ICSE 2025 EXAMINATION

Sample Question Paper - 9

Physics

Time: 2 Hours. **Total Marks: 80**

General Instructions:

1. *Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*
2. *The intended marks of questions or parts of questions are given in brackets [ ].*

SECTION A

*(Attempt **all** questions)*

Question 1

Choose the correct answers to the questions from the given options. (Do not copy the questions, write the correct answer only.)

i) The moment of a force about a given axis depends:
   (a) Only on the magnitude of force
   (b) Only on the perpendicular distance of force from the axis
   (c) Neither on the force nor on the perpendicular distance of force from the axis
   (d) Both on the force and its perpendicular distance from the axis.

ii) For the object placed between the optical centre and focus of a convex lens, the image is:
   (a) Real and enlarged.
   (b) Real and diminished.
   (c) Virtual and enlarged.
   (d) Virtual and diminished.

iii) In parallel combination of resistances:
   (a) P.D. is same across each resistance.
   (b) Total resistance is increased.
   (c) Current is same in each resistance.
   (d) All of the above are true.

iv) In India, at what voltage is the electric power generated at the power generating system?
   (a) 11 kV
   (b) 220 V
   (c) 22 kV
   (d) 11 V

v) **Assertion (A):** Sound waves in air, solid and liquid travels in the form of longitudinal waves.

Reason (R): If the vibrations of medium particles are along the direction of propagation of the waves, then such waves are said to be longitudinal waves.

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are True and R is not the correct explanation of A
(c) Assertion is false but reason is true.
(d) Assertion is true reason is false.

vi) The S.I. unit of specific latent heat is _____.

(a) cal/g
(b) cal/gK
(c) J/kg
(d) J/kgK

vii) If a force of 1 N is acting on an object that is moving through 10 m in a direction perpendicular to the force, then the work done is:

(a) 1 J
(b) 10 J
(c) 100 J
(d) Zero

viii) Which of the following is not an example of Class I levers?

(a) Crowbar
(b) Beam balance
(c) Forearm used for lifting a load.
(d) Pliers

ix) The sound of a single frequency is called _____.

(a) noise
(b) tone
(c) music
(d) note

x) The presence of a magnetic field at a point can be detected by :

(a) A strong magnet
(b) A solenoid
(c) A compass needle
(d) A current-carrying wire

xi) The wavelength of Gamma rays is 0.01 A. Calculate its frequency.

a) 3×10^8 Hz
b) 3×10^{10} Hz
c) 3×10^{20} Hz
d) 3×10^{18} Hz

xii) The boiling point of water in Delhi is
a) same as that at Shimla
b) less than that at Shimla
c) more than that at Shimla
d) cannot be predicted

xiii) If the ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal?
a) yes
b) can't predict
c) no
d) None of the above

xiv) The colour which deviates most in the formation of the spectrum of white light by a prism is
a) Red
b) Green
c) Violet
d) Yellow

xv) The temperature required for the process of nuclear fusion is nearly:
a) 1000 K
b) 10^4K
c) 10^5K
d) 10^7K

Question 2

i) Complete the following by choosing the correct answers from the bracket: [6]
(a) _____ [Electron/Neutron/Proton] is used in nuclear fission for bombardment.
(b) For normal incidence, the angle of incidence is _____ [180°/90°/0°].
(c) The turning effect of a force applied on the body about an axis is due to _____ [Torqe/Acceleration/linear momentum].
(d) The rating of the fuse depends on the _____ [Connected load/Potential difference /Temperature of surrounding].
(e) The mass number (A) of an element is not changed when it emits _____ [Alpha/Beta] and _____ [Beta/Gamma] radiation.

ii) A vessel of negligible thermal capacity contains 8.0 kg of water at 50°C. If 5.0 kg of ice at 0°C is added to it, find: [2]
a) heat energy imparted by water in the fall of its temperature from 50°C to 0°C,
b) The mass of ice melted.

iii) State any two characteristics of a musical sound. [2]

Section B

(Attempt *any four* questions)

Question 4

(i) 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. [3]

(ii) [3]

(a) Mention two properties and two uses of X rays.

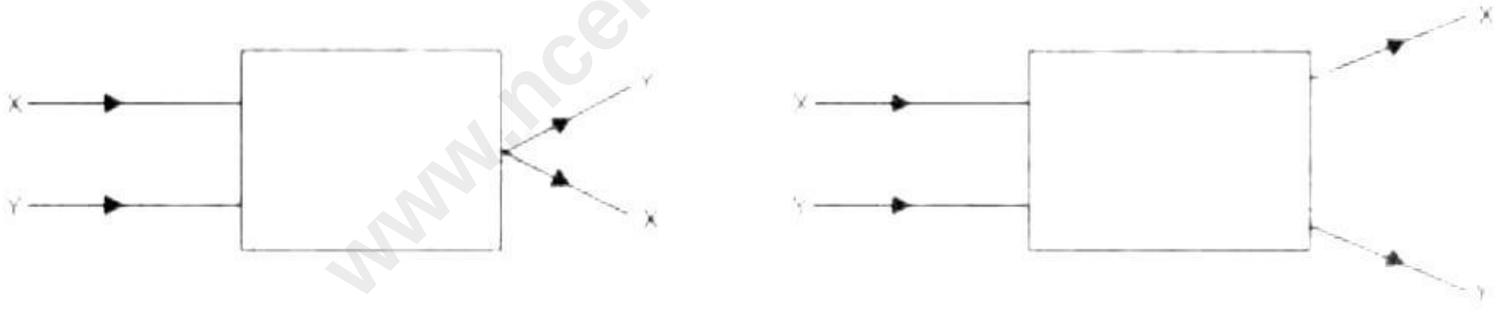
(b) Give one use each of the electromagnetic radiations given below:

