Hz
(b) 20 Hz to 20 kHz
(c) 10 Hz to 50 kHz
(d) 20 Hz to 1000 Hz

(viii) The ratio of the wavelength of A: wavelength of B is: A.

A. displacement (m)

(0, 0) time (s)

B. displacement (m)

(0, 0) time (s)

(a) 5:2
(b) 1:2
(c) 2:1
(d) 2:3

(ix) The resistance whose V - I graph is given below is :

(a) 5/3 ohm
(b) 3/5 ohm
(c) 5/2 ohm
(d) 2/5 ohm

(x) An electric fan and a heater are marked as 100 W, 220 V and 1000 W, 220 V respectively.The resistance of the heater is:

(a) equal to that of the fan
(b) less than that of the fan
(c) greater than that of the fan
(d) zero

(xi) A soft iron bar is introduced inside a current carrying solenoid. The magnetic field inside the solenoid:
(a) no change
(b) will decrease
(c) will increase
(d) uncertain

(xii)Specific heat capacity of a substance is equal to

(a) mass of the substance x heat capacity
(b) heat capacity/mass of the substance
(c) mass of the substance/heat capacity
(d) none of the above

(xiii) Which of the following liquids is most suitable for radiators in cars?
(a) Liquid P with specific heat capacity 4000 J/Kg K
(b) Liquid Q with specific heat capacity 2000 J/Kg K
(c) Liquid R with specific heat capacity 4200 J J/Kg K
(d) Liquid S with specific heat capacity 2100 J J/Kg K

(xiv) While entering from medium A to medium B if speed of light increases, then:

(a) angle i < angle r
(b) angle i = angle r
(c) angle i> angle
(d) angle i<= angle

(xv) The path of a ray of light coming from air passing through a rectangular glass slab traced by four students are shown as A, B, C and D in figure. Which one of them is correct?
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(a) A   (b) B   (c) C   (d) D
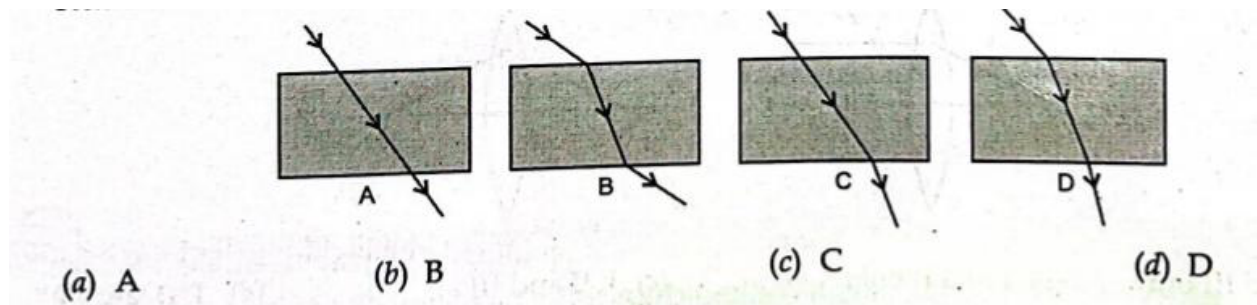
Question 2.

(i) (a) How many pulleys are there in a movable block of a block and tackle system with mechanical advantage 5?
(b) A radioactive nucleus emits an alpha particle. Does the position of daughter nucleus change periodic table as compared to the parent nucleus?
(c) To which electrically charged plate the alpha radiations will deflect while passing through an electric field [3]

