# ICSE 2025 EXAMINATION

# Sample Question Paper - 11

# Physics

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

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**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 [ ].*

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## SECTION A

*(Attempt **all** questions)*

**Question 1** [15]

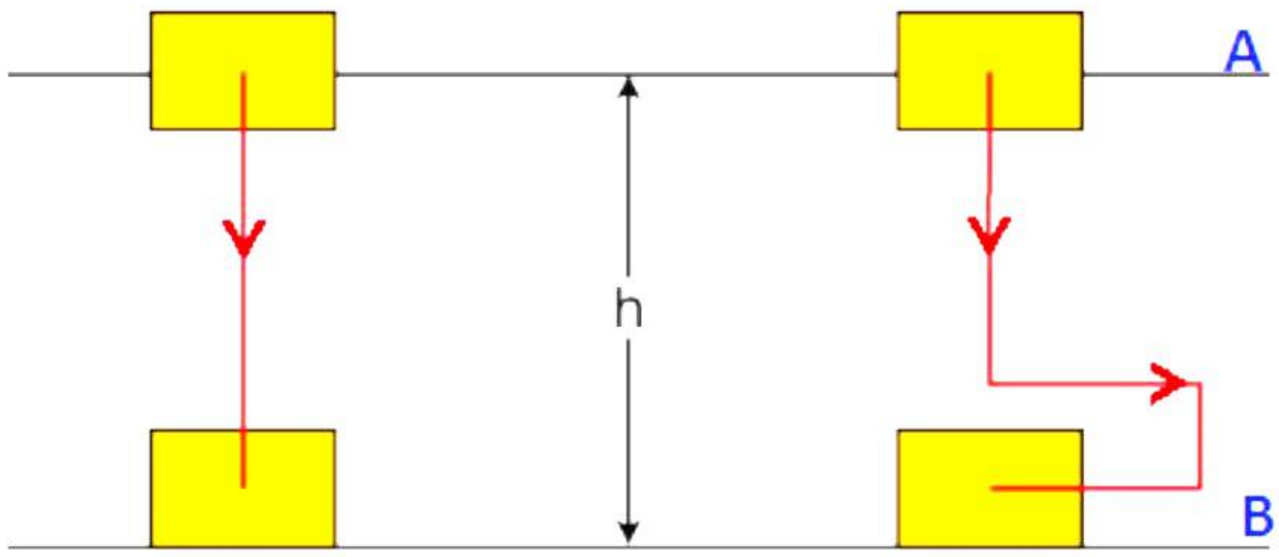
Choose the correct answers to the questions from the given options. (Do not copy the questions, write the correct answer only.)

i) A radioactive source emits three types of radiation. Which radiation has zero mass?
   (a) Alpha
   (b) Beta
   (c) Gamma
   (d) Neutrino

ii) Tension on an almost massless rope being pulled by two boys, one small and one big, will be _____.
   (a) same along the length of entire length of the rope
   (b) more on the big boy end
   (c) more on the small boy end
   (d) none of the above

iii) Where is the centre of gravity of a uniform ring situated?
   (a) Outside the ring.
   (b) At the centre of the ring.
   (c) At any point of the ring.
   (d) At any point of the diameter of the ring.

iv) An object is lifted from point A on the ground to another point B at a height h, through two different paths as shown in (i) and (ii). Which of the following is true about the work done in path (i) and (ii)?




(a) Work done in path (i) > Work done in (ii)
(b) Work done in path (ii) > Work done in path (i)
(c) Work done in path (i) = Work done in path (ii)
(d) No such conclusion can be drawn about work done in the two cases.

v) **Assertion (A):** The total internal energy of all the molecules of a substance is called its thermal energy.
**Reason (R):** A hot body has less internal energy than an identical cold body.
(a) Both assertion and reason are true.
(b) Both assertion and reason are false.
(c) Assertion is false but reason is true.
(d) Assertion is true reason is false.

vi) Striking a drum harder or softer produces a sound that differs in _____.
(a) Amplitude
(b) Frequency
(c) Time period
(d) Periodicity

vii) No refraction occurs when light goes from _____.
(a) rarer to denser medium.
(b) denser to rarer medium.
(c) one medium to other medium of same refractive index.
(d) one medium to other medium of same colour.

viii) Convex lens is also termed as converging lens because _____.

(a) Any incident ray on the convex lens is bent towards the principal axis.
(b) Any incident ray on the convex lens passes passed through un-deviated.
(c) Any incident ray on the convex lens is bent away from the principal axis.
(d) None of the above.

ix) At the time of short circuit, the current in the circuit-

(a) increases heavily
(b) does not change
(c) reduces substantially
(d) vary continuously

x) In electric generator, the direction of current in coil changes once every

(a) One rotation
(b) Two rotations
(c) Half rotation
(d) Three rotations

xi) The quantity of heat energy required to raise the temperature of a body depends on:

(a) mass of the body
(b) nature of material of the body
(c) rise in temperature of the body
(d) all of the above

xii) A charged particle enters a uniform magnetic field, parallel to the field, its Kinetic energy:

(a) Increases
(b) Decreases
(c) Remains constant
(d) Becomes zero

xiii) When an equilateral glass prism is in minimum deviation position.

A. the refracted ray is parallel to the base of the prism.
B. the angle of incidence is equal to the angle of emergence.

Choose the correct option among the following.

(a) only A is true
(b) only B is true
(c) Both A and B are true
(d) Both A and B are false

xiv) In a transverse standing wave the separation between an antinode and the immediate node is 0.6 cm, its wavelength will be:

(a) 1.2 cm
(b) 1.24 cm
(c) 2.4 cm
(d) 3.2 cm

xv) The appliance which works on the principle of moments is _____.

(a) Spring balance
(b) beam balance
(c) pendulum clock
(d) balance wheel

**Question 2**

i) Complete the following by choosing the correct answer from the bracket: [6]

(a) The maximum displacement of bob of a pendulum from mean position called _____ *[Frequency/Period/Amplitude].*