1. Ultraviolet radiation
2. Infra-red radiations.

(iii) [4]

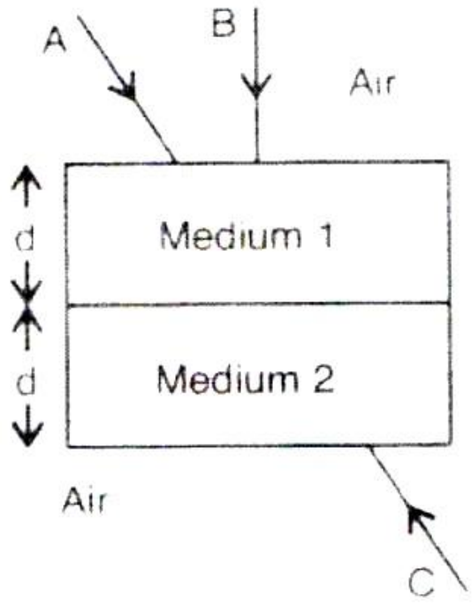
(a) There are two lenses, one convex and other concave lens having focal lengths 20 cm and 25 cm respectively. Find the power of this combination?

(b) Each box (shown below) has a lens kept inside it. Draw the lens and complete the path of the rays.



Question 5

(i) In the figure given below, two slabs of equal thickness are shown. The speed of light in medium '1' is less than the speed of light in medium '2'. Trace the path of the rays A, B and C incident from air on this composite slab in the manner shown. [3]



(ii) [3]

(a) For which spectral colours of light is the speed maximum and minimum in glass?

(b) What is angular deviation with respect to a glass block?

(c) If a glass block is placed over a mark on paper, the mark seems to rise. Explain.

(iii) Jacob is performing an experiment on refraction. He places two pins P_1 and P_2 at an angle of 45°, and then on the other side he places pins P_3 and P_4. [4]

a) Show the correct ray diagram.

b) What is the perpendicular distance between the incident ray and the emergent ray called?

c) If he places a red filter in the path of light, what will be the colour of the ray of light?

d) If the emergent ray is allowed to fall normally on a plane mirror, what will be the effect on the path of light?

Question 6

(i) State the energy conversions in the following: [3]

(a) Electroplating

(b) Photosynthesis

(c) Endothermic chemical reaction

(ii) [3]

(a) Write a relation expressing the mechanical advantage of the lever.

(b) Write an expression for the mechanical advantage of an inclined plane.

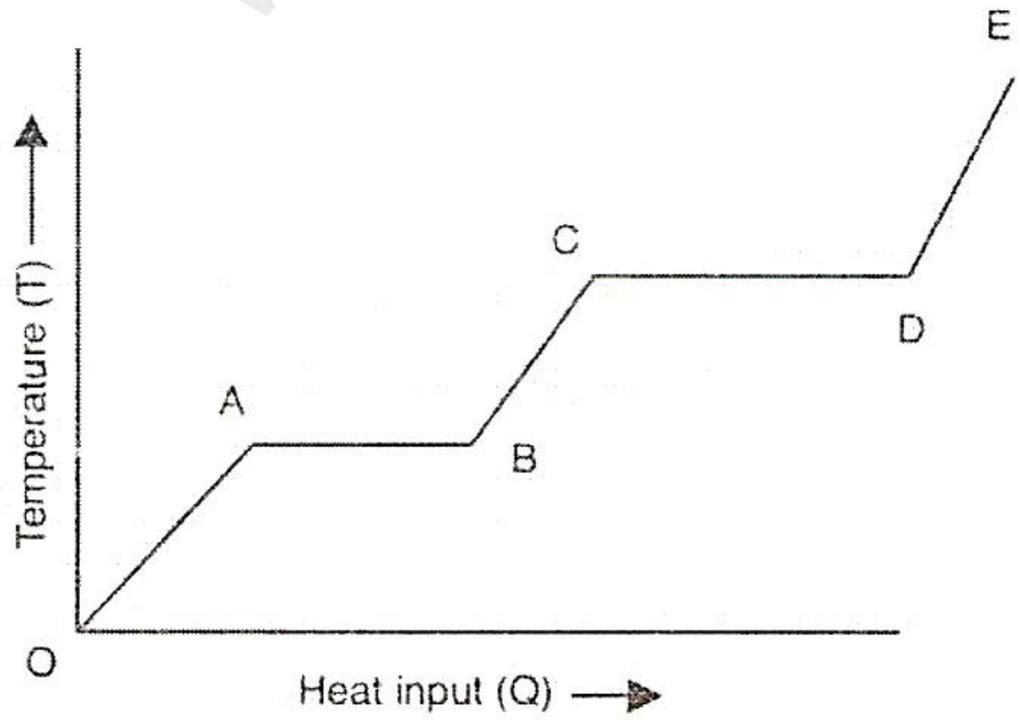
(c) Give two reasons as to why the efficiency of a single movable pulley system is always less than 100%.

(iii) Radha draws water from a well using a fixed pulley and the mass of bucket and water she pulled is 15 kg and the well is 5 m deep.

(a) Find the mechanical advantage if the force applied by her is 180 N.
(b) What will be the velocity ratio for the given case?
(c) Can you determine the efficiency of the pulley? Is the efficiency of the pulley being used in this case 100%? If not, can you explain why?
(d) What will be the energy gained by the load?

