ICSE EXAMINATION PAPER - 2025
PHYSICS
(SCIENCE PAPER – 1)
Class-10th
(Solved)

Maximum Marks: 80 *Time Allotted: Two Hours*

Instructions to Candidates:

1. *Answers to this Paper must be written on the paper provided separately.*
2. *You will **not** be allowed to write during the first **15** minutes.*
3. *This time is to be spent in reading the question paper.*
4. ***The time given at the head of this Paper is the time allowed for writing the answers.***
5. ***Section A is compulsory**. Attempt **any four** questions from **Section B***
6. *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]**

(Do not copy the questions, write the correct answers only.)

(i) A body is acted upon by two equal and opposite forces, that are **NOT** along the same straight line. The body will:

(a) remain stationary **(b)** have only rotational motion

(c) have only rectilinear motion **(d)** have both rectilinear and rotational motion

(ii) Which among the following is a **vector** quantity?

(a) work **(b)** power **(c)** energy **(d)** moment of couple

(iii) What is the correct energy transformation during burning of a candle?

(a) heat → kinetic + potential **(b)** heat → chemical + light

(c) chemical → heat + light **(d)** mechanical → chemical + heat

(iv) When a ray of light passes from one optical medium to another, which of the following physical quantities does **NOT** change?

(a) Amplitude of the wave **(b)** Frequency of the wave

(c) Wavelength of the wave **(d)** Speed of the wave

(v) Which one of the following combinations is the **correct ascending order** of electromagnetic waves in terms of **wavelength**?

(a) Gamma-rays, visible light, microwaves **(b)** Microwaves, visible light, gamma-rays

(c) Gamma-rays, microwaves, visible light **(d)** Microwaves, gamma-rays, visible light

(vi) For a lever, a graph is plotted with load on Y-axis and effort on X-axis. Which of the following represents the **slope** of the graph?

(a) Mechanical advantage **(b)** Velocity ratio

(c) $\frac{1}{\text{Velocity ratio}}$ **(d)** $\frac{1}{\text{Mechanical advantage}}$

(vii) For a real image formed by a convex lens, the ratio of I : O = 2 : 5, then the object is:

(I is the height of the image and O is the height of the object)

(a) between O and F **(b)** beyond 2F **(c)** at F **(d)** between F and 2F

(viii) A ray of light is incident normally on a face of an equilateral prism. The ray gets totally reflected at the second refracting surface. **The total deviation** produced in the path of the ray is:

(a) 30° **(b)** 60° **(c)** 90° **(d)** 120°

(ix) In a closed circuit containing a bulb and a cell, the electromotive force (ε) and the terminal voltage (*V*) is related as.

(Given I is current and r is internal resistance.)

(a) $V = \varepsilon + Ir$ **(b)** $V = \varepsilon - Ir$ **(c)** $V = \varepsilon \div Ir$ **(d)** $V = \varepsilon \times Ir$

(x) A metal piece of mass 5 g has thermal capacity **2.5 JK^{-1}**. If the mass of the metal is tripled, then its **specific heat capacity** will be:

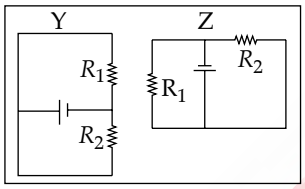
(a) 7.5 JK^{-1} **(b)** 2.5 JK^{-1} **(c)** 1.5 $Jg^{-1}K^{-1}$ **(d)** 0.5 $Jg^{-1}K^{-1}$

(xi) **Assertion (A):** As the level of water in a tall measuring cylinder kept under running tap rises, the pitch of sound gradually increases.

Reason (R): Frequency of sound is inversely proportional to the length of the water column.

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

(xii) In the given circuits **Y** and **Z**, the resistors, R_1 and R_2, are connected in:



(a) series in both the circuits **(b)** parallel in both the circuits
(c) parallel in Y and series in Z **(d)** series in Y and parallel in Z

(xiii) A radioactive element P emits one α-particle and transforms to a new element Q. What will be the position of the element Q in the periodic table?

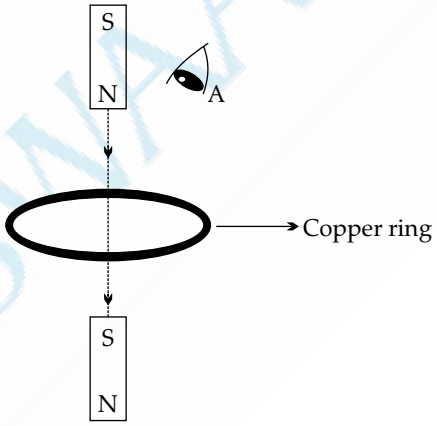
(a) One group to the left of P **(b)** One group to the right of P
(c) Two groups to the right of P **(d)** Two groups to the left of P

(xiv) Each of the substances given below is supplied with same amount of heat. Which one will attain the highest temperature?