*(b)* The least count of a metre rule is _____ *[1 cm/0.1 cm/0.01 cm].*

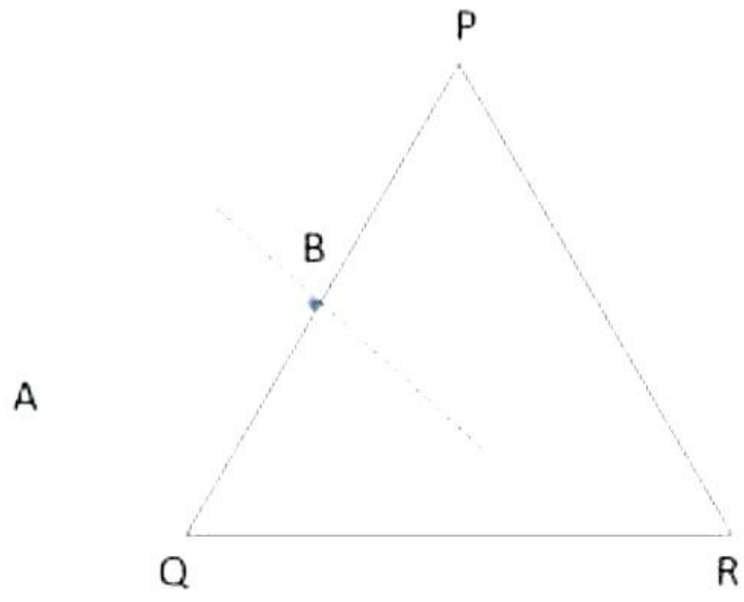
(c) If a body covers equal distances in equal intervals of time, its motion is _____ *[uniform motion/ non uniform motion]*

(d) _____ *[Rotatory/Translatory/Oscillatory]* motion is executed by the particles of the medium due to the wave propagation.

(e) An ammeter is a _____ *[height/low]* resistance device and it is always connected in _____ *[Series/Parallel]* with the circuit.

ii) A Nucleus of an element ($^{202}_{84}X$) emits an alpha particle followed by a beta particle. The final nucleus is ${}_aY^b$. Find a and b. [2]

iii) Complete the path of the monochromatic light ray AB incident on the surface PQ of the equilateral glass prism PQR till it emerges out of the prism due to refraction. [2]



**Question 3**

i) [3]

(a) A Satellite revolves around a planet in a circular orbit. What is the work done by the satellite at any instant? Give a reason.

(b) Draw a graph between displacement from mean position and the time for a body executing free vibration in a vacuum.

(c) Why is it not advisable to use a piece of copper wire as fuse wire in an electric circuit?

ii) [2]

(a) Define moment of force.

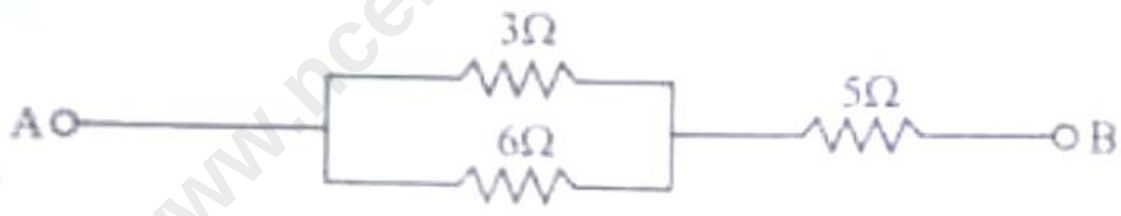
(b) Write the relationship between the SI and CGS unit of moment of force.

iii) When a current carrying conductor is placed in a magnetic field, it experiences a mechanical force. What should be the angle between the magnetic field and the length of the conductor so that the force experienced is: [2]

(a) Zero

(b) Maximum

iv) Calculate the total resistance across AB: [2]




v) Why do bottled soft drinks get cooled, more quickly by the ice cubes than by the iced water, both at 0°C? [2]

vi) Where should an object be placed in front of a convex lens in order to get: [2]

(a) An enlarged real image

(b) Enlarged virtual image?

vii) Give one example of each when:

(a) Chemical energy changes into electrical energy.

(b) Electrical energy changes into sound energy.

## SECTION B

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

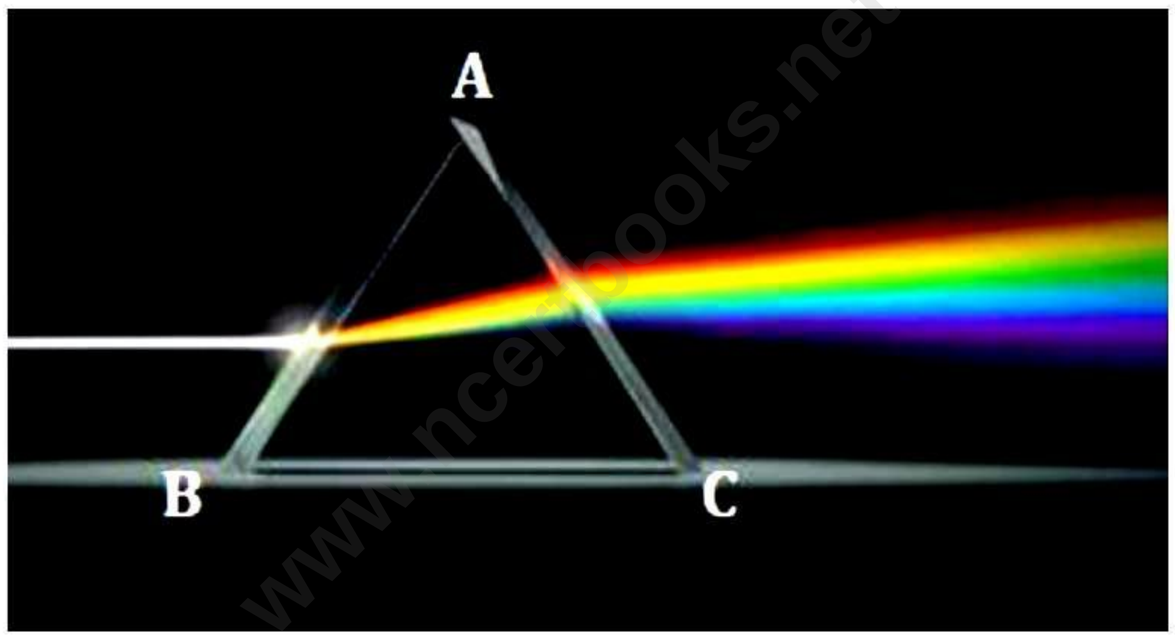
**Question 4**

i) [3]

(a) Water in a pond appears to be only three-quarters of its actual depth. What property of light is responsible for this observation?

(b) Illustrate your answer with the help of a ray diagram for the above case.

ii) Rahul allows the spectrum of white light from a source to enter through a small aperture. The white light then passes through a glass prism placed in the path of the spectrum. The light emerging out of the prism is obtained on a white screen. [3]






(a) What is white light comprised of?

(b) On which surface does the dispersion of light occur?

(c) On which surface does the deviation take place?

iii) [4]

(a) Monochromatic light is refracted from air into a glass of refractive index μ. Find the ratio of the wavelengths of the incident and refractive waves.

(b) What is the wavelength of an electromagnetic wave whose frequency is $10^{12}$ Hz? Name the electromagnetic wave.

(c) Why does the sun appear red at sunrise and sunset?

