ICSE 2024 EXAMINATION

PHYSICS

SAMPLE PAPER - 7

Time Allowed : 2 hours *Max. Marks : 80*

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

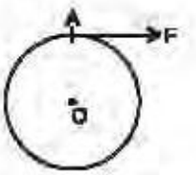
(i) One electron volt (eV) is equal to:

(a) 6.1×10^{-19}J (b) 1.6×10^{-19}J (c) 1.6×10^{-18}J (d) 6.1×10^{-18}J

(ii) A rod 100 cm long is made in such a way that half of it is made of aluminium and half of iron. If the density of Al = 2.7g cm^{-3} and that of iron is 7.6 g cm^{-3}, the centre mass (C.G) of the rod is:

(a) in the middle of rod (b) towards aluminum end of rod
(c) towards iron end of rod (d) either (b) or (c)

(iii) The diagram alongside shows a force F acting at point A, such that it produces a moment of force of 10 Nm in clockwise direction. If the diameter of circular body is 2 m, then magnitude of force act at A is:



(a) 10 N (b) 20 N
(c) 5 N (d) 40 N

(iv) An aeroplane is flying at an altitude of 10,000 m at a constant speed of 300 kmh^{-1}. The aeroplane at this height has:

(a) only kinetic energy (b) only potential energy
(c) both kinetic and potential energy (d) none of these

(v) A ball of mass '*m*' is dropped from a height *h*.

(a) The potential energy of the ball at ground level is *mgh*.
(b) The potential energy of the ball at height '*h*' is *mgh*.
(c) The kinetic energy of the ball at ground level is *mgh*.
(d) Either (b) or (c).

(vi) A force 'F' is applied on a body through a linear distance of 10 m, such that work done by the body is 3000 J. The magnitude of force is:

(a) 300 N (b) 450 N (c) 600 N (d) 150 N

(vii) A machine overcomes a load of 800 N through a distance of 0.12 m, when an effort of 160 N acts through a distance of 0.72. The velocity ratio of machine is

(a) 4 (b) 8 (c) 6 (d) 2

(viii) A piece of copper of mass 50 g has specific heat capacity of 0.4 $Jg^{-1}°C^{-1}$. The heat capacity of this piece of copper is:

(a) 20 $J°C^{-1}$ (b) 24 $J°C^{-1}$ (c) 16 $J°C^{-1}$ (d) 10 $J°C^{-1}$

(ix) 100 g of copper and 100 g of lead at same temperature are supplied equal quantities of heat energy for 2 minutes. If the sp. heat capacity of copper is 0.4 $Jg^{-1}{}^{o}C^{-1}$ and lead is 0.13 $Jg^{-1}{}^{o}C^{-1}$ the temperature of:

(a) copper is higher than lead
(b) lead is higher than copper
(c) both copper and lead are at same temperature
(d) none of these.

(x) Specific heat capacity of a substance:

(a) changes with the mass of given substance
(b) changes with the change in temperatures of substance
(c) change with the shape, area or volume of substance
(d) is a constant quantity for a given substance

(xi) Water tubs are kept in warehouses storing fruits and vegetables in cold countries in winter to:

(a) Make up the loss of water due to evaporation by fruits and vegetables
(b) To keep the air humid so as to prevent decaying of fruits and vegetables
(c) To keep the ware house cold as evaporation of water causes cooling
(d) To keep ware house warm as water has highest sp. heat capacity and hence liberates large amount of heat energy as the temperature falls.

(xii) A liquid of mass 0.5 kg and at a temperatue of 125 °C is cooled to 25 °C. If the sp. heat capacity of liquid is 750 $Jkg^{1}{}^{o}C^{-1}$, the heat energy given by the liquid is:

(a) 36500 J (b) 36900 J (c) 37500 J (d) 34500 J

(xiii) Stars appear to twinkle because:

(a) They give out light energy in short pulses.
(b) The light given out by stars is deviated by other stars.
(c) The refraction of light in the atmosphere which is in constant state of motion makes the stars to twinkle.
(d) None of these.

(xiv) The object is placed at $2F_2$ of a convex lens. The image formed by the lens is:

(a) Real, inverted and enlarged
(b) virtual, erect and enlarged
(c) Real, inverted and same size as object
(d) Real, inverted and diminished

(xv) An empty glass test tube placed obliquely in a beaker of water and is viewed from the top

(a) test tube appears empty, bent and short
(b) test tube appears black
(c) test tube appears silvery as if it is filled with mercury
(d) There is no change in the appearance of test tube.

