PHYSICS
(SCIENCE PAPER-1)

Maximum Marks : 80
Time allowed : Two hours
Answers to this Paper must be written on the paper provided separately.
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 question are given in brackets [ ].*

SECTION A
*(Attempt **all** questions from this Section)*

Question **1**

Choose the correct answer to the questions from the given options :   **[15]**

   (i) The turning effect of a force on a body depends on :

   (a) the magnitude of the force applied   (b) the perpendicular distance of line of motion from the axis of rotation

   (c) both (a) and (b)   (d) none of the above

  (ii) For work done to be maximum, the angle between the force and displacement should be :

   (a) 0°   (b) 30°   (c) 45°   (d) 90°

 (iii) In an electrical cell while in use, the change in energy is from :

   (a) electrical to magnetic   (b) chemical to electrical   (c) mechanical to electrical   (d) chemical to heat

  (iv) The number of protons and neutrons in $^{238}_{92}U$ is :

   (a) 92, 145   (b) 238, 92   (c) 92, 146   (d) 146, 92

   (v) 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

  (vi) Which of the following ray diagrams is not correct ?

   (a)   (b)

   (c)   (d)
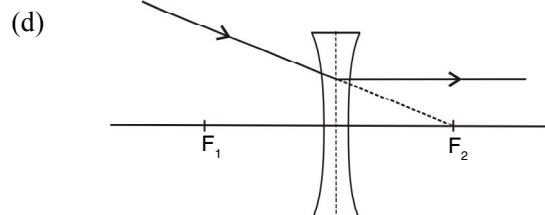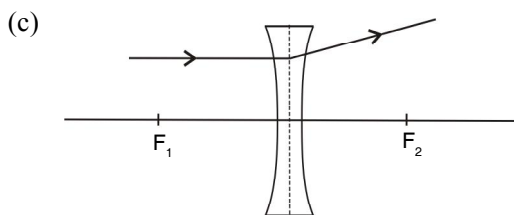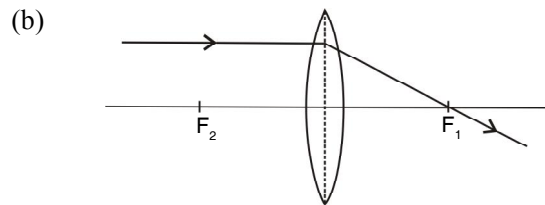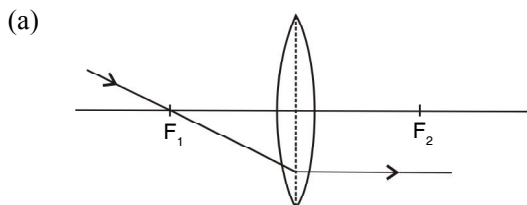
 (vii) When a tuning fork is sounded in air, the sound given by it is feeble. But when it is placed on a table top, the sound becomes much louder. The reason is :

   (a) amplitude of the wave   (b) its prongs start vibrating rapidly

   (c) presence of surrounding bodies   (d) large surface area of vibrating body

(viii) The condition for reflection of sound wave is :
   (a) surface must be smooth
   (b) surface must be polished
   (c) reflecting surface must be bigger than the wavelength of the sound wave
   (d) reflecting surface must be smaller than the wavelength of the sound wave

(ix) The following figures show V-I graphs. Select the graph(s) for ohmic resistors.
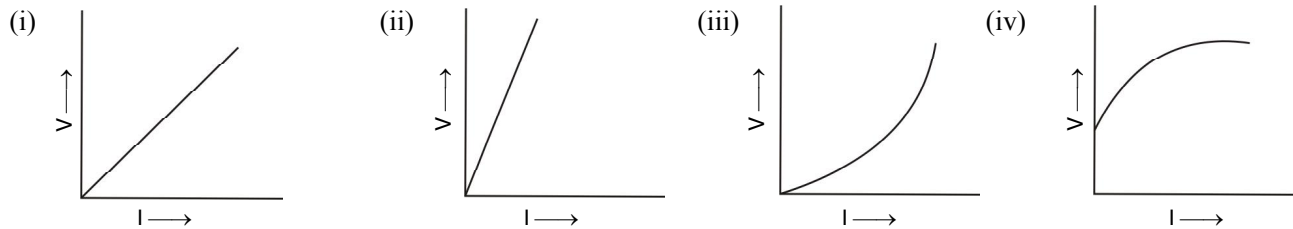
   (a) only (i)   (b) only (iii)   (c) both (iii) and (iv)   (d) both (i) and (ii)