(d) What characteristic property of light is responsible for the blue colour of the sky?

**Question 5**

i) [3]

(a) Classified as real or virtual, the image of a candle flame formed on a screen by a convex lens. Draw a ray diagram to illustrate how the image is formed.

(b) A lens forms an inverted image of an object.

1. Name the kind of lens.
2. State the nature of the image, whether real or virtual?

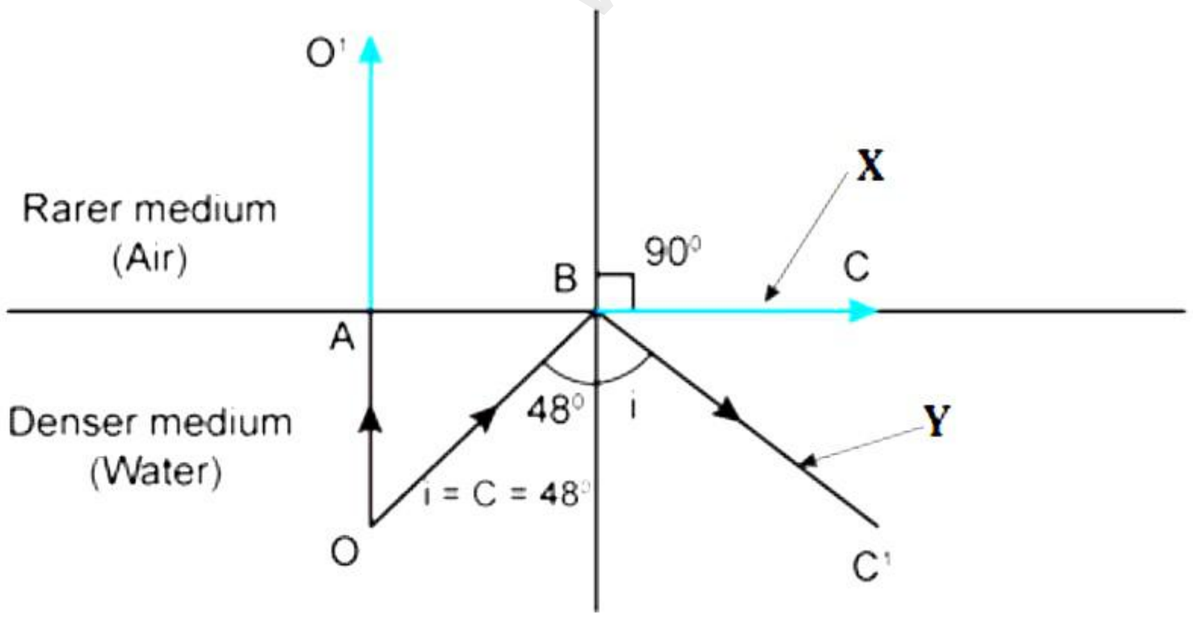
ii) A convex lens forms an image of an object equal to the size of the object. [3]

(a) Where is the object placed in front of the lens?

(b) Draw a diagram to illustrate it.

(c) State two more characteristics of the image.

iii) The figure given below shows the refraction of light rays from a point source O kept in a denser medium to a rarer medium. [4]




(a) What does the ray BC (=X) indicate?

(b) What is ray BC' (=Y)?

(c) What is the critical angle?

(d) What should be the value of angle of incidence for the occurrence of total internal reflection in the above given case?

**Question 6**

i) [3]

(a) Mention any two properties of non-contact forces.

(b) On what factor does the limiting value of contact forces depend? What happens if this limit is exceeded?

ii) A three-pulley system has an efficiency of 75%. Calculate [3]

(a) MA

(b) Effort required for lifting a load of 1000 N

iii) [4]

(a) What should be the change in the velocity of a body if its mass becomes four times the original mass and the kinetic energy remains constant?

(b) An elephant (mass = 5 tonne) takes tourists to a hill resort 0.4 km above the ground level. The elephant carries a 2000 kg load of tourists and luggage and takes 60 minutes. Calculate the

1. Work done by the elephant.
2. Potential energy gained by the tourists and luggage.

**Question 7**

i) [3]

(a) Name some devices that use current-carrying conductors and magnetic fields.

(b) What is a solenoid? Draw field lines of the magnetic field through and around a current-carrying solenoid.

(c) How are the electric appliances in a room connected (in series/parallel), and why?

ii) [3]

(a) A mass of lead is embedded in a block of wood. Radiations from a radioactive source incident on the side of the block produce a shadow on a fluorescent screen placed beyond the block. The shadow of wood is faint, but the shadow of lead is dark. Give a reason for this difference. If the block of wood is replaced by a block of aluminum, will there be any change in the shadow?

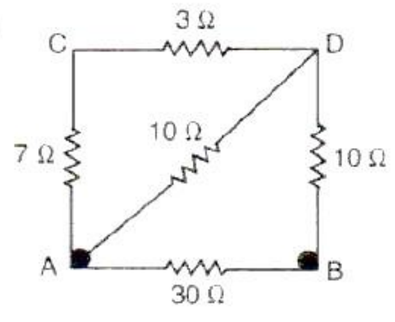
(b) A nucleus of an element X which has the symbol ${}^{200}_{80}X$ emits an alpha particle and then a β-particle. What would the final nucleus be?

iii) [4]

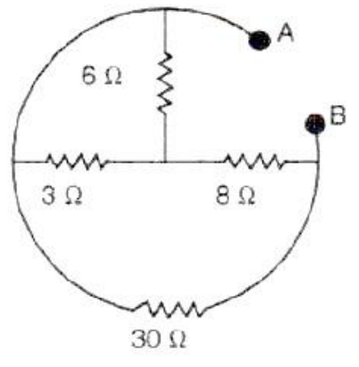
(a) A resistance coil is made by joining two resistors each of 10Ω in parallel. An emf of 1.0 V is applied between the two ends of the coil for 5 minutes. Calculate the heat produced in calories (1 cal = 4.2 J).

(b) Find the effective resistance between point A and point B.