Question 7

(i) A source supplies heat at a constant rate to a solid cube. The variation of the temperature of the cube with the heat supplied is shown in the figure given below. [3]

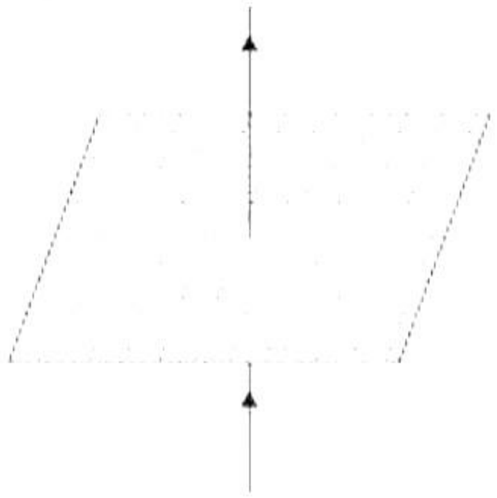


(a) At which points does the temperature of substance remain constant? Explain why?
(b) What does the slope of the part DE represent?
(c) If CD = 2.5 × AB, what does it mean?

(ii) [3]

(a) A straight wire conductor passes vertically through a piece of cardboard sprinkled with iron filings. Copy the diagram and show the setting of the iron filings when a

current is passed through the wire in the upward direction and the cardboard is tapped gently. Draw arrows to represent the direction of the magnetic field lines.



(b) Name the law which has helped you to find the direction of the magnetic field lines in the diagram above.

(iii) [4]

(a) What important property of the field is indicated by the field line pattern of a long straight solenoid?

(b) State two ways through which the magnetic field of a solenoid can be made stronger.

(c) How can the direction of force on a current carrying conductor placed in magnetic field be reversed?

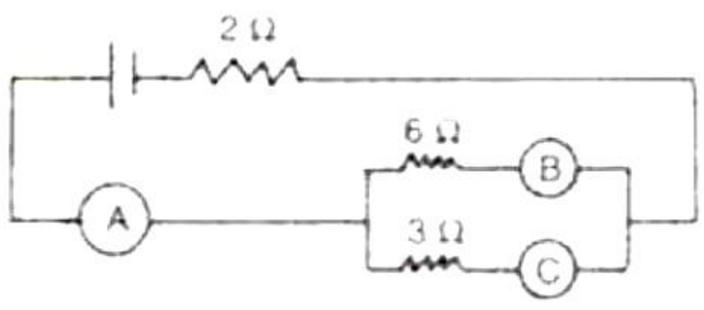
Question 8

(i) [3]

(a) Write the factors on which the frequency of a vibrating string depends.

(b) A bucket is placed below a tap. We can estimate the height of the water level in the bucket from a distance simply by hearing the sound. Explain.

(ii) Three ammeters A, B and C are connected in below circuit. Ammeter C reads 1 Ampere.[3]



(a) Calculate the total resistance in the circuit.

(b) Calculate ammeter readings for A and B. (Consider all ammeters have negligible resistance).

(iii) Relate the following quantities to the mass of the body: [4]

(a) Heat capacity

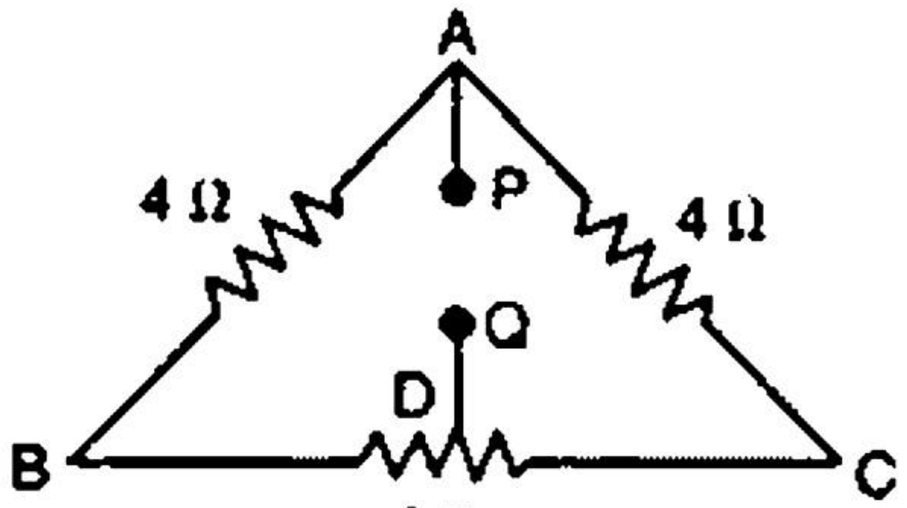
(b) Latent heat

(c) Specific latent heat

(d) Specific heat capacity

Question 9

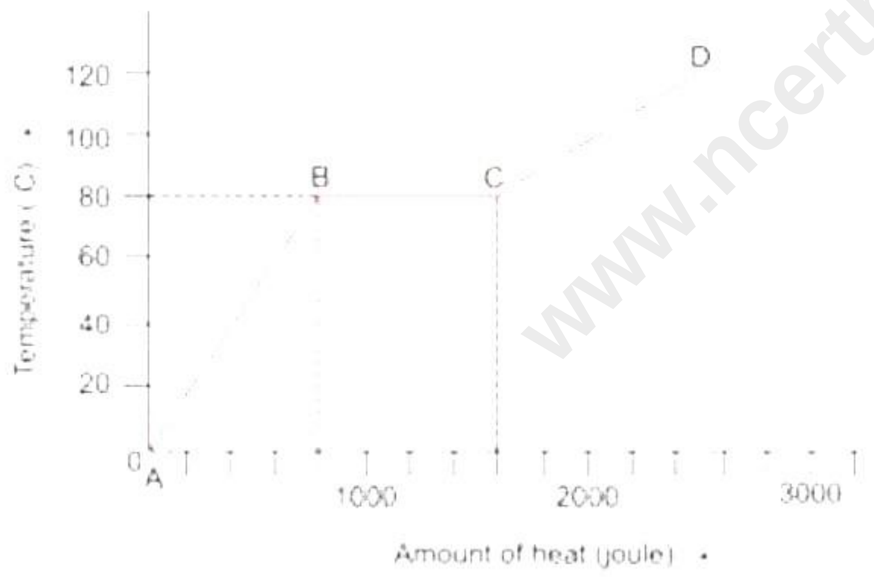
(i) In the figure given below, Point D divides the resistance of part BC into two equal halves. Calculate the resistance between point P and point Q. [3]



(a) State the factors on which the internal resistance of a cell depends.