Substance	Lead	Aluminium	Copper	Iron
Specific heat capacity (cal/g°C)	0.031	0.21	0.095	0.115

(a) Aluminium **(b)** Copper **(c)** Iron **(d)** Lead

(xv) The following figure shows a small bar magnet falling freely through a copper ring. For the observer at A, the direction of the induced current will be:



(a) clockwise when magnet is above and below the ring
(b) anticlockwise when magnet is above and below the ring
(c) anticlockwise when magnet is above the ring and clockwise when the magnet is below the ring
(d) clockwise when magnet is above the ring and anticlockwise when the magnet is below the ring

Question 2

(i) Complete the following by choosing the correct answers from the bracket: **[6]**

(a) In uniform circular motion the centrifugal force acts _____ *(towards the centre/away from the centre/along the tangential direction].*

(b) Refractive index of a medium is independent of _____ *[temperature/angle of incidence/wavelength of light).*

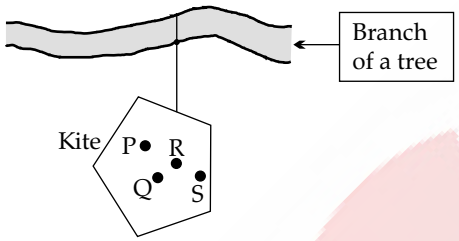
(c) Heat absorbed during change of phase depends on _____ *[mass/change in temperature/specific heat capacity]* of the substance.

(d) Emf of a cell is _____ *[greater than / less than / equal to]* the terminal voltage when the cell is in open circuit.

(e) In a step-up transformer the turns ratio is _____ *[more than 1/ less than 1/ equal to 1].*

(f) The nuclear radiation with lowest ionising power is _____ *[α/β/γ].*

(ii) A non-uniform kite is hanging freely from the branch of a tree as shown. Study the figure and answer the following: **[2]**

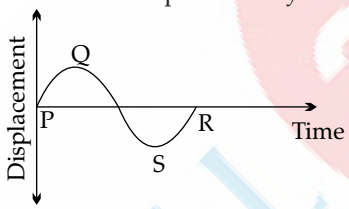


(a) **Fill in the blank.**

_____ (P, Q, R or S) is the most probable position of its centre of gravity.

(b) Support your answer to (a) with a reason.

(iii) The displacement–time graph of a sound wave produced by a vibrating wire is shown below. **[2]**



(a) How will you adjust the tension in the wire, to reduce the length of PR?

(b) Which characteristic of sound is affected by the reduction in the length of PR?

Question 3

(i) A ray of light enters a rectangular glass slab submerged in water at an angle of incidence 55°. Does this ray undergo total internal reflection when it moves from water to glass? Justify your answer. *(The critical angle for glass–water interface is 54°)* **[2]**

(ii) According to the NEW colour convention which colour of wire is connected to: **[2]**

(a) the metal body of the appliance

(b) the switch of the appliance?

(iii) **(a)** Which of the two, *alternating current or direct current*, produces a varying magnetic field when it flows through a conductor? **[2]**

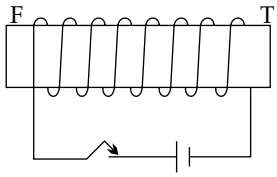
(b) State the frequency of the alternating current supply in India.

(iv) Calcuate the amount of heat absorbed by 200 g of paraffin wax to melt completely at its melting point. **[2]**
[Specific latent heat of fusion of paraffin wax = 146 Jg^{-1}]

(v) Copper wire is wound around a steel bar FT. Current is allowed to pass through the coil for some time and then the bar is removed. **[2]**

(a) Draw only the magnetised bar FT and mark its poles.

(b) Trace two magnetic lines of force around FT clearly indicating the direction.

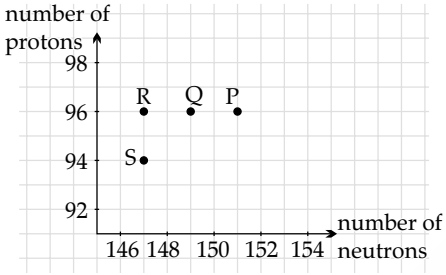


(vi) A current flows through a metallic conductor for a long period of time. State the change you would expect in its: **[2]**

(a) Resistance

(b) Resistivity

(vii) Curium is a radioactive element with the symbol $^{247}_{96}Cm$ named in honour of Madam Curie. The graph of number of protons vs number of neutrons for some elements are shown below: **[3]**



(a) Which point on the graph indicates the element *Cm*?

(b) Which point on the graph indicates daughter nucleus after *Cm* undergoes radioactive decay of 1α followed by 2β?

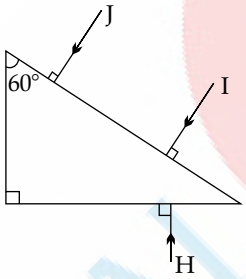
(c) State the mass number of the daughter nucleus.