(*i*)




(*ii*)

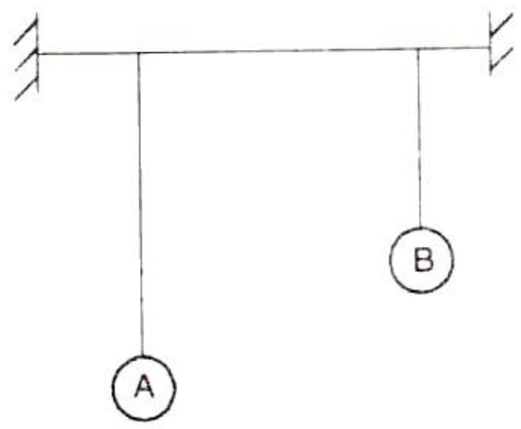



**Question 8**

i) A copper calorimeter of mass 100 g contains a lump of ice at −4°C. [3]
When 520 calories of heat is supplied to the calorimeter and its contents, the temperature is raised from −4°C to −2°C. The addition of another 41540 calories of heat brings the temperature of the calorimeter and its contents to +2°C. Determine the specific heat capacity of copper and ice present in the calorimeter.
**Given**: Latent heat of fusion of ice = 80 cal $g^{-1}$
Specific heat capacity of ice = 0.5 cal $g^{-1}$ $C^{-1}$

ii) [3]
(a) Give any one differences between isotopes and isobars.
(b) State three properties which are common to both the beta rays and cathode rays.
(c) How do beta rays differ from cathode rays?

iii) Two simple pendulums A and B of different lengths are suspended from the same string as shown in the figure. When A is displaced from its mean position and is let go, it is found that B also starts vibrating. [4]

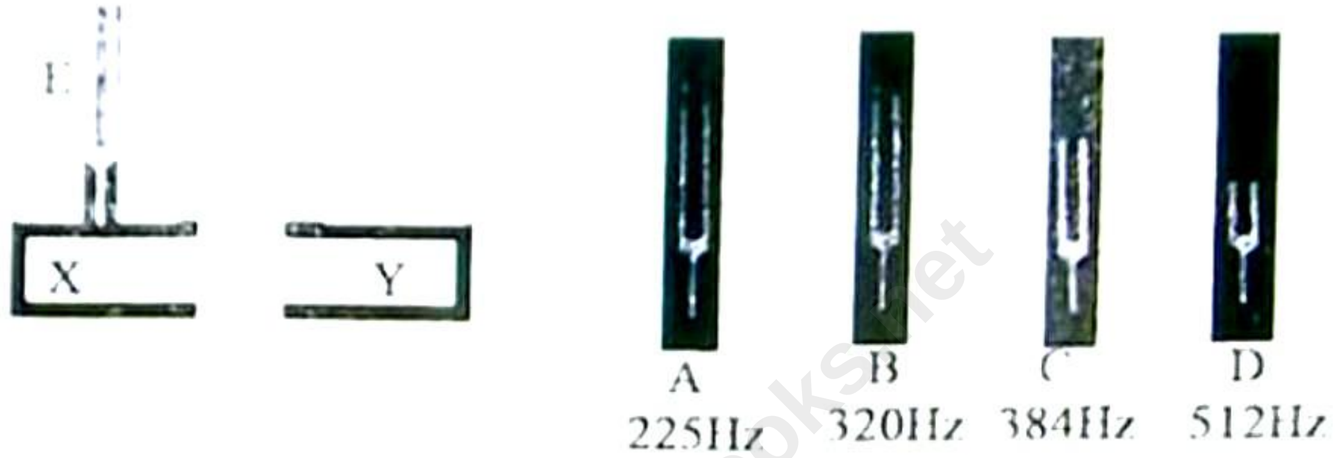



(a) Name the phenomenon responsible for B's vibrations.
(b) Does the frequency of the vibration of B depend on its own length or on the frequency of the vibration of A?
(c) What would happen to the amplitude of the vibration of B if its string length was equal to A?
(d) Name the phenomenon which occurs when the string length of B is made equal to the string length of A.

**Question 9**

i) An appliance rated 440W, 220V is connected across 220V supply [3]
   (a) Calculate the maximum current that the appliance can draw.
   (b) Calculate the resistance of the appliance.
   (c) Now if amount of current needed to run the device was half of its initial value. What will be the new power rating for the given device?

ii) The diagram below shows a vibrating tuning fork E mounted on a sound box X. When the vibrating tuning forks A, B, C and D are placed on the sound box Y one by one, it is observed that a louder sound is produced when the tuning fork B is placed on Y. [3]




   (a) What is the frequency of tuning fork E?
   (b) Why does B produce a louder sound?
   (c) Which of the following sets of tuning forks will produce the maximum sound if we replace tuning fork E with one of frequency around 510 Hz?

iii) A certain beam of α particles, β particles and y radiations travel through a region of electric field produced between two oppositely charged parallel plates A (+) and B (-).[4]
   (a) Which of the above three has the maximum speed?
   (b) Which one deviates the most from its original path?
   (c) Which one does not deviate at all when passing through a region of electric or magnetic field?
   (d) Complete the following nuclear reaction.

$${}^{3}_{2}\mathrm{He} + {}^{2}_{1}\mathrm{H} \rightarrow {}_{2}\mathrm{He} + {}^{1}\mathrm{H}$$

# 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 – c: Gamma

A radioactive source emits three types of radiation, out of which gamma radiation has zero mass.

ii) Correct answer – a: same along the length of entire length of the rope

It will be same along the length of entire length of the rope.

iii) Correct answer – b: At the centre of the ring

The centre of gravity of a uniform ring is situated at the centre of the ring.

iv) Correct answer – c: Work done in path (i) = Work done in path (ii)

Work done is independent of the path taken. Thus, the work done is same in both the cases.

v) Correct answer – d: Assertion is true reason is false.

A hot body has more internal energy than an identical cold body. When a hot body is kept in contact with cold body, the cold body warms up while hot body cools down. This means the internal energy of the cold body increases and there is flow of energy from hot body to cold body.

vi) Correct answer – a: Amplitude

Striking a drum harder or softer, results in a change in the loudness of the sound but not the frequency. Hence, the amplitude of the sound changes.

vii) Correct answer – c: one medium to other medium of same refractive index.

If the refractive indices of two media are equal, then the ray of light is not refracted and the boundary between the two media is not visible.

viii) Correct answer – a: Any incident ray on the convex lens is bent towards the principal axis.

A convex lens is a type of lens that has a curved surface on one side and a flat surface on the other. It is also known as a converging lens because it has the ability to bend light rays that pass through it in such a way that they converge at a single point. This point is known as the principal focus of the lens.

ix) Correct answer – a: increases heavily

In short circuit, the resistance becomes almost negligible.

x) Correct answer – c: Half rotation

In an electric generator, the direction of current in the coil changes once in each half rotation.

xi) Correct answer – d: all of the above

Factors affecting the quantity of heat required to raise the temperature of a body are:

1) mass of the body
2) nature of the material of the body
3) rise in temperature of the body

xii) Correct answer – c: Remains constant.

When a charged particle enters parallel to the uniform magnetic field, it is not acted by any force, that is, it is not accelerated. Thus, its speed remains constant and so does its kinetic energy.

xiii) Correct answer – c: Both A and B are true.