(ii) (a) Name the force which produces minimum moment about O.
(b) Calculate the maximum moment in SI unit.
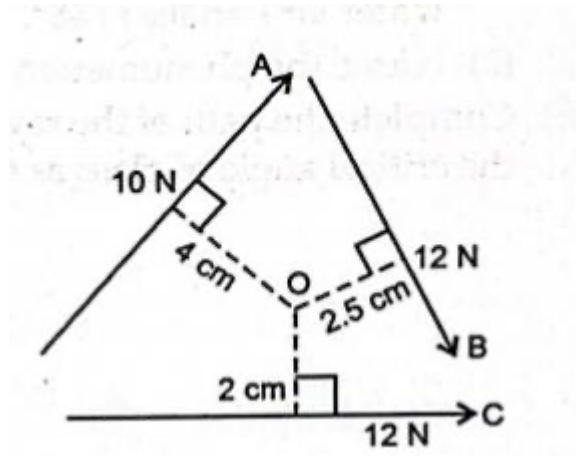
(iii) Name the force required for uniform circular motion. State its direction. [2]

(iv) A steering wheel of diameter 50 cm is rotated clockwise by applying a couple with each force of magnitude 7 N. Draw a free body diagram to show the application of forces and calculate the moment of couple applied.[2]

(v) If kinetic energy of a moving body is 40 J, then what will be its kinetic energy when its velocity is halved?[2]
(vi) A freely suspended pendulum in air is disturbed once and left to oscillate on its own:
(a) Name the type of vibrations.
(b) State one way to decrease the frequency of this vibration. [2]

(vii) Two copper wires A and B are of same area present at temperature 30°C. Length of A is twice the length of B.[2]

(a) Which wire has greater resistance?
(b) Which wire will have greater resistivity?

Questions 3.

(i) A lens L cannot form an image on the screen. [2]
(a) Name the lens L.
(b) Is it possible for this lens to form a magnified image?

(ii) (a) What is meant by earthing of an electrical appliance?[2]
(b) How does earthing offer protection?

(iii) State two ways by which the magnetic field of a solenoid can be made stronger. [2]

(iv) 10 g of ice of 0°C absorbed 5,460 J of heat to melt and change into water at 50 °C. Calculate the specific latent heat of fusion of ice. Given specific heat capacity of water is 4,200 J kg-1 °C-¹. [2]

(v) A mixture of radioactive substances gives off three types of radiations.[2]
(a) Name the radiation which travels with the speed of light.
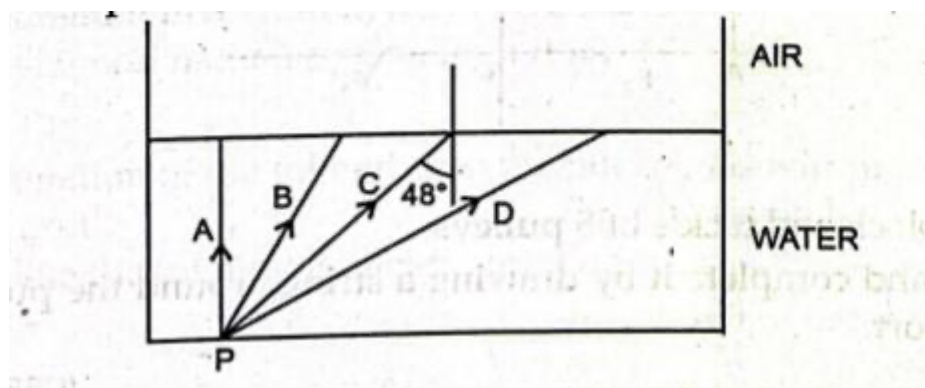(b) Name the radiation which has the highest ionizing power.


SECTION-B
(Attempt any four questions.)

Question 4.

(i) The diagram below shows a point source P inside a water container. Four rays A, B, C, D starting from the source P are shown upto the water surface.