SECTION B (40 Marks)

(*Attempt **any four** questions from this **Section**.*)

Question 4

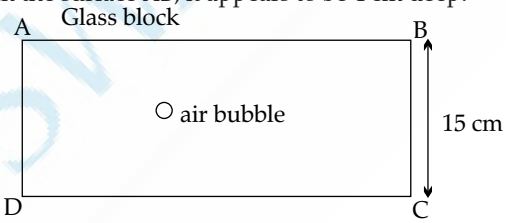
(i) **[3]**



(a) Out of the three rays (I, J, H) shown in the diagram, which ray will suffer Total Internal Reflection while inside the prism? *(Critical angle of the prism is 42°.)*

(b) Copy the diagram to complete the path of the ray which you have named in (a) till it comes out of the prism.

(ii) A rectangular glass block of refractive index 1.5 has an air bubble trapped inside it as shown in the diagram. When seen from the surface AB, it appears to be 4 cm deep. **[3]**



(a) Calculate the actual depth of the air bubble from the surface AB.

(b) For which colour of light, bluc or yellow, the apparent depth will be greater?

(c) Turning the glass block upside down, DOES NOT change the apparent depth of the air bubble. State True or False.

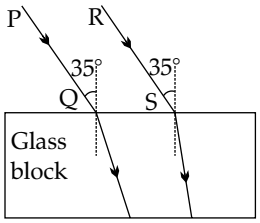
(iii) **(a)** An object is placed at 2F position of a convex lens. Draw a ray diagram showing the formation of the image. **[4]**

(b) How will the size of the image change if we, ONLY replace the lens in the above arrangement with another lens of a greater focal length?

Question 5 **[3]**

(i) An object is placed in front of a concave lens at a distance of 45 cm from it. If its image is formed at a distance of 30 cm from the lens, calculate the focal length of the lens.

(ii) Two rays PQ and RS are incident on a rectangular glass block as shown in the diagram. Observe the diagram and answer the questions that follow. **[3]**



Which of these two rays will:

(a) have greater lateral displacement on emerging out of the block?

(b) travel with greater speed in the block?

(c) scatter more in the atmosphere?

(iii) **(a)** Name the radiations: **[4]**

1. for which a quartz prism is used to study the spectrum.

2. which are used in remote sensing devices.

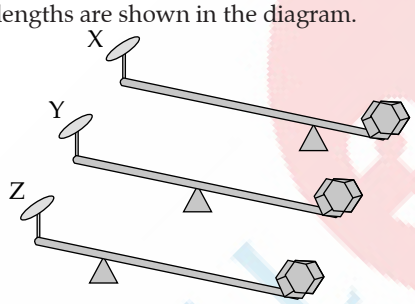
3. which are used in traffic signals in India.

(b) Name one property common to all electromagnetic radiations.

Question 6

(i) Akash takes a uniform metre scale and suspends a weight of 2 N at one end 'X', and a weight of 5 N on the other end 'Y". He then balances the ruler horizontally on a knife edge placed at 70 cm from X. Draw a diagram of the arrangement and calculate the weight of the ruler. **[3]**

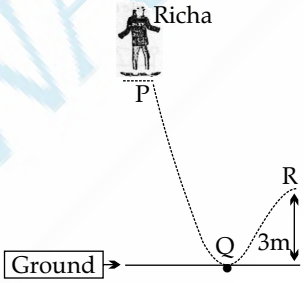
(ii) Three levers X, Y, Z of equal lengths are shown in the diagram. **[3]**



(a) Which class of lever do these belong to?

(b) Among these (X, Y or Z) which one will give the maximum mechanical advantage? Justify your answer.

(iii) **[4]**



Richa weighing 40 kgf leaves point P on her skateboard and reaches point Q on the ground with velocity 10 ms^{-1}. Calculate.

(a) the kinetic energy of Richa at point Q

(b) the vertical height of point P above the ground. *(use **g** as 10 m/s^2 and neglect friction)*

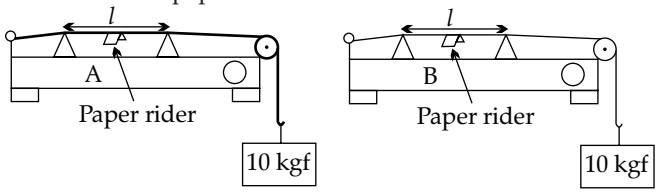
(c) the kinetic energy of Richa at point R. *(While moving from Q to R, she loses 500 J of energy against friction.)*

Question 7

(i) Draw a block and tackle system of pulleys with velocity ratio equal to 3. **[3]**

(ii) A submarine in the sea, sends ultrasonic ping and a stopwatch is started. simultaneously. The stopwatch stops on receiving the reflected wave from an obstacle and reads 1 minute 40 seconds. Calculate the distance of the obstacle from the submarine *(Speed of sound in water 1500 ms^{-1})* **[3]**

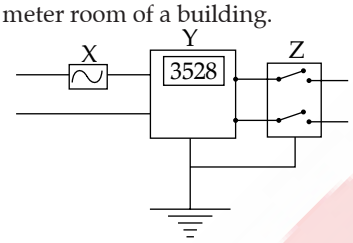
(iii) The diagrams given below show two sound boxes A and **B** with wires of same length *(l)* and tension *(10 kgf)* but different cross-sectional areas. Simultaneously, vibrating tuning forks of frequency 300 Hz are placed on the boxes A and B. The paper rider falls off in case of B but not in case of A. **[4]**



(a) Name and explain the phenomenon responsible for the falling off of the paper rider in B.
(b) The wire A resonates with a tuning fork of frequency *'f'*. Is *'f' greater than, less than or equal to* 300 Hz? Justify your answer.