ANSWERS

(i) (b) **(ii)** (c) **(iii)** (a) **(iv)** (c) **(v)** (d) **(vi)** (a) **(vii)** (c) **(viii)** (a) **(ix)** (b) **(x)** (d)
(xi) (d) **(xii)** (c) **(xiii)** (c) **(xiv)** (c) **(xv)** (c)

Question 2

(i) (a) What do you understand by the term angle of deviation for an equilateral prism? [3]
(b) State two factors which determine angle of deviation.

(ii) A convergent beam of sunlight is allowed to fall on a concave lens draw a ray diagram with a convergent beam of 5 rays. [2]

(iii) (a) Does convex lens always forms real and inverted image? [2]
(b) Give a reason for your answer in (a) above.

(iv) State two causes of energy loss in a transformer. [2]

(v) (a) Name the electromagnetic waves which are easily absorbed by glass, but not by a rock-salt prism. [2]
(b) What is the range of these waves?

(vi) Which class of lever will always have mechanical advantage (M.A.) > 1 and why? [2]

(vii) (a) What do you understand by the term persistence of hearing? [2]

(b) What is the magnitude of persistance of hearing for human beings?

Question 3

(i) (a) What do you understand by the term free vibrations as applied to sound energy? [2]

(b) Give two examples of free vibrations.

(ii) Why does an odd piece of cutlery start vibrating violently when a note of some particular frequency is played? [2]

(iii) (a) State and define practical unit of current. [2]

(b) A current 5 A, flows through a circuit for 1 hour. What is charge flowing through the conductor?

(iv) Give two differences between electric resistance and electric specific resistance. [2]

(v) (a) Distinguish between a kilowatt and kilowatt hour. [2]

(b) How many horse power is in one kilowatt?

SECTION - B (40 Marks)

(Attempt *any four* questions from this Section)

Question 4

(i) On what factors does the position of centre of gravity of a body depend? [2]

(ii) (a) A boy of mass 30 kg is sitting at a distance of 2 m from the middle of see saw where should a boy of mass 40 kg sit so as to balance the see-saw. [2]

(b) How many joules is equal to 10^{24} eV?

(iii) (a) Two bodies P and Q have mass m and $\frac{m}{2}$ and velocities v and $2v$ respectively. [2]

What is ratio of K.E. of A and K.E. of B? [4]

(b) A brick of mass 5.0 kg is taken from ground floor to the third floor, through a vertical height of 9 m in 10 s.

Calculate: [$g = 10\ ms^{-2}$]

(1) Gain in P. E.

(2) Power required to take brick to 3rd floor.

Question 5

(i) 40 g of water (specific heat capacity $4200\,Jkg^{-1}$) is heated when temperature rises by 20 K. When the same amount of heat energy is supplied to 120 g of a liquid its temperature rises by 25 K. Calculate: [4]

(a) Amount of heat energy absorbed by water.

(b) Specific heat capacity of the liquid.

(ii) (a) What do you understand by the term kelvin zero? [1]

(b) 200 g of water at 20 °C is placed in the freezing chamber of a refrigerator. It is found that after one hour the water changes to ice at –20 °C. If the specific heat capacity of ice is 2100 $Jkg^{-1}°C^{-1}$, specific latent heat of ice is $336\,kJkg^{-1}$, and the specific heat capacity of water is 4200 $Jkg^{-1}°C^{-1}$, calculate: [5]

(1) heat energy given out by water at 20°C to attain temperature of 0°C

(2) heat energy given out by water at 0°C to form ice at 0°C

(3) heat energy given out by ice at 0°C to attain temperature of –20°C.

(4) total heat energy extracted by refrigerator in one hour.

(5) Rate of extraction of heat in terms of unit of power.

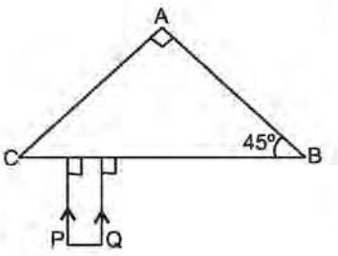
Question 6

(i) (a) Diagram alongside shows a right angled isosceles prism ABC of refractive index 1.5. An object PQ is placed in front of side BC. Copy the diagram and complete it, showing clearly how the image of PQ is formed. [4]

(b) What do you understand by the following terms? [2]

(1) dispersion of light

(2) Monochromatic light.



(ii) (a) Define refractive index of a medium '*m*' with respect to air. [1]

(b) Calculate the speed of light in water, when speed of light in air is 3×10^8 ms^{-1} and reparative index of water is 4/3 [1]

(c) A coin is placed under a glass block of thickness 2.5 cm. Calculate the height through which coin appears raised, if refractive index of glass is 1.5. [2]

Question 7

(i) (a) What changes, if any take place in the characteristics of a musical sound when the following increase: [2]

(1) amplitude;

(2) frequency.