(x) The main fuse is always connected in :
   (a) live wire
   (b) neutral wire
   (c) both the live wire and earth wire
   (d) both the earth wire and neutral wire

(xi) On reversing the direction of current in a wire, the magnetic field produced by it :
   (a) gets reversed in direction
   (b) increases in strength
   (c) decreases in strength
   (d) first increases in strength and then decreases

(xii) Two blocks P and Q of different metals having their masses in the ratio 3 : 2 are given the same amount of heat. Their temperatures rise by the same amount. Ratio of their specific heat capacities :
   (a) $\sqrt{3} : \sqrt{2}$ (b) 9 : 4   (c) 2 : 3   (d) 3 : 2

(xiii) The temperature of a substance on heating rises because :
   (a) average potential energy of molecules increases   (b) average kinetic energy of molecules increases
   (c) average kinetic energy of molecules decreases   (d) average potential energy of molecules remains the same

(xiv) The intensity of refracted light is always .... the intensity of incident light :
   (a) greater than   (b) equal to   (c) less than   (d) none of the above

(xv) The condition required for total internal reflection to take place is :
   (a) light ray passes from a rarer to denser medium   (b) light ray is incident normally on the separating medium
   (c) angle of incidence is less than critical angle   (d) none of the above

Question 2

(i) (a) How many strands are supporting the load in case of block and tackle system of 4 pulleys where the effort is in a downward direction ?   [3]
   (b) Name the particle used for bombardment in nuclear fission of uranium-235.
   (c) Arrange the nuclear radiations in ascending order of their biological damage.

(ii) (a) A nut is opened by a wrench of length 10 cm. If the minimum force required is 2·0 N, calculate the moment of force needed to turn the nut in S.I. units.   [2]
   (b) A uniform metre rule rests horizontally on a knife edge at the 60 cm mark, when a mass of 10 g is suspended from one end. What is the mass of the rule ?

(iii) State two differences between centripetal and centrifugal force.   [2]

(iv) The given figure shows two forces each of magnitude 10 N acting at points A and B at a separation of 60 cm in opposite directions. Calculate the resultant moment of the two forces about the point : (i) A, and (ii) B.   [2]
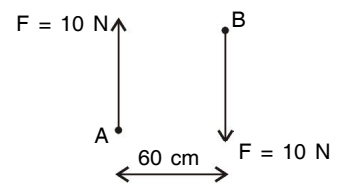
(v) Calculate the power of an engine required to lift 1000 kg of coal per hour from a mine 360 m deep. [Take g = 10 ms⁻²] **[2]**

(vi) State two differences between forced and resonant vibrations. **[2]**

(vii) State two differences between the emf and terminal voltage of a cell. **[2]**
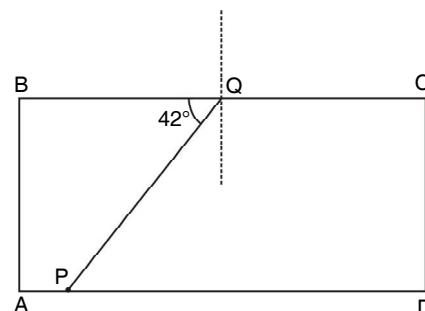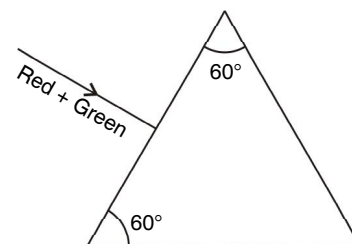
Question 3

(i) State the condition for each of the following : **[2]**

    (a) A lens having both its focal lengths equal.   (b) A ray passing undeviated through the lens.

(ii) (a) The earthing of an electric appliance is useful only if the fuse is in the live wire. Give reason. **[2]**

    (b) Name the part of the appliance which is earthed.

