Date: 17/03/2025

Question Paper Code

T25 521

Aakash
Medical | IIT-JEE | Foundations

Corporate Office : AESL, 3rd Floor, Incuspaze Campus-2, Plot-13, Sector-18, Udyog Vihar, Gurugram, Haryana-122015

Time: 2 Hrs.

PHYSICS

Max. Marks: 80

(Science Paper 1)

ICSE Board Class X Exam (2025)

Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions very carefully and follow them:

(i) Duration for the Test is 2 hours.

(ii) Maximum Marks for Section-**A** and **B** is 40 each.

(iii) The intended marks for questions or parts of questions are given in brackets [ ].

(iv) **Section A** is compulsory. Attempt all questions from this section.

(v) Attempt **any four** questions from **Section B**.

(vi) Use of calculator is not permitted.

(vii) It is mandatory to use Blue/Black ballpoint pen to write the answer.

SECTION-A (40 Marks)

*(Attempt **all** questions from this **Section**.)*

Choose the correct answers to the questions from the given options. **[15×1=15]**

1. (i) A body is acted upon by two equal and opposite forces, that are **NOT** along the same straight line. The body will: **[1]**

(a) remain stationary
(b) have only rotational motion
(c) have only rectilinear motion
(d) have both rectilinear and rotational motion

Answer (b)

(ii) Which among the following is a **vector** quantity? **[1]**

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

Answer (d)

(iii) What is the correct energy transformation during burning of a candle? **[1]**

(a) heat $\rightarrow$ kinetic + potential
(b) heat $\rightarrow$ chemical + light
(c) chemical $\rightarrow$ heat + light
(d) mechanical $\rightarrow$ chemical + heat

Answer (c)

(iv) When a ray of light passes from one optical medium to another, which of the following physical quantities does **NOT** change? **[1]**

(a) Amplitude of the wave
(b) Frequency of the wave
(c) Wavelength of the wave
(d) Speed of the wave

Answer (b)

(v) Which one of the following combinations is the correct **ascending order** of electromagnetic waves in terms of **wavelength**? **[1]**

(a) gamma-rays, visible light, microwaves
(b) microwaves, visible light, gamma-rays
(c) gamma-rays, microwaves, visible light
(d) microwaves, gamma-rays, visible light

Answer (a)

(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? **[1]**

(a) Mechanical advantage
(b) Velocity ratio
(c) 1/Velocity ratio
(d) 1/Mechanical advantage

Answer (a)

(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*) **[1]**

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

Answer (b)

(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: **[1]**

(a) 30° (b) 60°

(c) 90° (d) 120°

Answer (b)

(ix) In a closed circuit containing a bulb and a cell, the electromotive force (ε) and the terminal voltage (V) is related as **[1]**

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

(a) $V = \varepsilon + Ir$ (b) $V = \varepsilon - Ir$

(c) $V = \varepsilon \div Ir$ (d) $V = \varepsilon \times Ir$

Answer (b)

(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: **[1]**

(a) 7.5 JK^{-1} (b) 2.5 JK^{-1}

(c) 1.5 $Jg^{-1}K^{-1}$ (d) 0.5 $Jg^{-1}K^{-1}$

Answer (d)

(xi) **Assertion (A):** As the level of water in a tall measuring cylinder kept under running tap rises, the pitch of sound gradually increases. **[1]**

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)

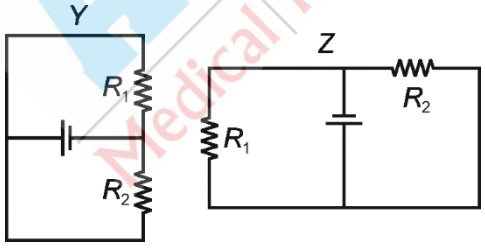
(b) Both (A) and (R) are true and (R) is not the correct explanation of (A)

(c) (A) is true but (R) is false

(d) (A) is false but (R) is true

Answer (c)

(xii) In the given circuits *Y* and *Z*, the resistors, R_1 and R_2, are connected in: **[1]**



(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*

Answer (b)

(xiii) A radioactive element *P* emits one α-particle and transforms to a new element *Q*. **[1]**

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*

Answer (d)