Both A and B are correct, as in minimum deviation position, the angle of incidence is equal to the angle of emergence and also the refracted ray moves parallel to the base of the prism.

xiv) Correct answer – c: 2.4 cm.

$\frac{\lambda}{4} - 0.6$ cm

$\lambda$- 2.4 cm

xv) Correct answer – b: beam balance.

The appliance which works on the principle of moments is beam balance.

**Solution 2**

i)

(a) The maximum displacement of bob of a pendulum from mean position called **Amplitude**.

(b) The least count of a metre rule is **0.1 cm.**

(c) If a body covers equal distances in equal intervals of time, its motion is **uniform motion.**

(d) **Oscillatory** motion is executed by the particles of the medium due to the wave propagation.

(e) An ammeter is a **low** resistance device, and it is always connected in **series** with the circuit.

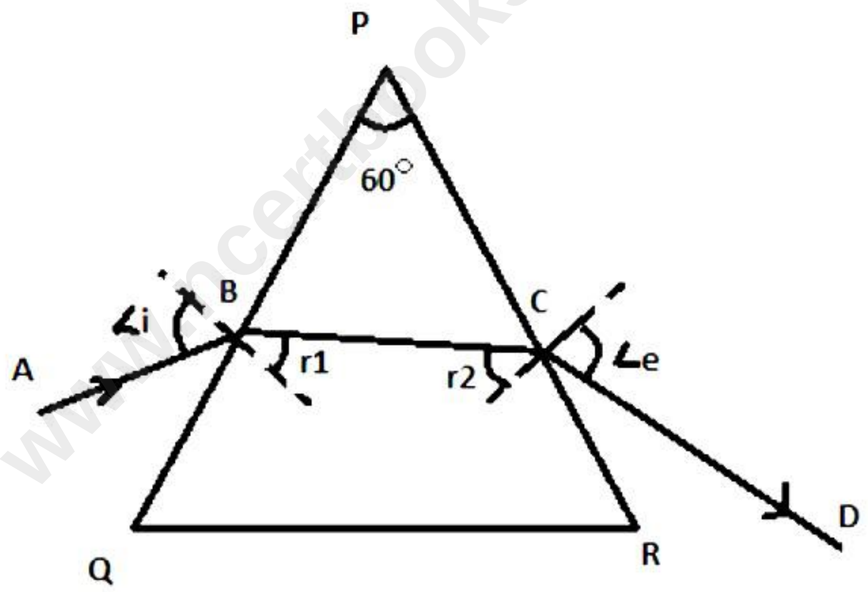
ii)

$$^{202}_{84}X \xrightarrow{\alpha \text{ emission}} {}^{198}_{82}Z + {}^{4}He_2$$

$$^{198}_{82}Z \xrightarrow{\beta \text{ emission}} {}^{198}_{83}Y + {}^{0}_{-1}e$$

Thus, a = 83 and b =198

iii)






**Solution 3**

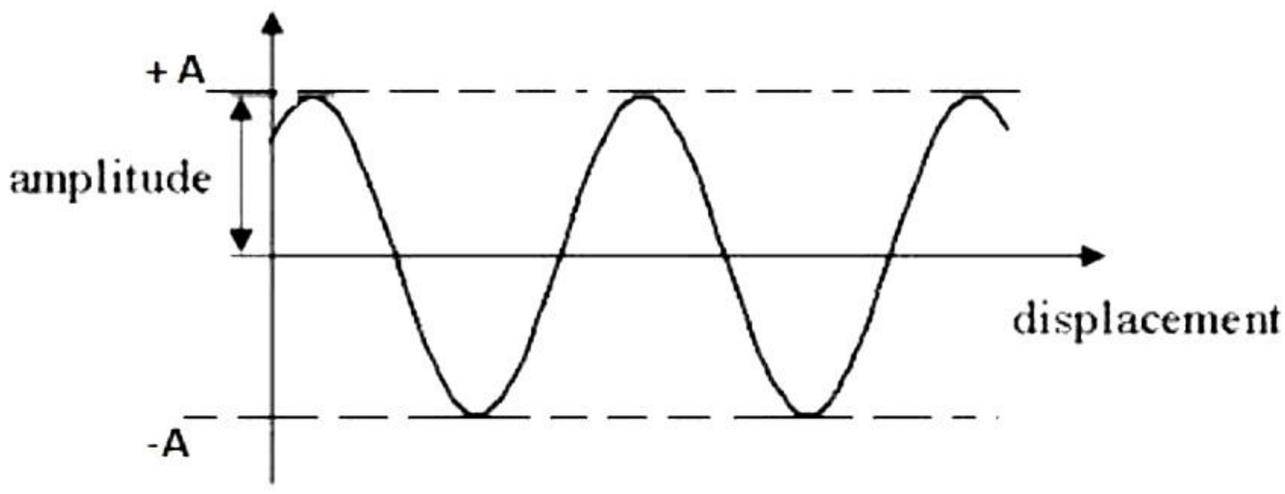
i)

(a) Work done at any instant by a satellite revolving around the planet in a circular orbit is zero as the centripetal force acting is perpendicular to the displacement.

$W = Fs\cos\theta$

i.e., $W = 0$.... ($\because \cos 90° = 0$)

(b)



(c) A pure copper wire cannot be used as a fuse wire because it has a high melting point. Thus, it will not melt easily when a short circuit occurs.
Hence, it is not advisable to use a piece of copper wire as a fuse wire in an electric circuit.

ii)

(a) The product of magnitude of force and the perpendicular distance of the line of action from the axis of rotation is called moment of force.

(b) The SI unit of moment of force is Nm and the CGS unit of moment of force is dyne cm.
1 Nm = $10^5$ dyne $10^2$ cm = $10^7$ dyne cm

iii)

(a) When a current-carrying conductor is placed in a magnetic field, it experiences mechanical force given by
$F = BIL \sin\theta$
Were,
B – magnetic field
I – current flowing through a conductor
L – length of the conductor
θ – angle between the magnetic field and the current
If $\theta = 0°$, then $\sin\theta = 0$
Thus, F = 0

(b) If $\theta = 90° \Rightarrow \sin\theta = 1$
Thus, F = BIL … (Force experience is maximum)



iv) Now,
The 3Ω and 6Ω resistors are connected in parallel and the 5Ω resistor is connected in series to the parallel combination.
Thus, the total resistance across AB is
$1/R_P = (1/3) + (1/6)$
$R_p = 18/9 = 2\Omega$
$R_{eq} = 2 + 5 = 7\ \Omega$

v) Drinks get cooled more quickly by adding pieces of ice at 0°C than the ice-cold water at 0°C: This is because 1 g of ice at 0°C takes 336 J of heat energy from the drink to melt into water at 0 °C. Thus, loses an additional 336 J of heat energy from 1g at 0°C than for 1 g ice – cold water at 0°C. Thus, cooling produced by 1 g ice at 0°C is more than that by 1g water at 0°C.

vi)

(a) When an object is placed between F and 2F of a convex lens, the image formed is an enlarged real image.