(iii) State the condition when the magnitude of induced emf in the secondary coil of a transformer is more than the primary coil. **[2]**

(iv) How much boiling water at 100°C is needed to melt 2 kg of ice so that the mixture, which is all water, is at 0°C. Given : Specific heat capacity of water = 4·2 Jg⁻¹K⁻¹, specific latent heat of ice = 336 Jg⁻¹. **[2]**

(v) Give two differences between nuclear fission and fusion. **[2]**

SECTION B

*(Attempt any **four** questions)*

Question 4

(i) The diagram alongside shows a beam of light (red + green) incident normally on an equilateral triangular prism. If the critical angle for the material of prism is 60° for the light of red colour, complete the diagram showing the path of light of each colour emerging out of the prism. Mark the angles in the diagram whereever necessary. **[3]**

(ii) A coin is placed at the bottom of a glass trough containing water (refractive index = 4/3) up to a height 20 cm. At what depth will it appear when it is viewed from air, almost vertically above the coin. Draw a suitable ray diagram in support of your answer. **[3]**

(iii) The diagram alongside shows a light source P embedded in a rectangular glass block ABCD of critical angle 42°. **[4]**

    (a) What is the angle of incidence at surface BC ?

    (b) Which phenomenon occurs at surface BC ?

    (c) What is the angle of refraction at surface CD ?

   (d) Draw a diagram showing the final path of the ray of light.

Question 5

(i) An object is placed at a distance 24 cm in front of a convex lens of focal length 10 cm. **[3]**

    (a) What is the nature of the image so formed ?

    (b) Calculate the distance of the image from the lens.

    (c) Is the size of the image bigger or smaller than the object ?

(ii) A beam consisting of red, blue and yellow colours is incident normally on the face AB of an isosceles right-angled prism ABC as shown in the figure given below. Critical angle of glass-air interface for yellow colour is 45°. Out of the three emergent rays P, Q and R : **[3]**

    (a) Which one is of the red colour ?
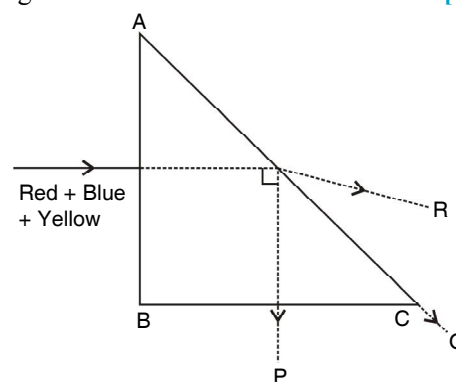
(b) Which one is of the blue colour ?

(c) Which one is of the yellow colour ?

(iii) The adjacent diagram shows a convex lens L, a plane mirror M and a point source of light S. Rays of light from the source S return to their point of origin.   **[4]**

(a) Complete the ray diagram to show this.

(b) What is the purpose of plane mirror M ?

(c) What is the effect of moving the mirror M towards the lens L on the return of rays of light ?
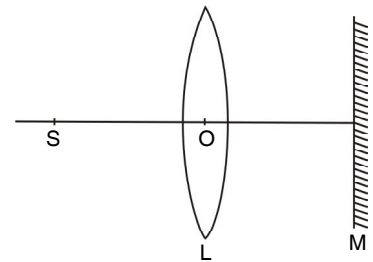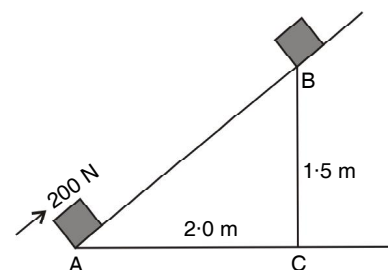
Question 6

(i) (a) In the given figure draw a tackle to lift the load by applying the force in a downward direction.   **[3]**

(b) Mark the direction of load L and effort E in the figure.

(c) State the number of strands of tackle supporting the load.
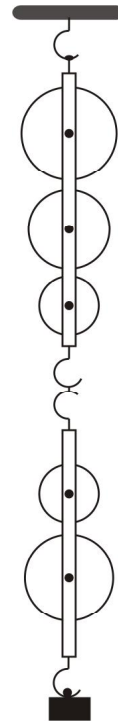
(ii) The adjacent diagram shows a steering wheel of radius 0·25 m which is rotated clockwise by a torque 10 Nm produced due to a pair of equal and opposite force F.   **[3]**

(a) Calculate the magnitude of force F.

(b) Show them on the diagram with their point of application.
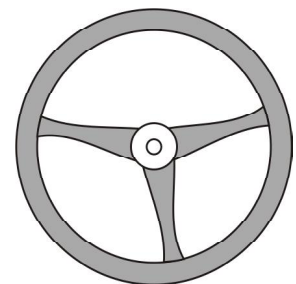
(iii) A block of mass 30 kg is pulled up a slope as shown in the figure with a constant speed by applying a force of 200 N parallel to the slope from the initial position A to the final position B.   **[4]**

(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. Take : g = 10 ms^{-2}.