(xiv) Each of the substances given below is supplied with same amount of heat. Which one will attain the **highest** temperature? **[1]**

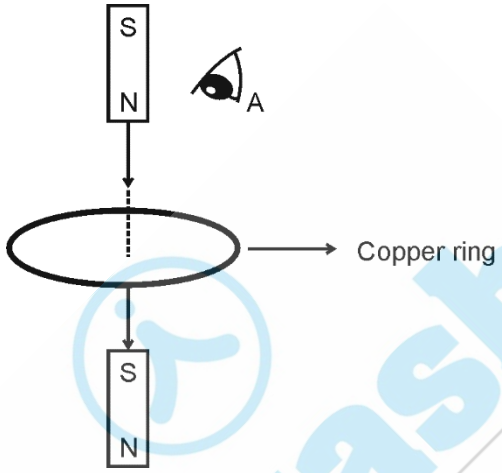
Substance	Lead	Aluminium	Copper	Iron
Specific heat capacity (cal/g°C)	0.031	0.21	0.095	0.115

(a) Aluminium (b) Copper

(c) Iron (d) Lead

Answer (d)

(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: **[1]**



(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

Answer (c)

2. (i) Complete the following by choosing the correct answers from the bracket :

(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 ionizing power is _____ [α / β / γ]

Sol. (i) (a) away from the centre **[1]**

(b) angle of incidence **[1]**

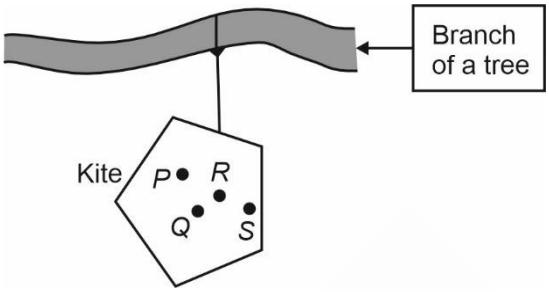
(c) mass **[1]**

(d) equal to **[1]**

(e) more than 1 **[1]**

(f) γ **[1]**

(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.

Sol. (ii) (a) *R* **[0.5]**

(b) As the kite hanging at point *R* from the branch is in equilibrium, hence net force and torque acting on it are zero. Therefore, most probable position of centre of gravity is point *R*. **[1.5]**

(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**?

Sol. (iii) (a) To reduce the wavelength of a vibrating wire, we have to increase the tension in the wire. **[1]**

(b) Reducing the length *PR*, it causes higher speed. **[1]**

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. *(This 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.

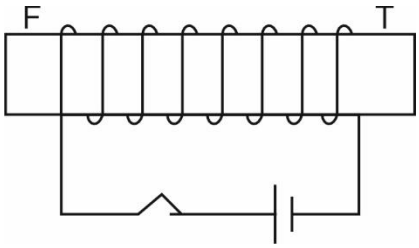
(iv) Calculate the amount of heat absorbed by 200 g of paraffin wax to melt completely at its melting point. **[2]**

[Specific latent heat of fusion of paraffin wax = 146 Jg^{-1}]

(v) Copper wire is wound 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 magnetic bar **FT** and mark its poles.

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

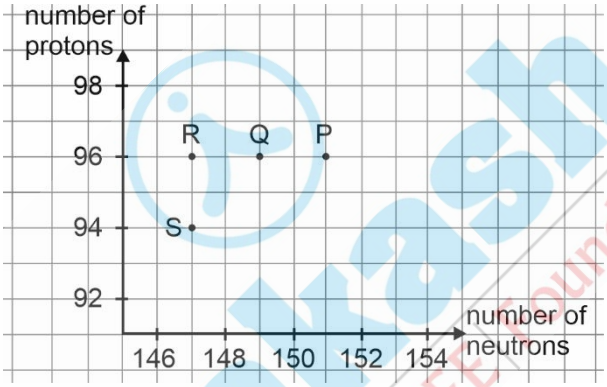


(vi) A current flows through a metalling conductor for a **long period** of time. State the change you would expect in its: **[2]**

(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 1 α followed by 2β?