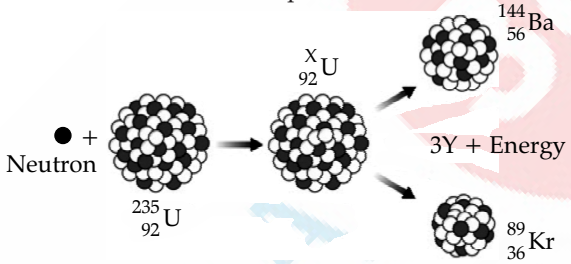
Question 8

(i) The diagram shows wiring in a meter room of a building. **[3]**



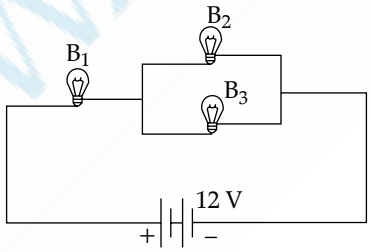
(a) What is the current rating of device X?
(b) What is the difference between the switch Z shown in the diagram and the switches you use to operate different appliances at home?
(c) What is the unit of the physical quantity displayed in Y?

(ii) Study the diagram given below and answer the questions that follow **[3]**



(a) Name the process depicted in the diagram.
(b) What is the value of X?
(c) Identify Y, the missing product of the reaction.

(iii) **[4]**



Three identical bulbs B_1, B_2 and B_3 each of power rating 18 W, 12 V are connected to a battery of 12 V.

(a) Calculate:
1. the resistance of each bulb
2. the current drawn from the cell
(b) If the bulb B_3 is removed from the circuit, then will the brightness of the bulb B_1 *increase, decrease or remain the same*?

Question 9

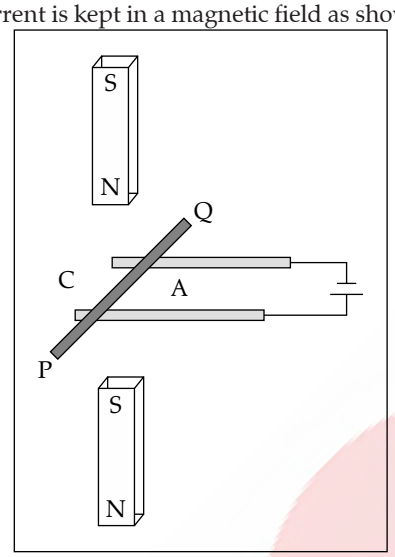
(i) 30 g of ice at 0°C is used to bring down the temperature of a certain mass of water at 70°C to 20°C. Find the mass of water *[Specific heat capacity of water = 4.2 $Jg^{-1}°C^{-1}$ and specific latent heat of ice = 336 Jg^{-1}.]* **[3]**

(ii) **(a)** A certain amount of heat will warm 1 g of material X by 10°C and 1 g of material Y by 40°C. Which material has higher specific heat capacity? **[3]**

(b) Which material, X or Y, would you select to make a calorimeter?

(c) The specific heat capacity of a substance remains the same when it changes its state from solid to liquid. State True or False.

(iii) A copper rod PQ carrying current is kept in a magnetic field as shown in the diagram. **[4]**



(a) The copper rod PQ will move towards C. State True or False.

(b) Name the law used to determine the direction of motion of PQ.

(c) What will be the effect on the force experienced, if the rod PQ is replaced by another copper rod of same length but of greater cross-sectional area?

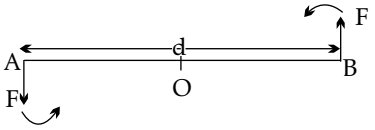
(d) Justify your answer in (c).

Answers

Answer 1.

(i) Option (b) is correct.

Explanation: Forces are equal and opposite, but not along same straight line.



So, the forces will form a couple and the body will have rotational motion only.

(ii) Option (d) is correct.

Explanation: Vector quantity has magnitude and direction.

The direction of a moment of couple is perpendicular to the plane containing the two forces forming the couple. The magnitude of moment of couple is the product of magnitude of one of the forces and the perpendicular distance between the lines of action of the two forces.

Hence, it is a vector quantity.

(iii) Option (c) is correct.

Explanation: When a candle burns, chemical energy stored in the wax is transformed into heat and light energy through a combustion reaction.