(c) Account for the difference in answers of parts (a) and (b).

Question 7

(i) A person standing at a distance x in front of a cliff fires a gun. Another person B standing behind the person A at distance y from the cliff hears two sounds of the fired shot after 2s and 3s respectively. Calculate x and y. . (Take speed of sound = 320 ms^{-1}). **[3]**

(ii) Complete the following nuclear reactions and rewrite them : **[3]**

(a) $^a_x P \longrightarrow Q + ^4_2 He$ (b) $^a_x P \longrightarrow R + ^0_{-1}\beta$ (c) $^{24}_{11}Na \longrightarrow Mg + ^0_{-1}\beta$

(iii) The diagrams given below show three modes of vibrations of a 1 m long stretched string. **[4]**
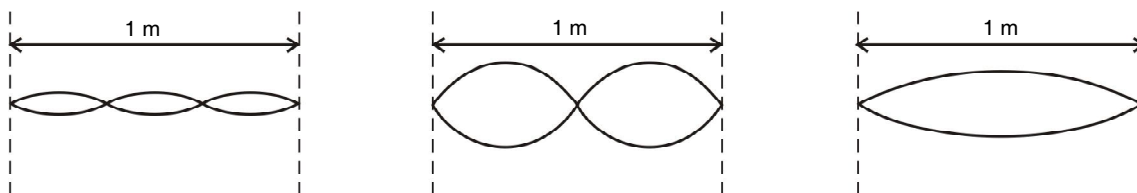
(a) Which of the above diagrams shows the fundamental mode ?

(b) If the frequency of the note produced in (i) is f, write down the frequency in cases (ii) and (iii).

(c) In which case is the note loudest ? Give reason.

Question 8

(i) (a) Two resistors of resistance $R_1 = 2\ \Omega$ and $R_2 = 1\ \Omega$ are connected in parallel with a current source of 3 A. Draw the arrangement and deduce the current I_1 in R_1 and I_2 in R_2. **[3]**

(b) What do you mean by earthing of an electric appliance ?

(ii) The given figure shows a radioactive source S in a thick lead walled container having a narrow opening. The radiations pass through an electric field between the plates A and B. **[3]**

(a) Complete the diagram to show the paths of α, β and γ radiations.

(b) Why is the source S kept in a thick lead walled container with a narrow opening ?

(iii) Three resistors 8 Ω, 12 Ω and 6 Ω are connected to a 12 V battery as shown in the figure alongside. Calculate : **[4]**

(a) the current through the 8 Ω resistor.

(b) the potential difference across the parallel combination of 6 Ω and 12 Ω resistors.

(c) the current through the 6 Ω resistor.
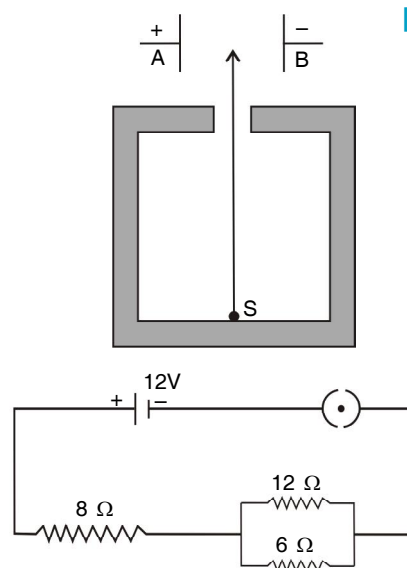
Question 9

(i) 200 g of water at 50·5°C is cooled down to 10°C by adding m g of ice cubes at 0°C in it. Find m. **[3]**
Take specific heat capacity of water = 4·2 Jg^{-1}°C^{-1} and specific latent heat of ice = 336 Jg^{-1}.

(ii) Explain the following : **[3]**

(a) The farmers fill their fields with water to save the crop on a very cold night.

(b) The heat supplied to a substance during its change of state does not cause any rise in its temperature.

(iii) The adjacent figure shows a coil AB connected to a centre zero galvanometer G and a magnet NS. **[4]**

(a) What will you observe when the magnet is inserted into the coil at end A and is pulled out of the coil.

(b) How will your observations in part (a) change if the number of turns in the coil is increased ?