(b) What is the function of a split ring in a DC motor?

(ii) For an experiment a substance initially in solid state at 0 °C is heated. The graph showing the variation in temperature with the amount of heat supplied is shown below: [3]



[Consider: specific heat capacity of the solid substance = 500 J $kg^{-1}C^{-1}$]

Answer the following questions based on the given graph:

(a) Between which two points does temperature of substance remains constant? Explain why?

(b) Find the mass of the substance.

(c) What will be the specific latent heat of fusion of the substance in the liquid state.

(iii) [4]

(a) Answer the following:

1. Name the radioactive radiations which have the least penetrating power.
2. Give one use of radioisotopes.

(b) Write the nuclear equations for the following:

1. The α – decay of $^{226}_{88}Ra$
2. The β – decay of $^{228}_{88}Ra$

Solution

SECTION A

Solution 1

Choose the correct answers to the questions from the given options. (Do not copy the questions, write the correct answer only.)

i) Correct answer – d: Both on the force and its perpendicular distance from the axis.
The moment of a force about a given axis depends on the force and its perpendicular distance from the axis.

ii) Correct answer – c: Virtual and enlarged.
When the object is kept between the optical centre and the focus of a convex lens, the image is formed on the same side, behind the object.
The image thus formed is virtual, enlarged and erect.

iii) Correct answer – a: P.D. is same across each resistance.
In a parallel combination of resistances, P.D. is same across each resistance.

Hint: In a parallel combination, the ends of each resistor are connected to the ends of the same source of potential. Thus, the potential difference across each resistance is the same and is equal to the potential difference across the terminals of the source (or battery).

iv) Correct answer – a: 11 kV
The electric power is generated at 11 kV at the power generating system.

v) Correct answer – a: Both assertion and reason are true.
Sound waves in air, solids, and liquids indeed travel as longitudinal waves, where the vibrations of particles are parallel to the direction of wave propagation. This explains why both the assertion and reason are true, and the reason correctly explains the assertion.

vi) Correct answer – d: J/kg
The S.I. unit of specific latent Heat is J/kg.

vii) Correct answer – d: Zero
Zero because force acts in a direction perpendicular to the direction in which the object moves.

viii) Correct answer – c: Forearm used for lifting a load.
Crowbar, beam balance and pliers are all examples of Class I levers. The forearm used for lifting a load is an example of a Class III lever.

ix) Correct answer – b: tone
The sound of a single frequency is called tone.

x) Correct answer – c: A compass needle
A compass needle can detect the presence of a magnetic field at a point.

Note:
In the presence of a magnetic field, the compass's needle rests only in the direction of the magnetic field and in the absence of any magnetic field, the compass's needle can rest in any direction. The needle rests in a north-south direction in the Earth's magnetic field alone.

xi) Correct answer – c: 3×10^{20} Hz
Frequency = c/wavelength = $3 \times 10^{8} / 0.01 \times 10^{-10}$ m = 3×10^{20} Hz

xii) Correct answer – c: More than that at Shimla
The boiling point of water at Delhi will be more than that at Shimla because atmospheric pressure at Shimla is less than at Delhi.

xiii) Correct answer – a: yes
When a ray of light travels from air into water obliquely, it bends towards the normal. This is because water is optically denser than air. The speed decreases on entering the water, and the light bends towards the normal.

xiv) Correct answer – c: violet
When white light falls on a glass prism, each colour in it is refracted by a different angle, from which violet colour is most deviated and red is the least.

xv) Correct answer – d: 10^{7}K
A high temperature of approximately 10^{7}K and high pressure is required to make the fusion possible.

Solution 2

i)

(a) **Neutron** is used in nuclear fission for bombardment.

(b) For normal incidence, the angle of incidence is **0°.**

(c) The turning effect of a force applied on the body about an axis is due to **torque**.

(d) The rating of the fuse depends on the **connected load.**

(e) The mass number (A) of an element is not changed when it emits **beta** and **gamma** radiation.

ii)

(a) Heat energy imparted by water in the fall of its temperature from 50°C to 0° C = mass x specific heat capacity x fall in temperature.
= 5.0 x 4200 x (50 - 0) J = 1050000 J =1.5 MJ

(b) If m kg of ice melts at 0°C by the heat energy imparted by water, then heat imparted - mL

a. or 1050000 J = m x 336 x 1000 J
b. Therefore, m = 1050000/ 336000 = 3.125 kg.
c. Remaining ice = 8.0 - 3.125 = 4.875 kg.
Thus 4.875 kg ice remains unmelted at 0°C.

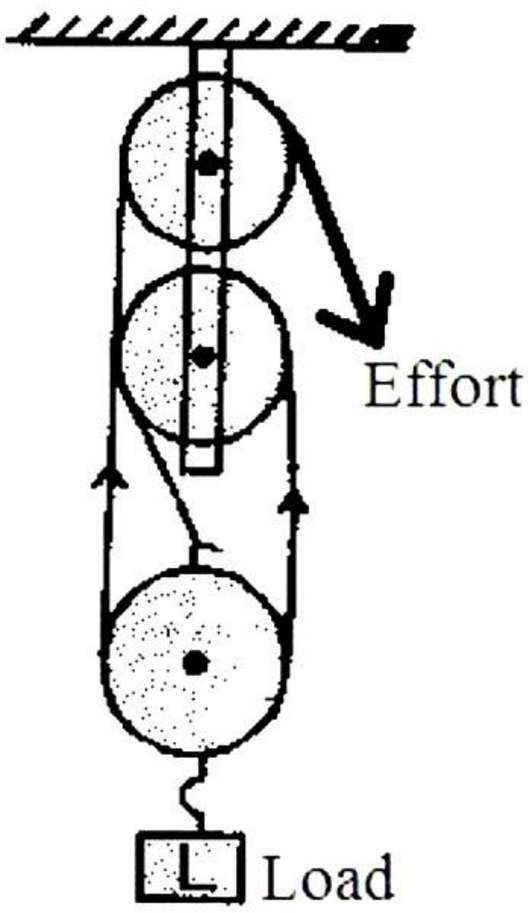
iii) The three important characteristics of musical sound are given below.