(b) When an object is placed between F and the optical centre O of the convex lens, the image formed is an enlarged virtual image.

vii)

(a) Charging of a battery is an example of the conversion of chemical energy to electrical energy.

(b) Loudspeaker is an example of the conversion of electrical energy to sound energy.

## SECTION B

**Solution 4**

i)

(a) The pond appears to be three-quarters of its actual depth due to the property of refraction of light.

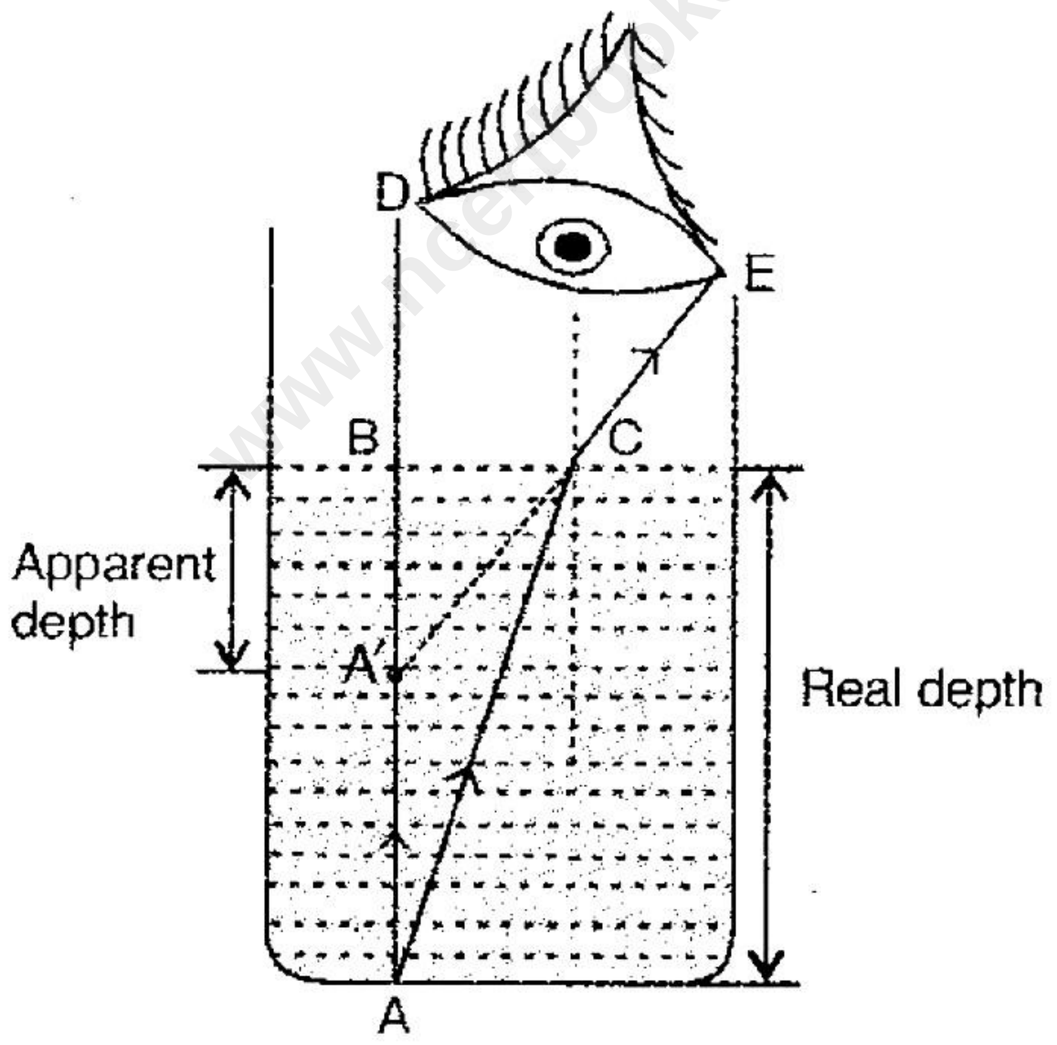
$$\mu = \frac{\text{Real depth}}{\text{Apparent depth}}$$

$$\text{since } \mu = \frac{4}{3} \text{ for water}$$

Therefore, Apparent depth = $\frac{3}{4}$(real depth)

A ray from the bottom of the tank A, striking normally at B, goes straight. Another ray from A striking the interface at C is refracted towards CE, and when produced back, it appears to come from A′. When BD and CE enter the eye, these form an image of A at A′. Thus, the depth appears to be A′B instead of the actual AB.

(b)




ii)

(a) White light has seven colours: Violet, Indigo, Blue, Green, Yellow, Orange and Red (VIBGYOR).

(b) Dispersion of white light occurs only at the first surface, in the given image on surface AB of the prism.

(c) Deviation occurs at both prism surfaces, in the given image surface AB and AC of the prism.
Violet colour deviates most towards the base of the prism.

iii)

(a)

$$v_a = n\lambda_a ; v_g = n\lambda_g$$

$$\therefore \frac{v_a}{v_g} = \frac{\lambda_a}{\lambda_g}$$

But, we know that $\frac{v_a}{v_g} = \mu$

$$\therefore \frac{\lambda_a}{\lambda_g} = \mu$$

Hence, the ratio of the wavelengths of the incident and refracted waves is μ:1.

(b) Frequency of the wave = $10^{12}$ Hz

Velocity = $3 \times 10^8$ m $s^{-1}$

Wavelength, $\lambda = \frac{v}{n}$

$$= \frac{3\times10^{8}\ \text{m s}^{-1}}{10^{12}\ \text{Hz}} = 3\times10^{-4}\,\text{m} = 3\times10^{-2}\,\text{cm}$$

These waves are infrared waves whose wavelength varies from $10^{-2}$ to $10^{-4}$ cm.