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

Sol. (i) No, this ray does not undergo total internal reflection when it moves from water (μ = 1.33) to glass (μ = 1.5) because water is a rarer medium compared to glass, and TIR occurs only when light travels from denser to a rarer medium. **[2]**

(ii) (a) Earth wire – Green or yellow. **[1]**

(b) Live wire – Brown. **[1]**

(iii) (a) Alternating current, produces a varying magnetic field when it flows through a conductor. **[1]**

(b) Frequency of the alternating current supply in India is 50 Hz. **[1]**

(iv) $L = \frac{Q}{m}$

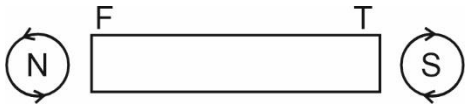
$\Rightarrow Q = L \times m$

$= 146 \times 200$

$= 29200$ J

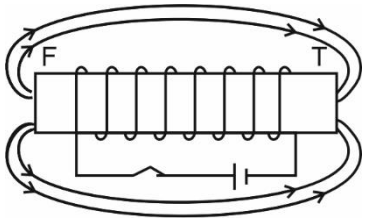
$= 29.2$ kJ **[2]**

(v) (a)



[1]

(b)



[1]

(vi) (a) The resistance of the metallic conductor increases with time, as resistance increases with increase in temperature and with the passage of time metallic conductor temperature increases. **[1]**

(b) The resistivity increases with increase in time as with the passage of time, the metallic conductor temperature increases and resistivity of metallic conductors increases with increase in temperature. **[1]**

(vii) (a) *P* represents the element *Cm*. **[1]**

(b) *R* represents daughter nucleus after *Cm* undergoes radioactive decay of 1α followed by 2β. **[1]**

(c) $^{247}_{96}Cm \xrightarrow{\alpha-\text{decay}} {}^{243}_{94}Cm + {}^{4}_{2}He$

$^{243}_{94}Cm \xrightarrow{\beta-\text{decay}} {}^{243}_{95}Cm + {}^{0}_{-1}e$

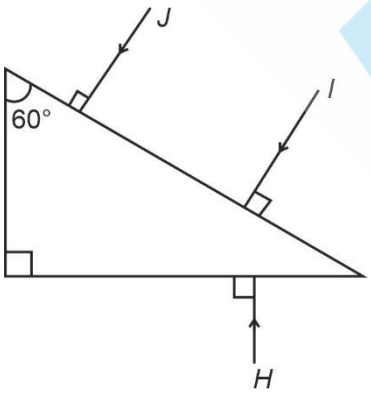
$^{243}_{95}Cm \xrightarrow{\beta-\text{decay}} {}^{243}_{96}Cm + {}^{0}_{-1}e$

Mass number of daughter nucleus = 243 **[1]**

SECTION-B (40 Marks)

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

4. (i)

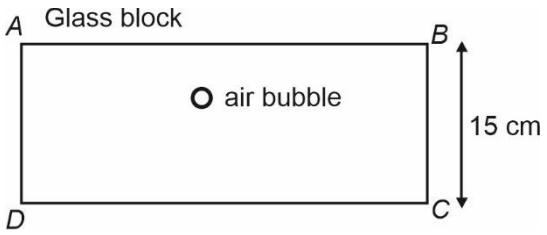


[3]

(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, blue or yellow, the apparent depth will be **greater**?

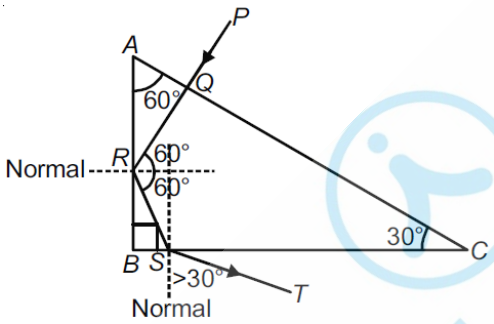
(c) Turning the glass block upside down, **DOES NOT** change the apparent depth of the air bubble. State **True** or **False**.

(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**?