(a) Show in the diagram the path of these rays after striking the water surface. The critical angle for water air surface is 48°.
(b) Name the phenomenon which the rays B and D exhibit.[3]

(ii) Complete the path of the ray coming through the glass prism PQR till it emerges out of the prism. the critical angle of glass as 42°.[3]
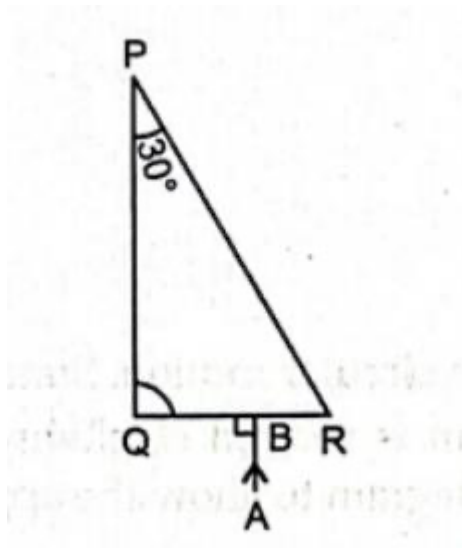
(iii) (a) A stick partly immersed in water appears to be bent. Draw a ray diagram to show the bending of the stick when placed in water and viewed obliquely from above.
(b) A ray of monochromatic light in air is incident on a glass slab:
(1) Draw a labelled ray diagram showing the change in the path of the ray till it emerges from the glass slab.
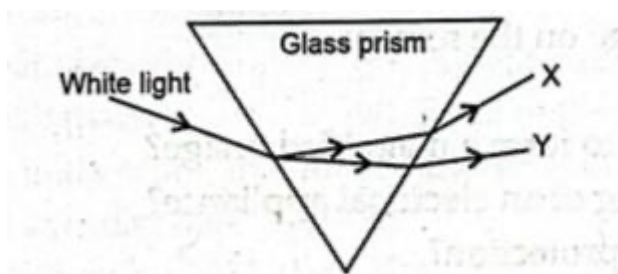(2) Name the two rays that are parallel to each other.
(3) Mark the lateral displacement in your diagram. [4]

Question 5.

(i) An object 5 cm high is held 25 cm away from a converging lens of focal length 10 cm. Draw the ray diagram and find the position, size and the nature of image formed. [3]
(ii) The diagram below shows the extreme colours of a visible spectrum (X and Y).[3]

(a) Identify the colours X and Y.
(b) Which colour has greater speed in vacuum?

(iii) Figure below shows an object AB placed on the principal axis of a lens L. The two foci of the lens are F and F. The image formed by the lens is erect, virtual and diminished. Copy the diagram and answer the following questions:
(a) Draw the outline of lens (L) used.

(b) Draw a ray from B, and passing through O. Show the ray after refraction by the lens.
(c) Draw a ray of light starting from B, which after passing parallel to the principal axis, is incident the lens and emerges after refraction from it. [4]
(d) Locate the final image formed.
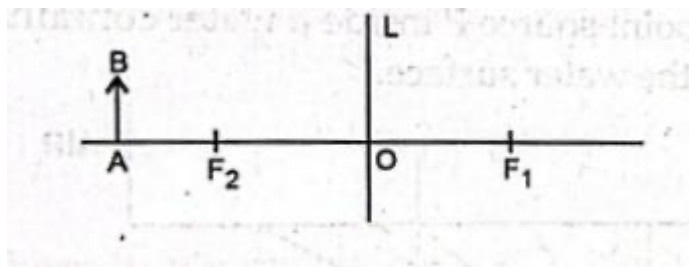
Question 6.