(iv) Option (b) is correct.

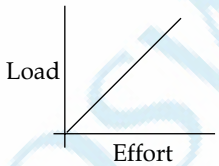
Explanation: Frequency of wave depends on the source and not on the medium through which it propagates.

(v) Option (a) is correct.

Explanation: wavelength of gamma rays is less than 0.01 nm. Wavelength of visible light ranges from 400 to 700 nm. Wavelength of microwave ranges from 1 mm to 1 m.

(vi) Option (a) is correct.

Explanation: Load vs effort graph is a straight line.

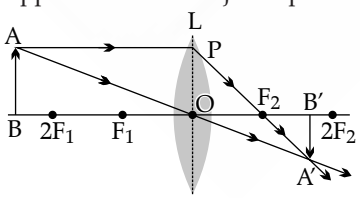


Slope of the graph = Load/effort = Mechanical advantage

(vii) Option (b) is correct.

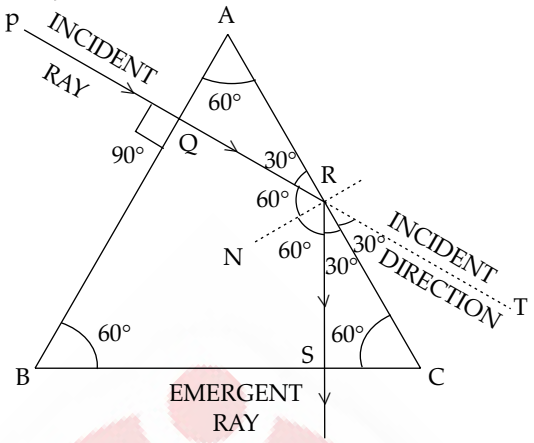
Explanation: Real Image size < Object size.

This happens when the object is placed beyond 2*F*.



(viii) Option (b) is correct.

Explanation:



The ray is normally incident on face *AB*. It passes undeviated. Angle of incidence on face *AC* is 60°. The reflected ray is incident normally on face *BC* and passes undeviated.

$\angle NRS = 60^\circ$

$\therefore \angle SRC = 30^\circ$

$\angle ARQ = 30^\circ$

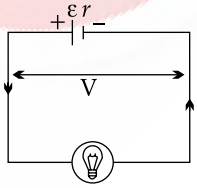
$\therefore \angle CRT = 30^\circ$

RT is the original path of the incident ray.

So, total deviation = $\angle SRT = 30^\circ + 30^\circ = 60^\circ$

(ix) Option (b) is correct.

Explanation: The circuit is:



When current flows,

$\varepsilon = V + Ir$

$\therefore V = \varepsilon - Ir$

(x) Option (d) is correct.

Explanation: Specific heat capacity

$$= \frac{\text{Thermal capacity}}{\text{mass}} = \frac{2.5\ \text{JK}^{-1}}{5\text{g}} = 0.5\ \text{JK}^{-1}\text{g}^{-1}$$

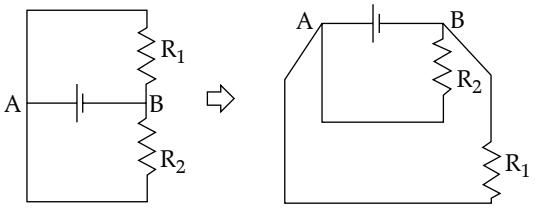
(xi) Option (c) is correct.

Explanation: As the water column increases, air column decreases, frequency increases. Hence, the assertion is true.

So, the frequency is proportional to the length of water column. Hence the reason is false.

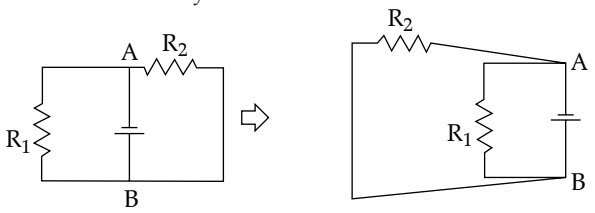
(xii) Option (b) is correct.

Explanation: Circuit *Y* may be redrawn as:



Both the resistors are connected across points *A* and *B*. Hence, those are connected in parallel.

Circuit *Z* may be redrawn as:



Both the resistors are connected across points *A* and *B*. Hence, those are connected in parallel.

(xiii) Option (d) is correct.

Explanation: The reaction is:

$^{A}_{Z}P \rightarrow {}^{A-4}_{Z-2}Q + {}^{4}_{2}He$

In periodic table elements are arranged in ascending order of atomic number.

The atomic number of *Q* is 2 less than that of *P*. Hence, position of *Q* will 2 groups left of *P*.

(xiv) Option (d) is correct.

Explanation: The substance whose specific heat capacity is the lowest will attain the highest temperature.

(xv) Option (c) is correct.

Explanation: **When the magnet is above the ring:**

- The flux through the ring increases downward.
- To oppose this, the ring induces a north pole on its top face.
- Using the right-hand rule, this corresponds to an anticlockwise current as seen by the observer A.