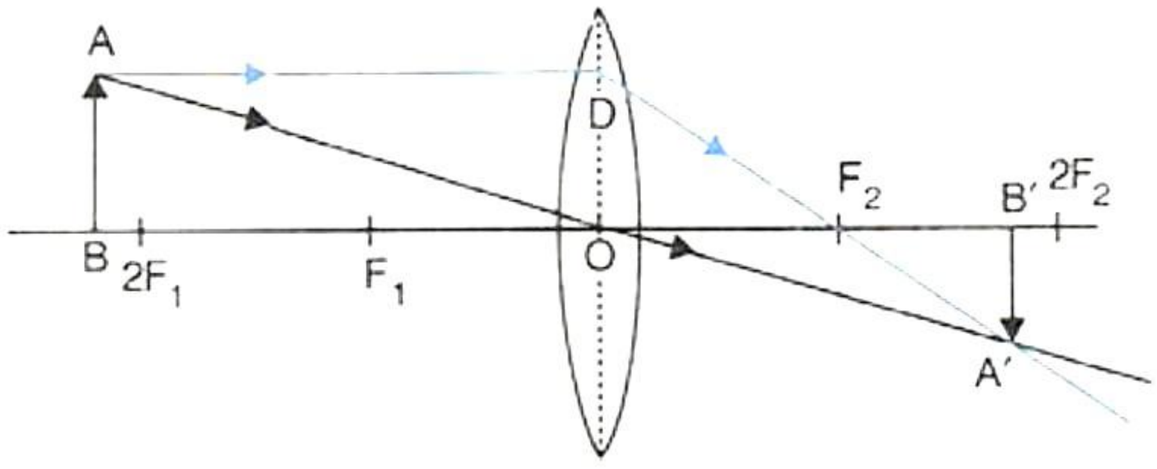
(c) At sunrise and sunset, the light from the sun has to travel the longest distance of the atmosphere to reach the observer. The light travelling from the sun loses blue light of short wavelength due to scattering, while the red light of long wavelength is scattered a little, so it is not lost much. Thus, blue light is almost absent in sunlight reaching the observer, while it is rich in red colour.

(d) The scattering property of light is responsible for the blue colour of the sky, as the blue colour is scattered the most due to its short wavelength.

**Solution 5**

i)

(a) Let the candle be placed beyond $2F_1$, and its diminished image, which is real and inverted, is formed between $F_2$ and $2F_2$.




The candle is AB, and its real and inverted image is formed between $F_2$ and $2F_2$.

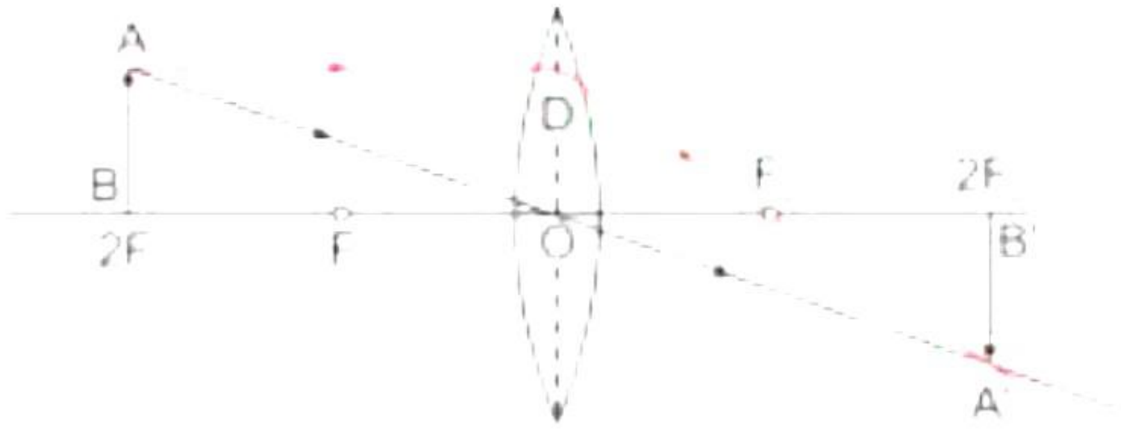
(b)

1. This is a convex lens.
2. The nature of the image is real.

ii)

(a) The object is placed at the centre of curvature.

(b)




(c) The image formed is real and inverted.

iii)

(a) BC indicates a partly refracted ray.

(b) BC' indicates partly reflected ray.

(c) A critical angle is the angle of incidence in the denser medium corresponding to which the angle of refraction in the rarer medium is 90°. In the above-given case, critical angle, c = 48°

(d) The angle of incidence, i should be greater than the critical angle (i >c) for the total internal reflection to occur. Thus, i must be greater than 48°.

**Solution 6**

i)

(a) Non-contact forces have the following properties:

1) They depend on the distance between the objects.

2) They depend on the medium between the objects in the case of electrical and magnetic forces and do not depend on the medium between the objects in the case of gravitational force.

(b) The force of bonding between the atoms determines the limiting value of the contact forces between a given pair of objects. If it exceeds the inter-atomic force, the bonding between the atoms is broken, and the surface of the string (whichever is applicable) splits into pieces.

ii)

(a) VR = No. of pulleys = n = 3

$$\eta = \frac{M.A}{V.R}$$

$$\therefore M.A = \eta \times V.R$$

$$M.A = \frac{75}{100} \times 3 = 2.25$$

(b) $M.A = \frac{Laod}{Effort}$

$$\therefore \text{Effort} = \frac{\text{Load}}{M.A} = \frac{1000\,N}{2.25} = 444.4\,N$$

iii)

(a) Let initial mass $m_1 = m$ and initial velocity $v_1 = v$

Final mass $m_2 = 4$ m and final velocity $v_2 = ?$

For the same kinetic energy,

$$\frac{1}{2} m_1 V_1^2 = \frac{1}{2} m_2 V_2^2$$

$$\text{Or } \frac{1}{2} m\ v^2 = \frac{1}{2} \times 4\ m\ v_2^2$$

$$\text{Or } v_2^2 = \frac{v^2}{4}$$

$$\text{Or } v_2 = \frac{1}{2} v$$

Thus, the velocity is halved.

(b)

1. Work done by an elephant, $W = (5000 + 2000)\ kg \times 10\ m/s^2 \times 400\ m$

   $W = 2.8 \times 10^7\ J$
2. Potential energy gained by the tourists and the luggage.

   $P.E = 2000\ kg \times 10\ m/s^2 \times 400\ m$

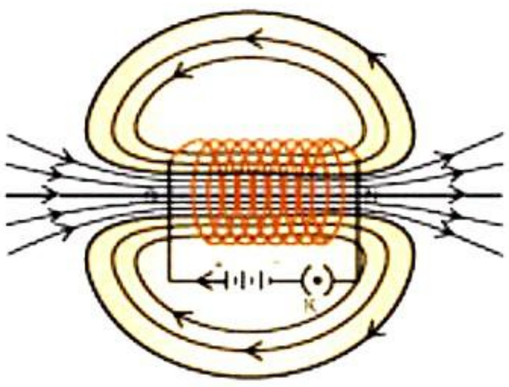
   $= 8 \times 10^6\ J$

**Solution 7**

i)

(a) Some common devices that use current-carrying conductors and magnetic fields are electric motors, generators, loudspeakers, microphones and measuring instruments like galvanometers, ammeter and voltmeter.