(i) Figure below shows a block and tackle of 5 pulleys.
(a) Copy the diagram and complete it by drawing a string around the pulleys. Mark the positions of the load and the effort.
(b) If the load is raised by 1 m, through what distance will effort move? [3]
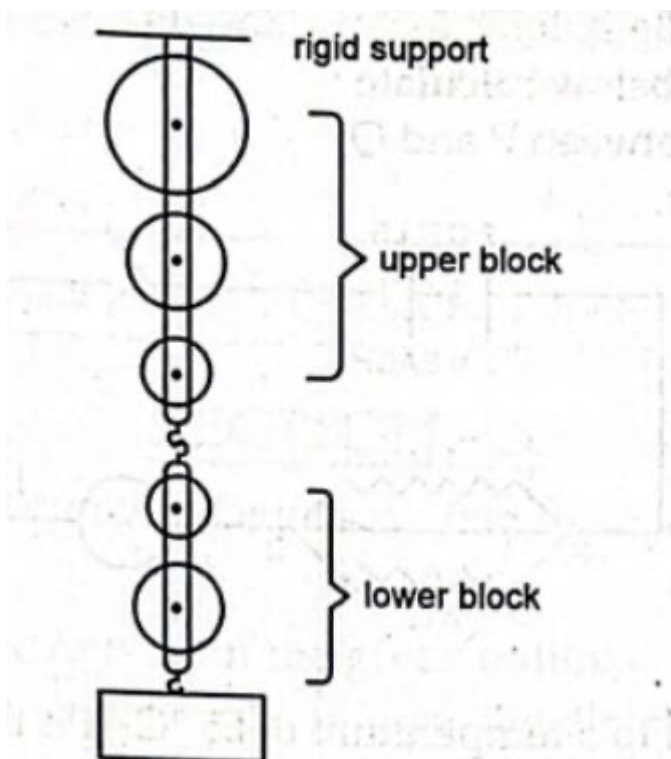
(ii) A, B and C are three forces each of magnitude 4 N acting in the plane of paper as shown in the figure. The point O lies in the same plane.[3]
(a) Which force has the least moment about O? Give reason.
(b) Which force has the greatest moment about O? Give reason.

(c) Name the force producing (1) clockwise (2) anticlockwise moments.
(d) What is the resultant torque about the point O?

(iii) A block of mass 30 kg is pulled up a slope (diagram below) with a constant speed by applying a force of 200 N parallel to the slope. A and B are initial and final positions of the block.
(a) Calculate the work done by the force in moving the block from A to B.
(b) Calculate the potential energy gained by the block. [3]
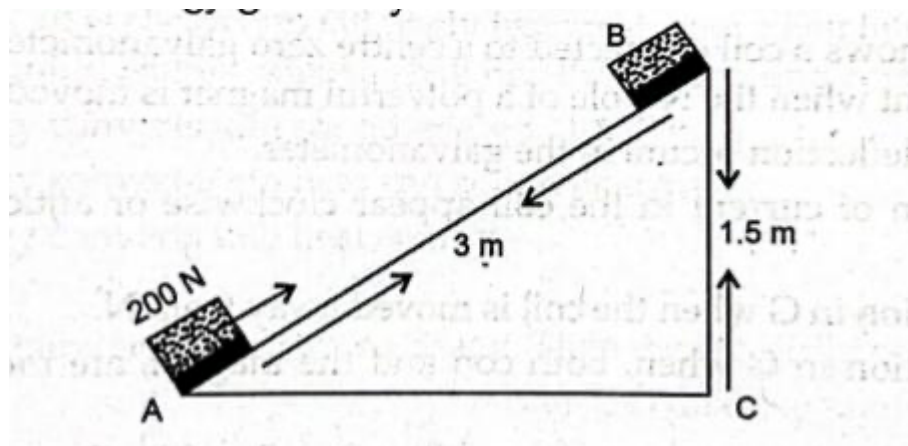
Question 7.

(i) A person standing between two vertical cliffs and 640 m away from the nearest cliff shouted. He heard the first echo after 4 seconds and the second echo 3 seconds later.[3]
Calculate:
(a) the velocity of sound in the air.
(b) the distance between the cliffs.

(ii) How many alpha and beta particles are emitted when uranium nucleus U_{92}^{238} decays to lead Pb_{82}^{206} ? [3]

(iii) A person is tuning his radio set to a particular station.
(a) What is the person trying to do to tune it?
(b) Name the phenomenon involved, in tuning the radio set.
(c) Define the phenomenon named by you in part (b)."