(c) State how your observation in part (a) changes when magnet is inserted in coil at A and leaves out at end B.

ICSE SEMESTER 2 EXAMINATION
MODEL QUESTION PAPER-2
PHYSICS
(SCIENCE PAPER-1)

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***Section A** is compulsory. **Attempt any four** questions from **Section B**.*
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## SECTION A
*(Attempt **all** questions from this Section)*

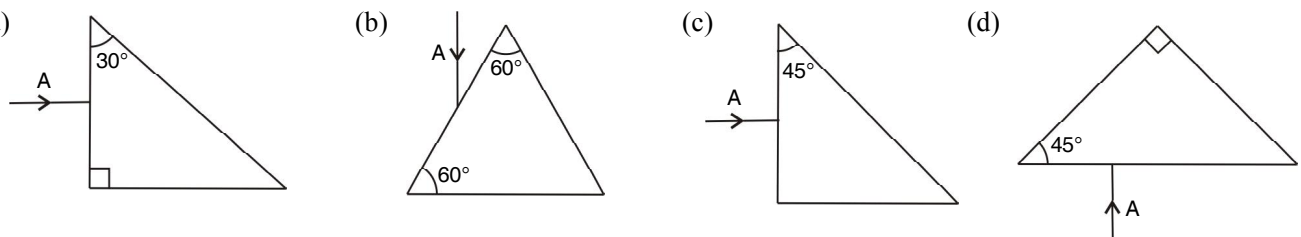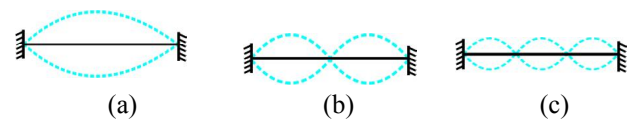### Question 1

Choose the correct answer to the questions from the given options :   **[15]**

(i) When a heavy load is lifted by applying a less effort, the machine acts as a :

   (a) force multiplier   (b) power multiplier   (c) velocity multiplier   (d) none of these

(ii) The splitting of light into its constituent colours is called :

   (a) scattering   (b) dispersion   (c) interference   (d) refraction

(iii) The diagram alongside shows a ski jump. A skier weighing 60 kgf stands at A at the top of the ski jump. He moves from A and takes off for his jump at B [$g = 10$ ms^{-2}].

The change in the gravitational potential energy of the skier between A and B is :

   (a) $3 \cdot 6 \times 10^4$ J   (b) $4 \cdot 5 \times 10^4$ J

   (c) $0 \cdot 9 \times 10^4$ J   (d) 0

(iv) A radioactive substance emits radiations :

   (a) α or β and γ simultaneously   (b) α, β and γ respectively, one by one

   (c) X-rays and γ-rays   (d) α or β

(v) A ray of light incident at an angle of incidence 48° on a prism of refracting angle 60° suffers minimum deviation. The angle of minimum deviation is :

   (a) 0°   (b) 36°   (c) 48°   (d) 60°

(vi) Which figure depicts both of the focal points and optical centre O correctly ?

(a)

(b)

(c)

(d)
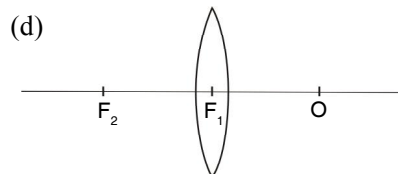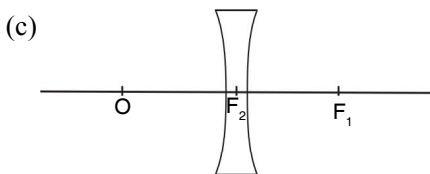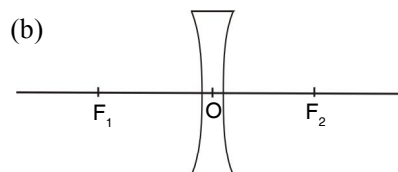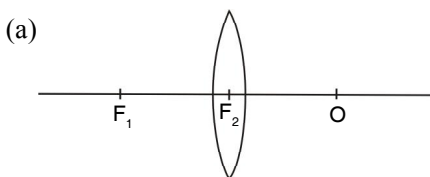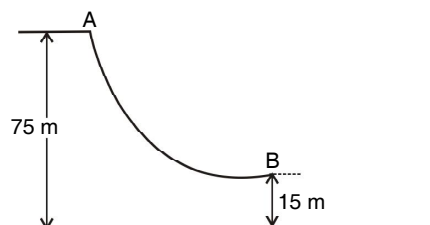
(vii) The unit of loudness of sound is :