Sol. (i) (a) Out of the three rays (I, J, H) ray J will suffer total internal reflection. **[1]**

(b) **[2]**



(ii) (a) Apparent depth $= \frac{\text{Real depth}}{\mu}$ **[1]**

$4 \times 1.5 =$ Real depth

$\therefore$ Real depth = 6 cm

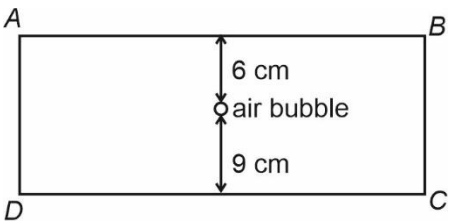
The air bubble is 6 cm deep

(b) $v = f\lambda = \frac{c}{\mu}$ **[1]**

$\therefore \quad \lambda \propto \frac{1}{\mu}$ or $\mu \propto \frac{1}{\lambda}$

The apparent depth will be greater for yellow light as refractive index of a medium is lower for longer wavelength of light.

(c) False,

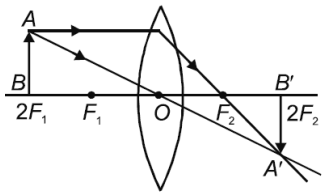


If the observer sees the air bubble from surface *DC* then,

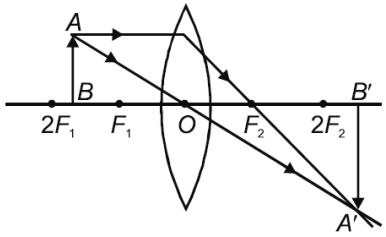
$= \frac{9}{1.5} = 6$ cm

∴ The apparent depth changes from 4 cm to 6 cm when the glass block is turned upside down. **[1]**

(iii) (a) **[2]**



(b) Assuming that the object distance remains constant

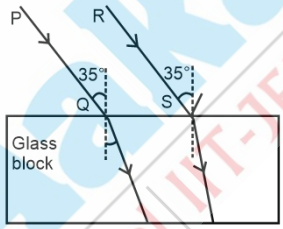


[2]

∴ The size of the image will increase.

5. (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.



Which of thee 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:

(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.

Sol. (i) Given

$u = -45$ cm, $v = -30$ cm, $f = ?$

from lens formula

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

$$\frac{1}{-30}+\frac{1}{45}=\frac{1}{f}$$

$$\frac{-3+2}{90}=\frac{1}{f}$$

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

$\therefore f = -90$ cm **[3]**

(ii) (a) RS **[1]**

Since, Lateral displacement (d) = $\frac{t}{\cos r}\sin(i-r)$

(b) PQ **[1]**

(c) RS **[1]**

(iii) (a) 1. Ultraviolet radiations **[1]**

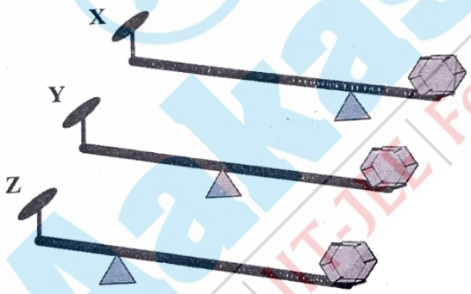
2. Infrared radiations **[1]**

3. Infrared radiations **[1]**

(b) They can travel through vacuum. **[1]**

6. (i) Akash takes a uniform meter 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]**

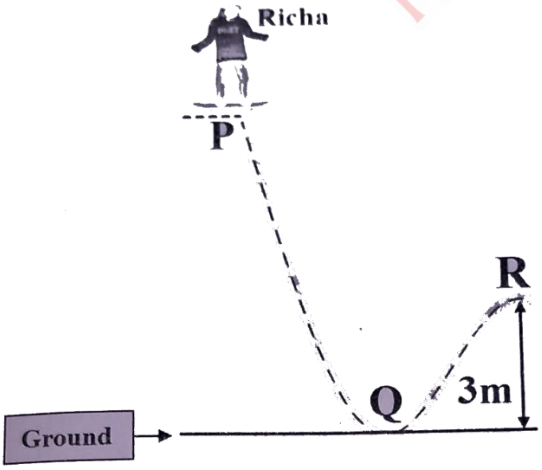
(ii) Three levers **X, Y, Z** of **equal lengths** are shown in the diagram. **[3]**



(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]**



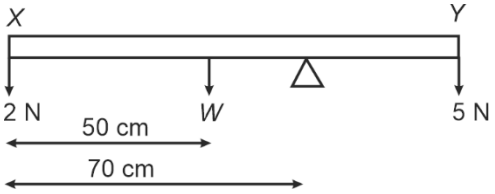
Richa weighing 40 kgf leaves point **P** on her skateboard and reaches point **Q** on the ground with velocity 10 ms^{-1}. Calculate:

(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.*)

Sol. (i)



[1]

Because the ruler is balanced, the net torque acting on it must be zero. **[1]**

Net torque = $2 \times 70 + W \times (70 - 50) - 5 \times (30) = 0$

$W \times 20 = 150 - 140$

$W = 0.5$ N

$\therefore$ Weight of the ruler is 0.5 N **[1]**

(ii) (a) Class I lever **[1]**

(b) Lever *X* will give the maximum mechanical advantage **[1]**

For the maximum mechanical advantage the ratio of effort arm to load arm should be greater. **[1]**

(iii) (a) K.E. at point $Q = \frac{1}{2} mv^2$

$= \frac{1}{2} \times 40 \times (10)^2$

$= 2000$ J

$= 2$ kJ **[1]**

(b) Decrease in potential energy from point *P* to point *Q* = *K.E.* at point *Q*

$mgh = 2$ kJ

$h = \frac{2000}{40 \times 10} = 5$ m **[1]**

(c) Total mechanical energy at point *Q* = Total mechanical energy at point *R*

$KE_Q + PE_Q = KE_R + PE_R$ + loss in energy against friction **[1]**

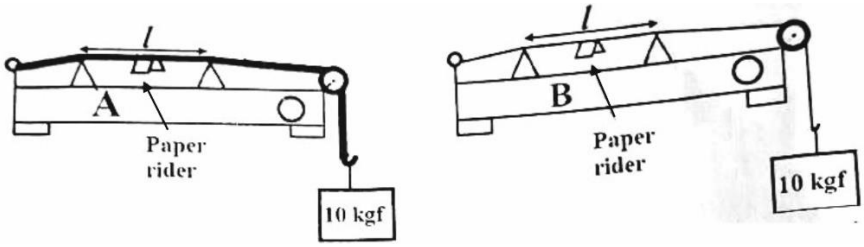
$2000 + 0 = KE_R + 40 \times 10 \times 3 + 500$

$KE_R = 300$ J **[1]**

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]**

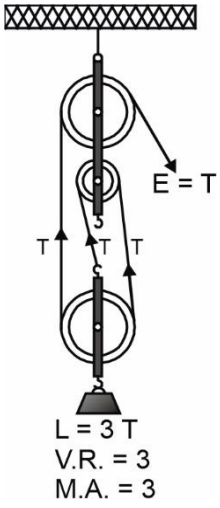
(iii) The diagrams given below show two sound boxes **A** and **B** with wires of **same** length **(*l*)** and tension (*10 kgf*) but **different** cross-sectional areas. Simultaneously, vibrating tuning forks of frequency 300 Hz are placed on the boxes **A** and **B**. The paper rider falls off in 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.

Sol. (i) **[3]**



(ii) $v = \frac{2d}{t}$

$1500 = \frac{2 \times d}{t}$

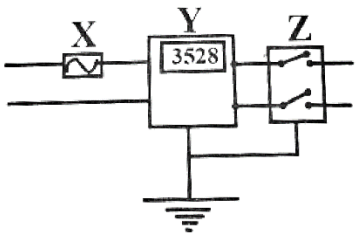
d = 75000 m = 75 km **[3]**

$\Rightarrow$ Distance of the obstacle from the submarine is 75 km.

(iii) (a) The paper rider in **B** fall off due to the resonance. When the wire's natural frequency matches the tuning fork's frequency, causing the wire to vibrate with increased amplitude and the paper rider fly off. **[2]**

(b) As wire **A** resonates with a tuning fork of frequency ***f***. Its frequency is less than 300 Hz because in resonance the frequency of the periodic force becomes equal to the natural frequency of the vibrating body. Here the thickness of wire **A** is greater than **B**. Hence the frequency of wire **A** will be less than 300 Hz. **[2]**

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

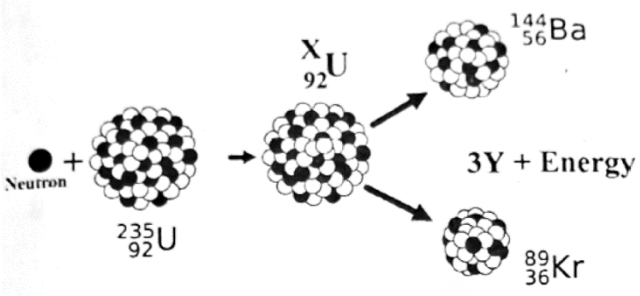


(a) What is the current rating of device **X**?