(b) A solenoid is a coil of many circular turns of wire wrapped in the shape of a cylinder. A magnetic field is developed along the solenoid axis on passing electric current. Magnetic field lines are drawn below.



(c) All the electrical appliances, like bulbs, fans, sockets, etc., in a room are connected in parallel across the live wire and the neutral wire because of the following advantages:

1) In a parallel circuit, if one of the appliances is switched off or gets fused, there would be no effect on the other appliances, and they keep on operating.

2) In a parallel circuit, the same voltage of the mains is available for all the electrical appliances.

Example: all bulbs connected in parallel would get the same voltage and glow brightly, whereas if connected in series, bulbs would get less voltage and glow less brightly.

ii)

(a) The shadow of wood is faint because only the α-radiations are stopped by wood (since α-radiations are least penetrating). The shadow of lead is dark because β and γ-radiations are also stopped by lead. If wood is replaced by aluminium (or any other light metal), the shadow of an aluminium block will remain faint because aluminium will not stop the γ-radiations.

(b)

${}^{200}_{80}X$ First, it emits an α-particle. Hence, we have

${}^{200}_{80}X \rightarrow {}^{196}_{78}Y + {}^{4}_{2}He$ (α-particle)

Then, it emits a β-particle. Hence, we have

${}^{196}_{78}Y \rightarrow {}^{196}_{79}Z + {}^{0}_{-1}e$ (β-particle)

Hence, the final nucleus is ${}^{196}_{79}Z$.

iii)

(a) Given that,

$R_1 = 10\,\Omega$,

$R_2 = 10\,\Omega$,

V = 1.0 volt,

$t = 5 \times 60$ s

Now,

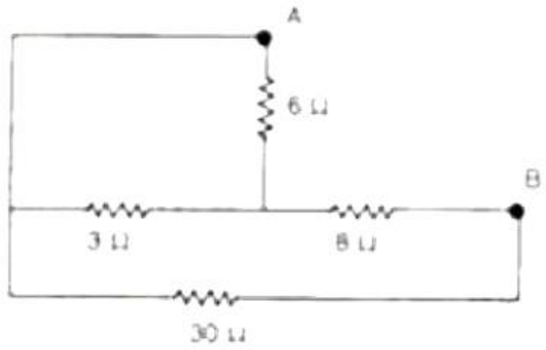
Effective resistance in a parallel combination will be

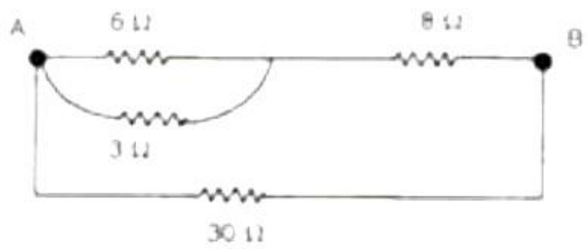
$$R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{10 \times 10}{10 \times 10} = \frac{100}{20} = 5\,\Omega$$

$$\text{Heat produced} = \frac{V^2 t}{R_p} = \frac{(1)^2}{5} \times 5 \times 60\,J = 60J$$

$$= \frac{60}{4.2}\,\text{cal} = 14.3\,\text{cal}$$

(b) The given circuit can be re-drawn as follows:




$R_1 = 6\Omega$ is parallel to $3\Omega = \frac{6 \times 3}{6+3} = \frac{18}{9} = 2\,\Omega$

$R_2 = 2 + 8 = 10\,\Omega$

As the $10\,\Omega$ and $30\,\Omega$ resistances are in parallel, the effective resistance will be

$$R = \frac{10 \times 30}{10+30} = \frac{300}{40} = 7.5\,\Omega$$

**Solution 8**

i) Let C be the specific heat capacity of copper and m be the mass of ice present in the calorimeter.

So, we have

$100 \times C \times [-2 - (-4)] + m \times 0.5 \times [-2 - (-4)] = 520$

$200\ C + m = 520$ ..... (1)

Also,

$100\ C \times [2 - (-2)] + m \times 0.5 \times [0 - (-2)] + m \times 80 + m \times 1 \times (2 - 0) = 41540$ ..... (2)

Solving equations (1) and (2), we get

$m = 495.06$ g

$C = 0.125$ cal $g^{-1}°C^{-1}$

ii)

(a) (Any-one difference)

| **Isotopes** | **Isobars** |
|---|---|
| Isotopes are atoms of the same elements having the same atomic number but different atomic masses due to the difference in the number of neutrons in their nucleus.<br><br>Isotopes have the same chemical properties but differ in nuclear properties.<br>Examples: ${}_{1}^{1}H$, ${}_{1}^{2}H$, ${}_{1}^{3}H$ | Isobars are the atoms of different elements with the same mass number but different atomic number due to the difference in protons.<br><br>Isobars have different chemical properties.<br>Examples: ${}_{12}^{24}Mg$ and ${}_{11}^{24}Na$ |

(b) Common properties of beta rays and cathode rays:

- Both are negatively charged with charge and mass equal to that of an electron.
- The electric and magnetic fields deflect both.
- Both cause fluorescence on striking a fluorescent material.

(c) Difference: Beta rays differ from cathode rays in their origin. Beta rays are given out from the nucleus of the atom, while cathode rays are given out from the orbital electrons.

iii)

(a) Pendulum B vibrates due to the phenomenon of forced vibrations.

(b) The frequency of the vibration of B depends on the frequency of the vibration of A.

(c) The amplitude of B increases dramatically.

(d) The phenomenon of resonance occurs when the length of B is equal to that of A.

**Solution 9**

i) Given that,

Power, P = 400 W

Voltage, V = 220 V

Now,

(a) Maximum current drawn = I =P/V = 440/220 = 2A

(b) Resistance of appliance = R = $P/I^2$ = $440/2^2$ = 110 Ω

(c) New power rating, $P' = I'V = \left(\frac{1}{2} \times I\right) V = P/2$

i.e., P' =440/2 =220 W

Hence, the new power rating will be 220 W.

ii)

(a) The frequency of E is 320 Hz.

(b) B produces large since the frequency of B matches with the frequency of E, and resonance occurs.

(c) D will produce maximum sound because of resonance.

iii)

(a) γ radiation has a maximum speed equal that of light in a vacuum.

(b) β particles deviate from their original path.

(c) γ radiation does not deviate when passing through a region of electric or magnetic field since it is made of uncharged particle photons.

(d) ${}_{2}^{3}\mathrm{He} + {}_{1}^{2}\mathrm{H} \rightarrow {}_{2}^{4}\mathrm{He} + {}_{1}^{1}\mathrm{H} + \mathrm{Energy}$