1. Loudness is the sensation produced in the ear, enabling us to distinguish between a loud and faint sound. It depends upon the intensity of sound and the sensitivity of the ear. It is measured in terms of bel.
2. The pitch of sound is that subjective property that distinguishes a sharp sound from a dull one. It depends upon the frequency of the source.
3. Quality is that subjective characteristic of sound that enables us to distinguish between sounds of the same loudness and pitch but emitted from two different sources. It depends upon the waveforms, determined by the number of overtones present and their respective intensities.

Solution 3

i)

(a)



If w be the total weight of the pulleys in the lower block, in the balanced position

$$\text{Efficinecy} = \frac{MA}{VR} = \frac{n - \frac{w}{E}}{n} = 1 - \frac{w}{nE}$$

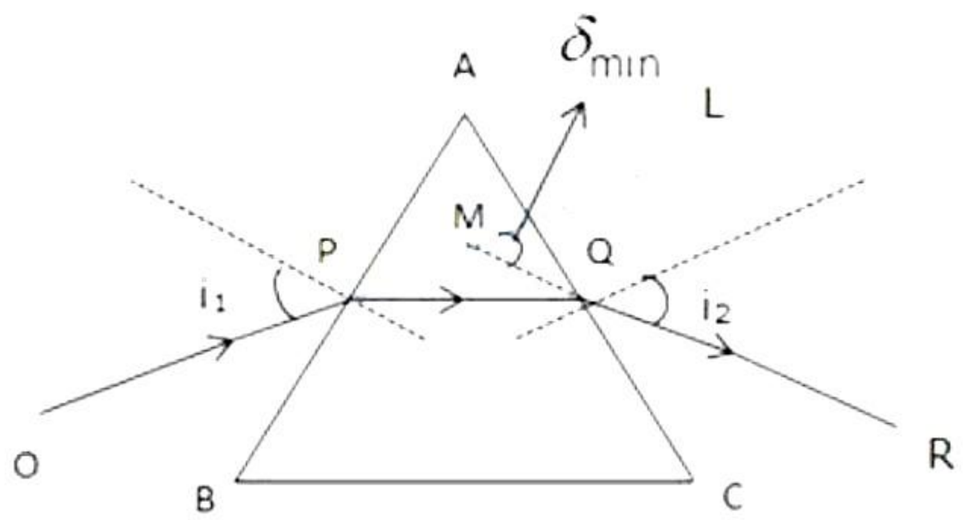
(b) From the expression it is clear that for greater efficiency $\frac{w}{nE}$ should be negligible. The pulleys in the lower block should be as light as possible.

ii)

- Electrons revolving in the outermost orbit of an atom that is weakly held by the nucleus are called free electrons.
- Free electrons cannot leave the metal surface on their own because they do not have sufficient kinetic energy.

iii) In the case of an equilateral prism, when the prism is in the position of minimum deviation $\delta = \delta_{min}$ the angle of incidence i_1 is equal to the angle of emergence i_2.

$i_1 = i_2 = i$



iv) In the first case

F = 150 N,

r =40 cm =0.4 m

Now,

The moment of force needed to open the nut, $\tau = 150\ N \times 0.4$

$\therefore \tau = 60 Nm$

v) All heated bodies, such as a heated iron ball, flame, fire, etc., are the sources of infrared radiation.

The electric arc and sparks give ultraviolet radiation.

vi) Relation of refractive index μ with real and apparent depths

$$\mu = \frac{\text{Real Depth}}{\text{Apparent Depth}}$$

vii)

$$P = \frac{V^2}{R}$$

$$100 = \frac{220 \times 220}{R}$$

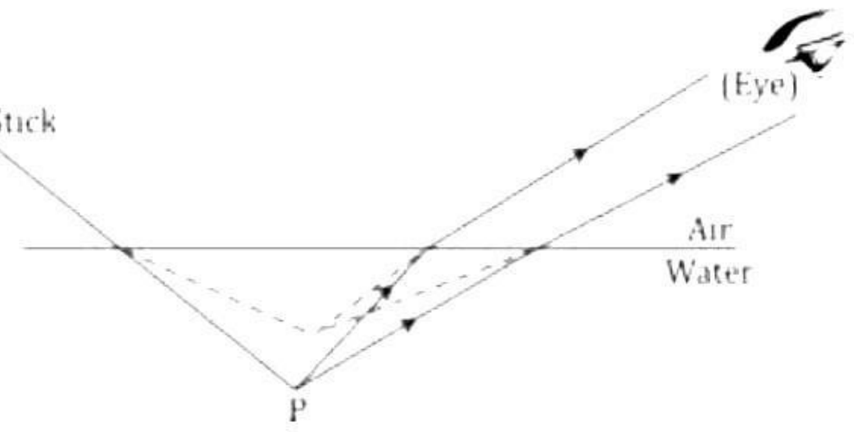
$$R = \frac{220 \times 220}{1000} = 48.4\Omega$$

Section B

(Attempt *any four* questions)

Solution 4

(i) The diagram is as follows:



(ii)

(a) Properties of X-rays :

- These are invisible rays
- These are electromagnetic rays, which travel at the speed of light.