(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**?

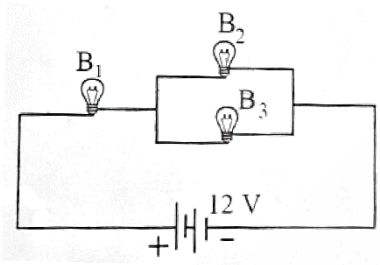
(ii) Study the diagram given below and answer the questions that follow: **[3]**



(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*?

Sol. (i) (a) 30 A **[1]**

(b) Switch Z is a double pole switch while house hold switches are single pole. A single pole switch disconnects only the live wire from the appliance while a double pole switch disconnects both the live and neutral wire simultaneously. **[1]**

(c) kWh **[1]**

(ii) (a) Nuclear fission of $^{235}_{92}U$ nucleus **[1]**

(b) From conservation of mass number

$235 + 1 = X$

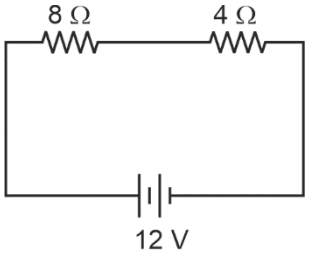
$\therefore \quad X = 236$ **[1]**

(c) Y = neutron $\left(^{1}_{0}n\right)$ **[1]**

(iii) (a) 1. $R = \frac{V^2}{P}$

$R = \frac{(12)^2}{18}$

$= 8\ \Omega$ **[1]**

2. 

$R_{net} = 12\ \Omega$

$\therefore\ I = \frac{12}{12} = 1\ A$ **[1]**

(b) The brightness of B_1 will decrease as the effective resistance of the circuit will increase. **[2]**

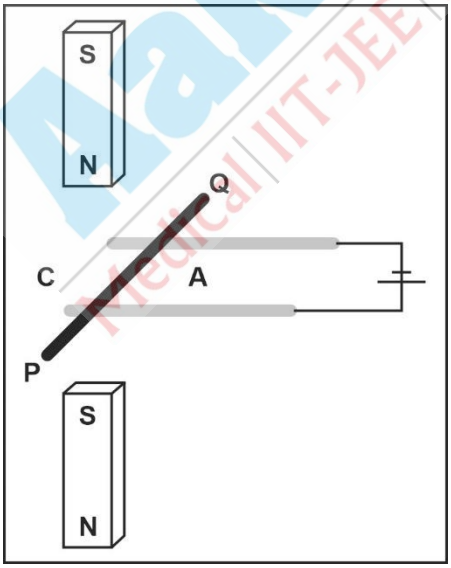
9. (i) 30 g of ice at 0°C is used to bring down the temperature of a certain mass of water at 70°C to 20°C. Find the mass of water. [Specific heat capacity of water = 4.2 $Jg^{-1}°C^{-1}$ and specific latent heat of ice = 336 Jg^{-1}] **[3]**

(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).

Sol. (i) Heat energy taken by ice = Heat energy given by water

$m_i L_i + m_i s_w \Delta T = m_w s_w \Delta T'$ **[1]**

$30 \times 336 + 30 \times 4.2 \times [20 - 0] = m_w \times 4.2 \times [70 - 20]$ **[1]**

$m_w = 60$ g **[1]**

(ii) (a) As $Q = mc\Delta T$

$$c \propto \frac{1}{\Delta T}$$

Material X will have higher specific heat capacity. **[1]**

(b) Material Y will be used to make a calorimeter as it has lower specific heat capacity. **[1]**

(c) False. **[1]**

(iii) (a) True. **[1]**

(b) Fleming's left-hand rule. **[1]**

(c) The force will remain same. **[1]**

(d) As $F = BIL\sin\theta$ **[1]**

F is independent of the cross-sectional area of the rod.

❑ ❑ ❑