    (a) meter   (b) phon   (c) hertz   (d) None of the above

(viii) If l is the length of the string stretched between its ends, the wavelength of different modes in Fig. (a), (b) and (c) will be :

(a)   (b)   (c)

    (a) $2l/2, 2l, 2l/3$ (b) $2l/3, 2l/2, 2l$

    (c) $2l, 2l/2, 2l/3$ (d) $2l, 2l/3, 2l/2$

(ix) Which of the following does not change the form of energy :

    (a) motor   (b) generator   (c) transformer   (d) geyser

(x) An alloy of lead and tin is used as the material of the fuse wire because its melting point is .... and specific resistance is .... :

    (a) low, low   (b) high, low   (c) high, high   (d) low, high

(xi) The magnetic field strength of a current carrying solenoid :

    (a) is maximum at its ends

    (b) increases with an increase in the number of turns in the solenoid of a given length.

    (c) does not change in direction by changing the direction of current

    (d) is maximum at the middle point inside the solenoid

(xii) The vessel used for measurement of heat (*i.e.* calorimeter) is made of a thin sheet of copper because :

    (a) Copper is a good conductor of heat   (b) Specific heat capacity of copper is low

    (c) Specific heat capacity of copper is high   (d) Both (a) and (b)

(xiii) In cold countries, water in lakes and ponds does not freeze all at once because :

    (a) Specific latent heat of fusion of ice is low   (b) Ice is a good conductor of heat

    (c) Specific latent heat of fusion of ice is high   (d) None of the above

(xiv) In refraction of light, from rarer to a denser medium, its wavelength :

    (a) increases   (b) decreases   (c) remains the same   (d) there is no fixed relation

(xv) Which of the following figures will depict deviation of the ray of light A through 180° ?

(a)   (b)   (c)   (d)

Question 2

  (i) (a) In a single movable pulley, if the effort moves by a distance x upwards, by what height is the load raised ?   **[3]**

     (b) Alpha particles find no use in radiotherapy. Give reason.

     (c) Name the radiation which is similar in nature to cathode rays.

 (ii) (a) The iron door of a building is 3 m broad. It can be opened by applying a force of 100 N normally at the middle of the door. Calculate the torque needed to open the door.   **[2]**

     (b) The diagram shows a uniform metre rule weighing 100 gf, placed horizontally on a fulcrum at its centre O. Two weights 150 gf and 250 gf hang from the metre rule as shown. Calculate the net moment about O and its direction.

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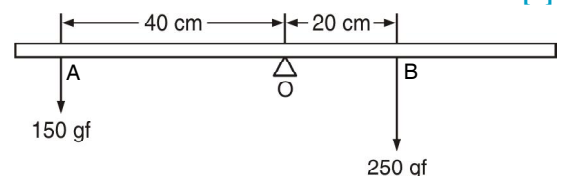
(iii) A small pebble tied at one end of a string is placed near the periphery of a circular disc. The other end of the string is tied to a peg at the centre of the disc. The disc is rotating about an axis passing through its centre. **[2]**

    (a) What will be your observation when you are standing outside the disc ? Explain.

    (b) What will be your observation when you are standing at the centre of the disc ? Explain.

(iv) State two conditions for a body, acted upon by several forces, to be in equilibrium. **[2]**

(v) An *ox* can apply a maximum force of 1000 N. It is taking part in a cart race and is able to pull the cart at a constant speed of 30 ms^{-1} while making its best effort. Calculate the power developed by the *ox*. **[2]**

(vi) State two differences between natural and forced vibrations. **[2]**

(vii) Name two factors on which the internal resistance of a cell depends and state how does it depend on the factors stated by you. **[2]**
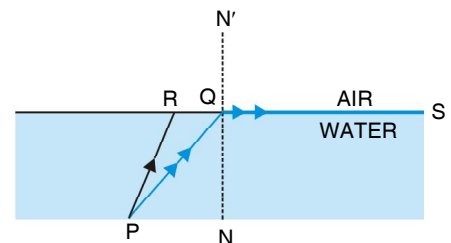
Question 3

(i) (a) A mercury thermometer when placed in a radiation X, shows a rapid increase in temperature. Name the radiation X. **[2]**

    (b) Write the approximate wavelength of the radiation mentioned above in part (a).