Uses of X-rays :

- X-ray radiographs are used in surgery for detect of fractures, diseased organs.
- These are used in detecting flaws and in metal sheets used in manufacture of air glass.

(b)

1. Ultraviolet radiations are used for detection of invisible writing.
2. Infra-red radiations are used to detect the secret writing on the walls.

(iii)

(a) Given that,

Focal length of the convex lens, $f_1 = +20$ cm

Focal length of the concave lens, $f_2 = -25$ cm

Let the focal length of the combination is F and the power of this combination is P.

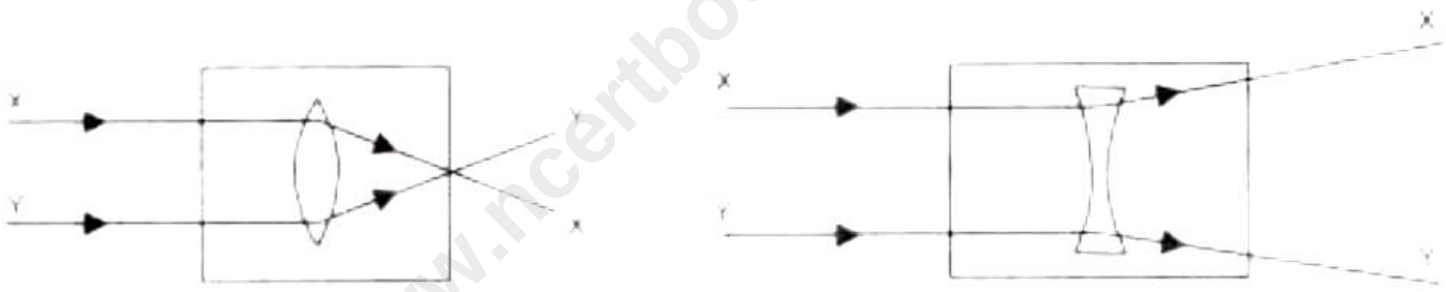
$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$= \frac{1}{20} + \frac{1}{-25} = \frac{1}{100}$$

$$\therefore F = 100 \text{ cm} = 1\text{m}$$

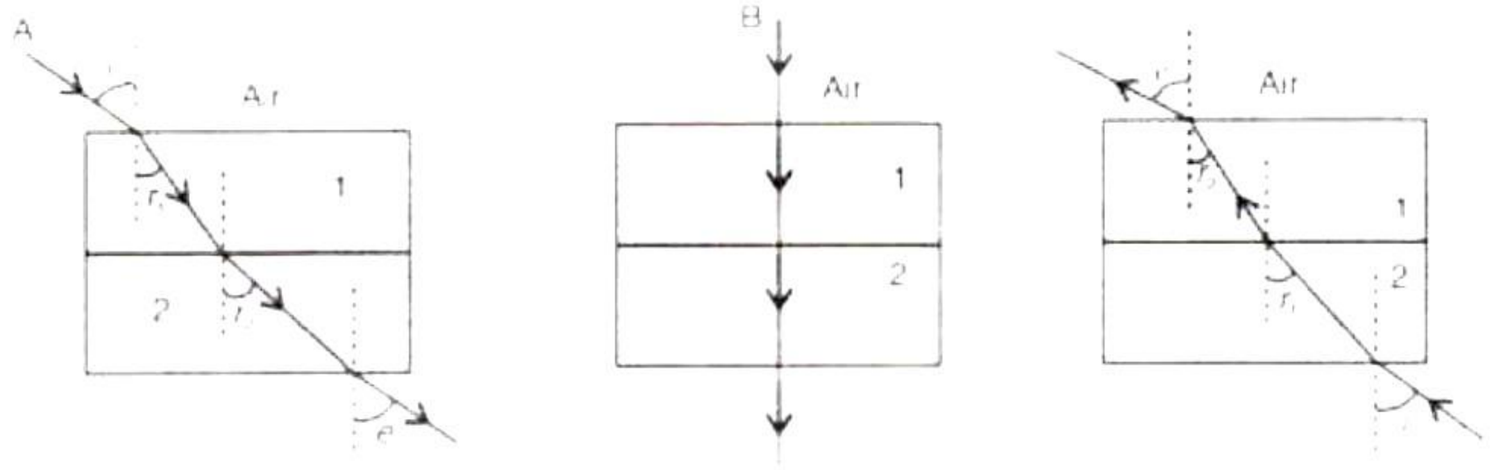
$$P = \frac{1}{F} = \frac{1}{1\text{m}} = 1 \text{ Dioptre}$$

(b)



Solution 5

(i)



Speed of light in medium '1' is less than speed of light in medium '2'.