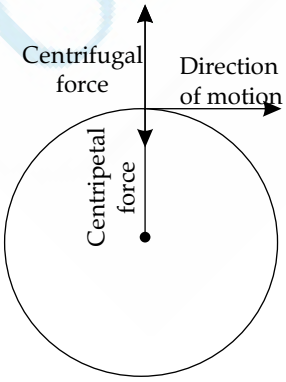
When the magnet passes below the ring:

- The flux through the ring decreases downward.
- To oppose this, the ring induces a south pole on its top face.
- Using the right-hand rule, this corresponds to a clockwise current as seen by the observer.

Answer 2.

(i) (a) away from the centre

Explanation:



(b) angle of incidence

Explanation: Refractive index depends on temperature and nature of light but not on the angle of incidence.

(c) mass

Explanation: As mass increases, the amount of heat absorbed also increases since

heat absorbed = mass × latent heat capacity

(d) equal to

Explanation: For closed circuit: $\varepsilon = V + ir$

But for open circuit: $\varepsilon = V$

(e) more than 1

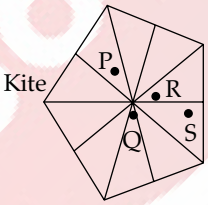
Explanation: The turns ratio of a transformer is defined as the number of turns on its secondary divided by the number of turns on its primary. For step up transformer, number of turns on its secondary is greater than the number of turns on its primary.

(f) γ

Explanation: It is composed of charged particle. Hence it has the lowest ionising power.

(ii) (a) *Q*

Explanation: Drawing the medians, it is found that *Q* is the most probable position of the centre of gravity.



(b) Of a uniform triangular lamina, the meeting point of the all the medians is the centre of gravity. For a uniform pentagonal lamina such point is the most probable position of centre of gravity.

(iii) (a) *PR* is the time period of the vibration.

Reduction of time period means the increase of frequency.

Frequency is proportional to square root of the tension.

So, tension is to be increased to increase the frequency i.e., to reduce the time period.

(b) Since, pitch depends on frequency, pitch will be affected by reduction of *PR*.

Answer 3.

(i) This ray will not undergo total internal reflection.

For total internal reflection, the light ray should travel from denser to rarer medium. But in the given situation light ray travels from rarer to denser medium (refractive index of glass is more than that of water). So, there will be no total internal reflection.

(ii) (a) Earth wire is connected to the metal body of electrical appliances. According to new convention the colour of earth wire is green or yellow.

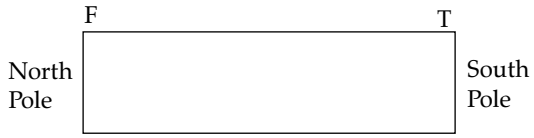
(b) Live wire is connected to the switch of an appliance. According to new convention the colour of live wire is brown.

(iii) (a) alternating current

(b) 50 Hz

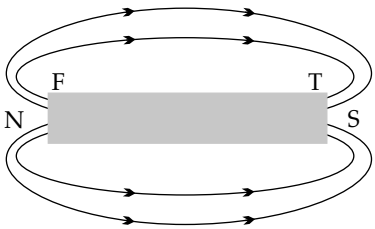
(iv) Total amount of heat absorbed, Q = $m \times L$ = 200 × 146 = 29200 J

(v) (a)



[***Explanation:*** Since, looking from the *F* side current was flowing in anti-clockwise direction, north pole developed at that end and south pole at the *T* end.]

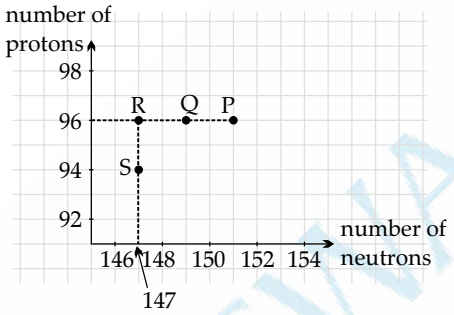
(b)



(vi) (a) As current flows for a long period of time, heat is generated and temperature increases. So, the resistance of metallic wire increases.

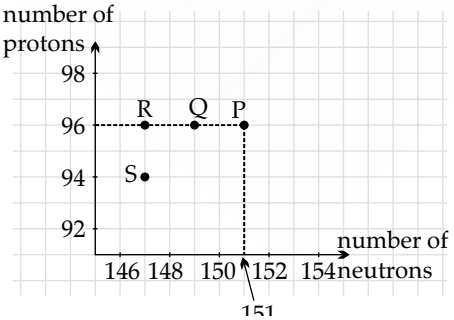
(b) As temperature increases, resistivity of metallic wire increases.

(vii) (a) Curium has 96 protons and 247 – 96 = 151 neutrons.



Point P represents 96 protons and 151 neutrons. Hence P point indicates element Curium.