(ii) (a) Why is it dangerous to connect a switch to the neutral wire ? **[2]**

    (b) What precautions would you observe while handling a switch ?

(iii) State two dissimilarities between a d.c. motor and an a.c. generator. **[2]**

(iv) An electric heater of power 100 W raises the temperature of 5 kg of a liquid from 25°C to 31°C in 2 minutes. Calculate : **[2]**

    (a) the energy supplied by the heater, and   (b) the specific heat capacity of the liquid.

(v) Write the approximate value of the energy released in the fission of one nucleus of $^{235}_{92}$U. What is the source of this energy ? **[2]**

SECTION B
*(Attempt any **four** questions)*

Question 4

(i) A beam of white light is incident normally on the surface AB of an equilateral prism ABC and emerges out of it suffering a deviation of 60°. **[3]**

    (a) Draw a diagram to show the path of beam till it emerges out of the prism. Mark the angles wherever necessary.

    (b) What assumptions have you made while drawing the diagram ?

    (c) Name the phenomenon exhibited by the light beam.

(ii) Water in a pond appears to be only three-quarter of its actual depth. **[3]**

    (a) What property of light is responsible for this observation ? Illustrate your answer with the help of a ray diagram.

    (b) How is the refractive index of water calculated from its real and apparent depths ?

(iii) In the given figure PQ and PR are two light rays emerging from an object P. The ray PQ is refracted as QS. **[4]**

    (a) What is the angle of refraction for the refracted ray QS ?

    (b) Name the phenomenon that occurs if the angle of incidence ∠PQN is increased.

    (c) The ray PR suffers partial reflection and refraction on the water-air surface. Give reason.

    (d) Draw in the diagram the refracted ray for the incident ray PR and hence show the position of the image of the object P by the letter P′ when seen vertically from above.
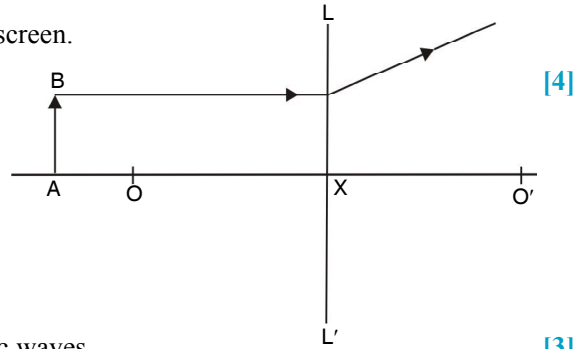
Question 5

(i) A lens of focal length 15 cm forms an image on the screen of size three times that of the object. **[3]**

    (a) What kind of lens is this ?

    (b) Find magnification, the position of object and the position of screen.

(ii) Study the diagram given alongside : **[4]**

    (a) Name the lens LL′.

    (b) What are the points O and O′ called ?

    (c) Complete the diagram to form the image of the object AB.

    (d) State three characteristics of the image.

(iii) (a) State two differences between mechanical and electromagnetic waves. **[3]**

    (b) Name the electromagnetic radiations having the (i) highest wavelength (ii) maximum heating effect.

    (c) Arrange the following radiations in the increasing order of their frequencies : Microwaves, X-rays, light and ultraviolet radiation

Question 6

(i) A block and tackle has two pulleys in each block, with the tackle starting from the hook above the top pulley of the lower block and the effort being applied upwards. Draw a neat diagram to show this arrangement. **[3]**

    (a) What is its mechanical advantage ?

    (b) If the load moves up by a distance x, by what distance will the free end of the tackle move up ?

(ii) The wheel shown in the diagram has a fixed axle passing through O. The wheel is kept stationary under the action of (1) a horizontal force F_1 at A and (2) a vertical force F_2 at B. **[3]**
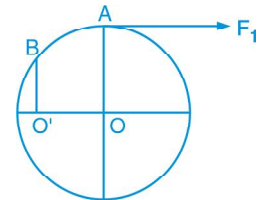
    (a) Show the direction of force F_2 in the diagram.

    (b) Which of the force, F_1 or F_2 is greater ?

    (c) Find the ratio between the forces F_1 and F_2.
    Given : AO = 5·0 cm, BO′ = 3·0 cm and O′O = 4·0 cm.