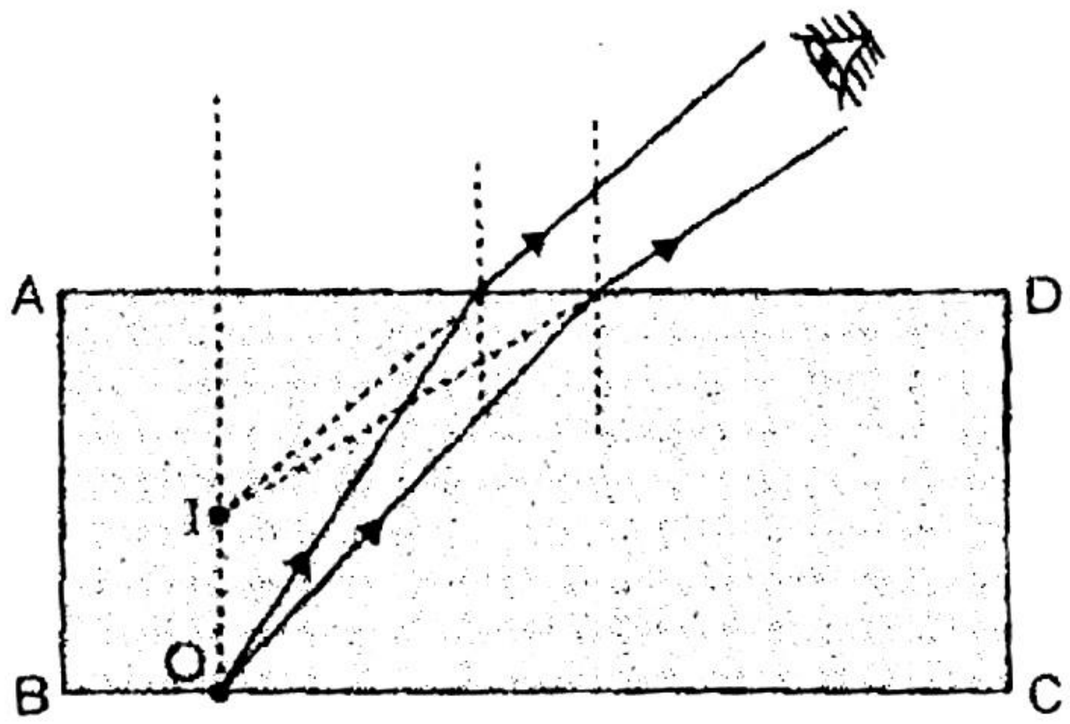
So, the refractive index of medium '1' is more than that of medium '2', i.e. medium '1' is optically denser than medium '2'.

(ii)

(a) In glass, speed is maximum for red light and minimum for violet light.

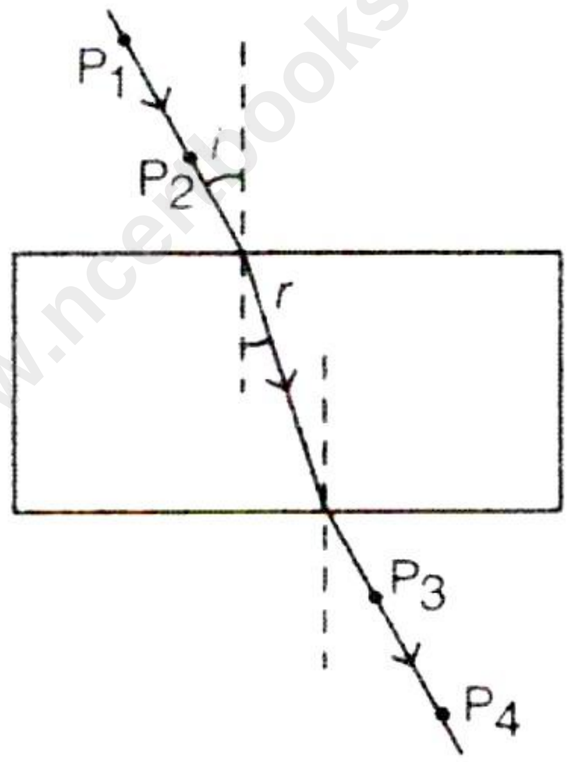
(b) Deviation between the incident ray and the emergent ray is called angular deviation. In case of a glass block, the incident ray and the emergent ray are parallel. Hence, angular deviation is zero.

(c) When a glass block is placed over a mark on a paper, the mark seems to rise due to refraction of light from denser medium to rarer medium at the plane surface separating the two media.



(iii)

(a)



(b) Lateral displacement

(c) Red light

(d) Light will retrace its original path or it will pass without any deviation.

Solution 6

(i)

(a) Electrical energy is converted to chemical energy.

(b) Light energy is converted to chemical energy which is used by plants for producing carbohydrates.

(c) Heat energy is converted to chemical energy.

(ii)

(a) The mechanical advantage of a lever = $\frac{\text{Effort arm}}{\text{Load arm}}$

(b) The mechanical advantage of an inclined plane = $\frac{l}{h}$

Where 'l' is the length of the plank and 'h' is the vertical height of plank.

(c) The efficiency of a single movable pulley system is always less than 100% because of the friction in the pulley bearing or at axle and the weight of the pulley.

(iii)

(a) Given that,

Mass, m = 15 kg

Acceleration due to gravity, g = 10 m/s^2

Now,

Mechanical advantage = $\frac{mgh}{F} = \frac{15 \times 10}{180} = \frac{5}{6}$

∴ M.A = 0.833

(b) For the given case, when efforts move by a distance d the load moves a distance d upwards.

∴ Velocity ratio = $\frac{\text{displacement of effort}}{\text{displacement of load}} = \frac{d}{d} = 1$

(c) Now,

Efficiency, $\eta = \frac{M.A}{V.R} = 0.833 \text{ or } 83.33\%$

The efficiency is less than 100% because some energy is wasted in overcoming the frictional force.

(d) Energy gained by the load = load × displacement

∴ E = 150 × 5 = 750 J

Solution 7

(i)

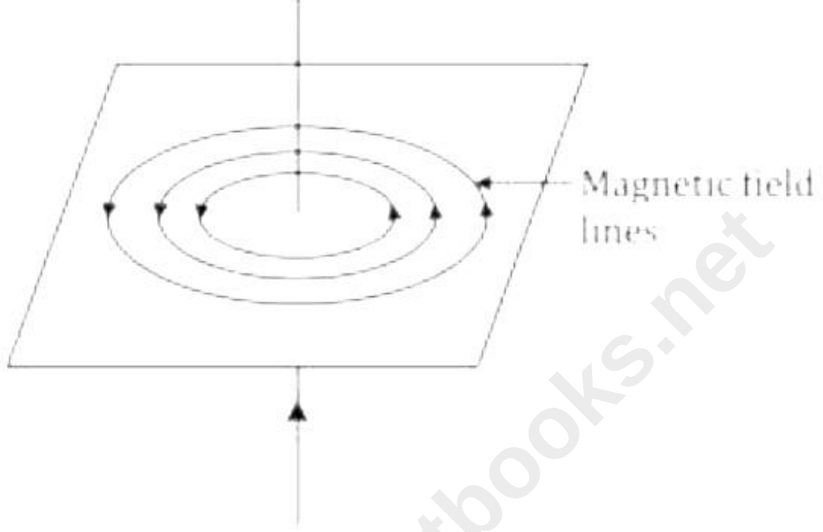
(a) Because of the latent heat of fusion employed by the substances, the temperature of a substance remains constant between melting (AB) and boiling points (CD) until the melting and boiling are completed.