(b) After the radioactive decay of 1 α and 2 β particles, the atomic number and mass number of daughter nucleus will be 243 and 96 respectively. So, it will have 243 – 96 = 141 neutrons.



Point *R* represents 96 protons and 147 neutrons. Hence *R* point indicates the daughter nucleus.

(c) Mass number of daughter nucleus

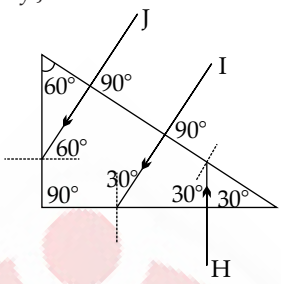
= Mass number of Curium – Mass number of α

= 247 – 4

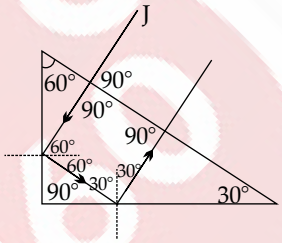
= 243

Answer 4.

(i) (a) Inside the prism, the angles of incidence of rays *I*, *J* and *H* are respectively 30°, 60° and 30°. Hence only the ray *J* will suffer total internal reflection.



(b)



(ii) (a) Refractive index = $\frac{\text{Real depth}}{\text{Apparent depth}}$

Or, 1.5 = $\frac{\text{Real depth}}{4}$

∴ Real depth = 6 cm

(b) Refractive index = $\frac{\text{Real depth}}{\text{Apparent depth}}$

Or, Apparent depth = $\frac{\text{Real depth}}{\text{Refractive index}}$

Apparent depth will increase, if refractive index decreases.

As wavelength increases, refractive index decreases.

Wavelength of yellow light is greater than wavelength of blue light.

So, refractive index for yellow light is smaller than refractive index blue light.

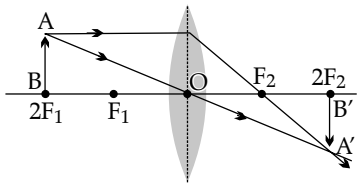
So, for yellow light apparent depth will be greater.

(c) When the block is turned upside down, then the real depth of the bubble is 15 – 6 = 9 cm

Apparent depth = $\frac{\text{Real depth}}{\text{Refractive index}} = \frac{9}{1.5} = 6\text{cm}.$

So, the statement is false.

(iii) (a)



(b) Size of the image remains unchanged since, magnification is not related to the focal length of the lens. Magnification = $\frac{h_i}{h_o} = \frac{v}{u}$.

Answer 5.

(i) Object distance = $u = -45$ cm

Image distance = $v = -30$ cm

Applying lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

Or, $$\frac{1}{-30} - \frac{1}{-45} = \frac{1}{f}$$

Or, $$\frac{-1}{90} = \frac{1}{f}$$

$\therefore f = -90$ cm

(ii) (a) Angle of incidence for both the rays being same, the directions of both the rays remain same. As the refracted ray corresponding to *RS* bends towards the normal is more than that corresponding to ray *PQ* hence, the lateral displacement of the emergent ray corresponding to incident ray *RS* will also be more.

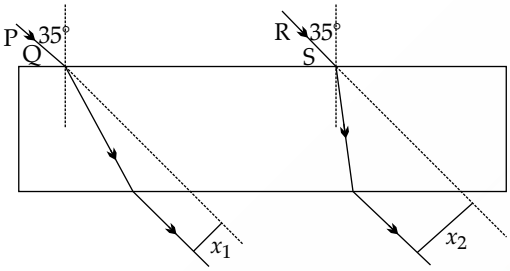


Diagram shows, x_1 and x_2 are the lateral shifts of the emergent rays corresponding to incident rays *PQ* and *RS*. $x_2 > x_1$.

(b) Since, the refracted ray corresponding to incident ray *PQ* bends less towards the normal, hence this travels with greater speed.

(c) Speed corresponding to incident ray *PQ* is more than the speed corresponding to incident ray *RS*.

So, wavelength corresponding to incident ray *PQ* is more than the wavelength corresponding to incident ray *RS*.

So, RS will scatter more in atmosphere.

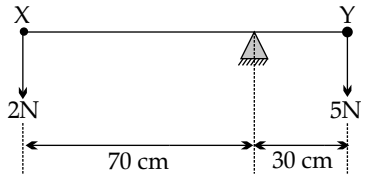
(iii) (a)

1. Ultraviolet radiation since, ordinary glass absorbs UV radiation.
2. Infra red radiation.
3. Visible light radiation (Red, Yellow, Green)

(b) All electromagnetic radiations travels with the same speed ie., 3×10^8 ms^{-1}.

Answer 6.

(i)



Let W = weight of the scale

Clockwise moment (due to 5N) = $5 \times 30 = 150$ Nm

Counter-clockwise moment (due to 2N) = $2 \times 70 = 140$ Nm

Counter-clockwise moment (due to weight of the scale) = $W \times 20 = 20W$ Nm

For equilibrium,

$150 = 140 + 20\,W$

Solving, $W = 0.5$ N

Weight of the scale = 0.5 N

(ii) (a) All are class I levers since, the fulcrum is in between the load and effort.