(iii) (a) A body of mass M is allowed to fall freely from the roof of a building of height h. Name the kind of energy and its value possessed by the body when it is : **[4]**

    (1) at the roof (2) at the ground (3) at a point in between the roof and the ground at a distance x below the roof.

    (b) Express the velocity of the body in terms of h when the body strikes at the ground.

    (c) Draw a graph showing the variation in potential energy and kinetic energy with the height of the body above the ground.

Question 7

(i) A boy stands at 60 m in front of a tall wall and claps. The boy continues to clap every time an echo is heard. Another boy finds that the time taken between the first and fifty first clap is 18 s. Calculate the speed of sound. **[3]**

(ii) A certain nucleus P has a mass number 15 and atomic number 7. The nucleus P loses : **[3]**

    (a) One proton   (b) One β-particle   (c) One α-particle

    Write the symbol of the new nucleus in each case and express each change by a reaction.

(iii) Figures A, B, C and D represent the test tubes each of height 20 cm which are filled with water up to a height of 12 cm, 14 cm, 16 cm and 18 cm respectively. If a vibrating tuning fork is placed over the mouth of test tube D, a loud sound is heard. **[4]**
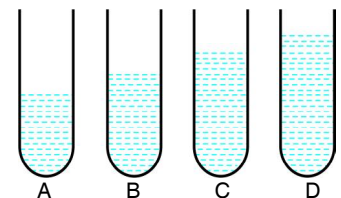
(a) Describe the observation with the tubes A, B and C when the vibrating tuning fork is placed over the mouth of each of these tubes.

(b) Give the reason for your observation in each case.

(c) State the principle illustrated by the above experiment.

Question 8

(i) (a) While measuring the resistance of a conductor, the following observations are obtained : **[3]**

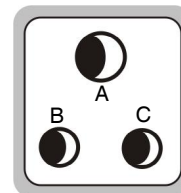| Ammeter reading (in A)	0·8	0·9	1·0	1·1	1·2
Voltmeter reading (in V)	4·0	4·5	5·0	5·5	6·0

Draw a graph for voltage against current. Is the conductor ohmic ?

(b) The adjacent figure shows the connecting points of a socket outlet. State the connections which are made to the pins marked A, B and C.

A : ....   B : ....

C : ....

(ii) What kind of change takes place in a nucleus when a β-particle is emitted ? Express it by an equation. **[3]**

(a) State whether atomic number and mass number are conserved in a radioactive β-decay.

(b) Name another particle which is associated to be emitted along with a β-particle.

(iii) The circuit diagram in the given figure shows three resistors 2 Ω, 4 Ω and R Ω connected to a battery of e.m.f. 2V and internal resistance 3 Ω. If main current of 0·25 A flows through the circuit, find : **[4]**
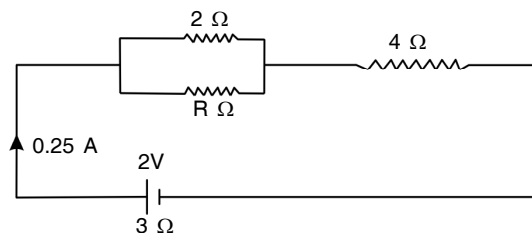
(a) the p.d. across the 4 Ω resistor.

(b) the p.d. across the internal resistance of the cell.

(c) the p.d. across the R Ω or 2 Ω resistor and the value of R.

Question 9

(i) The melting point of naphthalene is 80°C and the room temperature is 25°C. A sample of liquid naphthalene at 90°C is cooled down to room temperature. Draw a temperature-time graph to represent this cooling. On the graph, mark the region which corresponds to the freezing process.

(ii) In an experiment to determine the specific latent heat of fusion of ice, the following observations are taken : **[3]**

$$\text{Mass of calorimeter + stirrer} = x \text{ kg}$$
$$\text{Mass of water} = y \text{ kg}$$
$$\text{Initial temperature of water} = t_1°\text{ C}$$
$$\text{Mass of ice added} = z \text{ kg}$$
$$\text{Final temperature of mixture} = t°\text{C}$$

If the specific heat capacity of calorimeter is C_1 and of water is C_2 J kg^{-1}K^{-1}, express the specific latent heat of fusion of ice L in terms of the above data.

(iii) (a) Complete the following diagram of the figure of a transformer and name the parts labelled A and B. **[4]**

(b) Name the part you have drawn to complete the diagram in part (a).

(c) Is this transformer a step up or step down ? Give reason.

(d) Name one important kind of loss of energy in this device.