(b) The slope of the part DE of the graph represents $\frac{\Delta T}{Q}$, i.e., the reciprocal of the thermal capacity $\frac{Q}{\Delta T}$ of the vapour.

(c) CD = 2.5 × AB means that the latent heat of vaporisation is 2.5 times the latent heat of fusion.

(ii)

(a)



(b) The Right-hand thumb rule was used to find the direction of magnetic field lines.

(iii)

(a) The magnetic field (of a long straight solenoid) is nearly uniform inside it.

(b) The two ways through which the magnetic field of a solenoid can be made stronger are as follows:

1. By increasing the current.
2. By increasing the number of turns of a wire in the solenoid.

(c) The direction of force on a current carrying conductor placed in magnetic field can be reversed by following two methods-

1. By reversing the direction of current flowing through the conductor
2. By reversing the direction of magnetic field.

Solution 8

(i)

(a) The fundamental frequency of a stretched string can be affected by the following three factors:

1. Tension (T : $f \propto \sqrt{T}$, where l and m are constants.
2. Length (l : $f \propto \frac{1}{l}$, where T and m are constants.
3. Radius (r : $f \propto \frac{1}{r}$, where T and l are constants.

(b) The frequency of the note emitted by an air column is inversely proportional to the length of the air column. So, as the length of the air column decreases, frequency increases, i.e. the sound becomes shrill. As the water level in the bucket rises, the length of the air column goes on decreasing and the sound produced goes on becoming shriller. Thus, one can estimate the height of the water level in the bucket simply by hearing the sound.

(ii)

(a) Total resistance of the circuit be R and R_P be the resistances connected in parallel.

Thus, $R = 2 + R_P$

$$\frac{1}{R_p} = \frac{1}{3} - \frac{1}{6} = \frac{1}{2}$$

$$R_p = 2\ \Omega$$

$$R = 2 - 2 = 4\ \Omega$$

(b) The current in the ammeters B and C is inversely proportional to the value of resistance in parallel branch. Thus,

$$\frac{\text{reading of ammeter B}}{\text{reading of ammeter C}} = \frac{R}{R_p}$$

$$\frac{\text{reading of ammeter B}}{1} = \frac{3}{6} = 0.5$$

Thus, ammeter reading of B = 0.5 A

Hence, reading of ammeter A = total current flowing in circuit = current reading of B + current reading in C = 0.5 + 1 = 1.5 A

(iii)

(a) Heat capacity of a body changes directly as the mass of the body.

(b) Latent heat capacity changes directly as the mass of the body.

(c) Specific latent heat does not depend on the mass of the body as it is the characteristic of the material of the body.

(d) Specific heat capacity does not depend on the mass of the body as it is the characteristic of the material of the body.

Solution 9

(i) As point D divides the resistance of arm BC in two equal halves, the resistances in part BD = DC = 2Ω.

Let the equivalent resistance between P and Q be R.

Now, from the figure, resistances AB and BD are in series and their equivalent resistance is 4 Ω + 2 Ω = 6 Ω.

Similarly, AC and CD are in series and their equivalent resistance is also 4 Ω + 2 Ω = 6 Ω.

According to the figure, these two 6 Ω resistances are in parallel. So, we have

$$\frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6}$$

$$\therefore R = 3\ \Omega$$

(b) Internal resistance of a cell depends on
- Distance between the plates
- Nature of the electrolyte
- Nature of electrodes
- Area of the plates immersed in the electrolyte

(c) In a DC motor, the split ring acts as a commutator. The direction of the current through the coil is reversed after every half rotation so that the direction of the rotating couple remains unchanged and the coil continues to rotate in the same direction.

(ii)

(a) Between point B and C the temperature of the substance will be constant as shown in the graph. This is because of latent heat of fusion.

(b) In the graph, AB part represents the increase in temperature of solid substance from 0 °C to 80°C on absorbing the heat Q = 800 J.
If m kg is the mass of solid substance, then Heat absorbed will be
Q = mass × specific heat capacity × rise in temperature
$800 = m \times 500 \times 80$
$\therefore m = 1/50 \text{ kg} = 0.02 \text{ kg} = 20 \text{ g}$

(c) In the graph, BC part represents the change of state of substance from solid to liquid at 80°C on absorbing the heat energy Q.
$\therefore Q = 1600 \text{ J} - 800 \text{ J} = 800 \text{ J}.$
If L J kg^{-1} is the latent heat of fusion of the substance in the liquid state, then
Heat absorbed, Q = mass ×latent heat of fusion
$800 = 0.02 \times L$
$\therefore L = 800 / 0.02 = 40000 \text{ J kg}^{-1}.$

(iii)

(a)
1. α –radiation has the least penetrating power.
2. Radioisotopes are used to cure many diseases such as leukaemia, cancer, etc. through radiation therapy.

(b)
1. $^{226}_{88}\text{Ra} \rightarrow ^{222}_{86}\text{Rn} + ^{4}_{2}\text{He}$
2. $^{228}_{88}\text{Ra} \rightarrow ^{228}_{89}\text{Ac} + ^{0}_{-1}\text{e}$