Question 8.

(i) Explain briefly the function of the following in the household wiring: [3]
(a) a three pin plug
(b) main switch.

(ii) (a) Copy and complete the following nuclear reaction:[3]

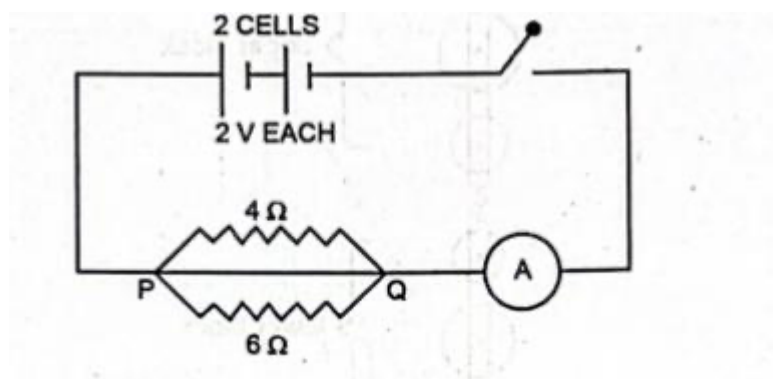$$_{86}^{-}\text{Rn} \rightarrow _{-}^{218}\text{Po} + _{2}^{4}\alpha$$
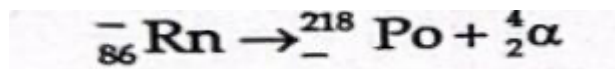
(b) What will be the effect on the radiation emitted in the above reaction when it is allowed to pass through an electric field? [Be specific in your answer]

(iii) With reference to the diagram below calculate: [4]
(a) the equivalent resistance between P and Q
(b) the reading of the ammeter.

Question 9.

(i) A metal of mass 250 g is heated to a temperature of 65 °C. It is then placed in 50 g of water at 20 °C. final steady temperature of water becomes 25°C. Neglecting the heat taken by the container, calculate the specific heat capacity of the metal [3]

(ii) The graph represents a cooling curve for a substance being cooled from higher temperature to a lower temperature. [3]
(a) What is the boiling point of the substance?
(b) What happens in the region DE?
(c) Why is region DE shorter than the region BC?
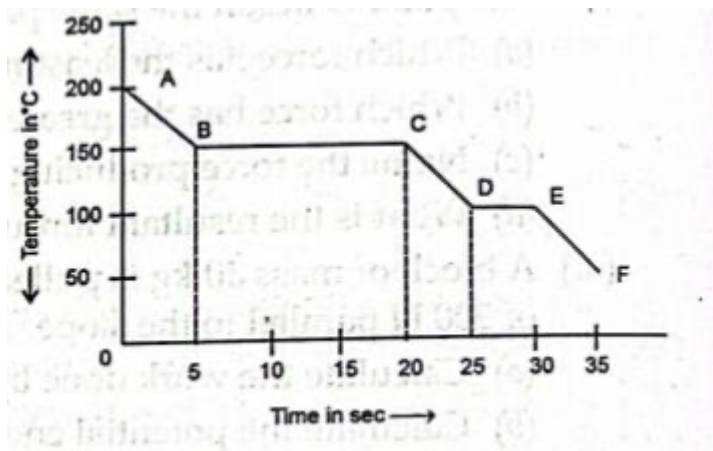
(iii) The diagram below shows a coil connected to a centre zero galvanometer G. The galvanometer shows a deflection to the right when the N-pole of a powerful magnet is moved to the right as shown. [4]

(a) Explain why the deflection occurs in the galvanometer.
(b) Does the direction of current in the coil appear clockwise or anticlockwise when viewed from end A?
(c) State the observation in G when the coil is moved away from N.
(d) State the observation in G when, both coil and the magnet, are moved to the right at the same speed