(b) Mechanical advantage = $\frac{\text{Effort arm}}{\text{Load arm}}$

For *X*, effort arm is greater than the load arm.

Hence, it has the maximum mechanmical advantage.

(iii) (a) Kinetic energy at Q = $\frac{1}{2}$ mv^2 = $\frac{1}{2} \times 40 \times 10^2$ = 2000 J

(b) If the height of *P* is *h*, then

$$mgh = \frac{1}{2} mv^2$$

or, $40 \times 10 \times h = 2000$

$\therefore h = 5$ m

(c) At R,

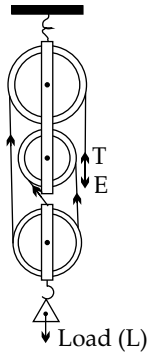
Potential energy = $mgh = 40 \times 10 \times 3 = 1200$ J

Energy loss due to friction = 500 J

So, Kinetic enregy at $R = 2000 - 1200 - 500 = 300$ J

Answer 7.

(i)



(ii) Time taken = 1 minute 40 seconds = 100 s

Speed of sound = 1500 ms^{-1}

So, distance of the obstacle = $\frac{1}{2}$ (1500 × 100)

= 75000 m

(iii) (a) Phenomenon responsible for falling off the paper rider is resonance. During resonance, the wire vibrates with a large amplitude and dislodge the rider.

(b) Thicker wire will have a lower resonant frequency compared to a thinner wire provided length, tension and material remaining same. This is because a thicker wire has a higher mass per unit length, which affects the natural frequency of vibration.

So, f will be less than 300 Hz.

Answer 8.

(i) (a) X is a company fuse or pole fuse. It does not have a fixed current rating. It depends on the load capacity of the connection.

(b) Z can connect & disconnected live and neutral line simultaneously. But the switch which is used to opearte domestic appliances connect & disconnected live line only.

(c) Unit is kWh.

(ii) (a) Nuclear fission.

(b) $X = 236$

(c) Neutrons

(iii) (a)

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

Or, $18 = \frac{12^2}{R}$

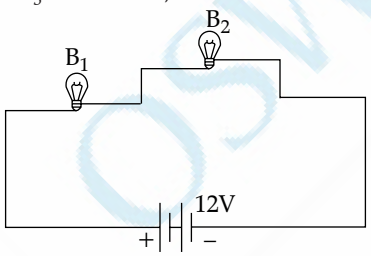
$\therefore R = \frac{144}{18} = 8\ \Omega$

2. B_2 and B_3 are in parallel. so, the combined resistance = $\frac{8 \times 8}{8+8} = 4\ \Omega$

This combination is in series with B_1.

Hence, equivalent resistance = 8 + 4 = 12 Ω

(b) When B_3 is removed, the circuit becomes:



Now, the equivalent resistance = 8 + 8 = 16 Ω.

Since, the resistance increases, current in the circuit decreases.

Hence, brightness of B_1 decreases.

Answer 9.

(i) Mass of ice at 0° C = m_1 = 30 g

Heat absorbed to be converted into water at 0°C

$Q = m_1 \times L = 30 \times 336$ J

Heat absorbed rise of temperature from 0° C to 20°C $Q = m_1 \times c \times \Delta t = 30 \times 4.2 \times 20$ J

Heat lost by water at 70° C to come down to 20°C

$Q = m_2 \times c \times \Delta t = m_2 \times 4.2 \times 50$ J

From the principle of calorimetry,

Heat absorbed = Heat lost

Or, $30 \times 336 + 30 \times 4.2 \times 20 = m_2 \times 4.2 \times 50$

Or, $12600 = 210 m_2$

$\therefore m_2 = 60$ g

$\therefore$ Mass of water at 70° C = 60 g

(ii) (a) Amount of heat = Q

For X,

$Q = m \times c_x \times \Delta t = 1 \times c_x \times 10 = 10C_x$

For Y,

$Q = m \times c_Y \times \Delta t = 1 \times c_Y \times 40 = 40C_Y$

$\therefore 10c_x = 40c_Y$

$\therefore c_x = 4c_Y$

$\therefore c_x > c_Y$

(b) Material chosen for calorimeter should have low specific heat capacity. So, here Y material may be used to make a calorimeter.

(c) The specific heat capacity of a substance does not remain the same when it changes state. The specific heat capacity is phase dependant.

(iii) (a) The magnetic field is upward to downward direction. The direction of current is from left to right. So, the rod PQ will experience a force towards C. So, PQ will move towards C. The statement is true.

(b) Fleming's left hand rule.

(c) If the replaced copper rod has same length but greater cross-sectional area then the resistance of this rod will be lower than the previous rod. So, the current through the new rod will be more than the previous one. So, the force experienced will also be more.

(d) Force experienced, $F = BIL\sin\theta$

As I increases, then F obviously increases.