(b) A man standing between two cliffs fires a gun and hears two echoes after every one second. The distance between the man and nearest cliff is 170 m. Calculate (1) velocity of sound (2) distance between two cliffs. [3]

(ii) (a) How the resistance of a conductor related to its: [2]

(1) length

(2) area of cross-section.

(b) Four resistances of 4 Ω each are joined to form a rectangle. What is the equivalent resistance of the rectangle between: [3]

(1) Two adjacent corners

(2) Two opposite corners

Question 8

(i) An electric bulb is rated 40 W-200 V and an electric heater is rated 1000 W-200 V. Answer the following questions:

(a) What is the ratio of resistance of filament of the bulb and resistance of the element of heater? [3]

(b) Does the power-voltage rating of an electric appliance help us to decide the type of connecting wires (leads) to be used by it? Explain. [2]

(c) In the above mentioned devices in Q:-8 (a) which of the two devices needs a thinner wire? [1]

(ii) (a) Why does the heating coil of an electric heater gets red hot, but not the connecting wires? [2]

(b) What is a solenoid? Draw magnetic field lines of force around a solenoid. [2]

Question 9

(i) (a) Name the colour code of the wire which is connected to the metallic body of an appliance. [3]

(b) Draw the diagram of a dual control switch when the appliance is switched 'ON'.

(ii) (a) Which particles are responsible for current in conductors? [3]

(b) To which wire of a cable in a power circuit should the metal case of a geyser be connected?

(c) To which wire should the fuse be connected?

(iii) (a) Thorium isotope $^{223}_{90}Th$ undergoes a alpha-decay and changes into radium (Ra). What is the atomic number and mass number of radium? [4]

(b) If the thorium further undergoes two successive disintegration by emitting beta particle in each case to form nuclei X and Y, represents the reactions in the form of nuclear equation.

(c) From the nuclear equation starting from thorium find isotopes/isobars if formed.

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SOLUTION

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(Attempt *all* questions from this Section)

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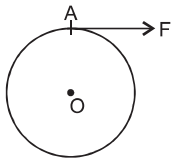

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(xiv) The object is placed at $2F_2$ of a convex lens. The image formed by the lens is:

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ANSWERS

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Question 2

(i) (a) What do you understand by the term angle of deviation for an equilateral prism? [3]
(b) State two factors which determine angle of deviation.

(ii) A convergent beam of sunlight is allowed to fall on a concave lens draw a ray diagram with a convergent beam of 5 rays. [2]

(iii) (a) Does convex lens always forms real and inverted image? [2]
(b) Give a reason for your answer in (a) above.

(iv) State two causes of energy loss in a transformer. [2]

(v) (a) Name the electromagnetic waves which are easily absorbed by glass, but not by a rock-salt prism. [2]
(b) What is the range of these waves?

(vi) Which class of lever will always have mechanical advantage (M.A.) > 1 and why? [2]

(vii) (a) What do you understand by the term persistence of hearing? [2]

(b) What is the magnitude of persistance of hearing for human beings?

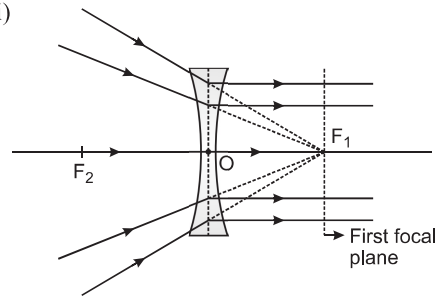
Solution :

(i) (a) The angle between the incident ray and the emergent ray (produced backward) when a ray of light travels through a prism in called angle of deviation.

(b) (i) Angle of deviation depends upon refraction index of glass.

(ii) Angle of deviation depends upon the angle of prism.

(ii)



(iii) (a) No, convex lens does not form real and inverted image ALWAYS.

(b) When object is placed between F_1 and optical centre of the convex lens, it forms, virtual, erect and enlarged image.

(iv) 1. A part of energy is lost due to resistance of primary and secondary coils.

2. A part of energy is lost due to the formation of eddy currents in the core of the transformer.

(v) (a) Infrared ray is easily absorbed by glass, but not by rock-salt prism.

(b) Infrared rays have range of 8×10^{-7} m to 10^{-3} m.

(vi) The lever of second order will always have mechanical advantage (M.A.) greater than 1.

Reason : We know that, M.A. $= \frac{\text{Effort arm}}{\text{Load arm}}$.

As in the lever of second order, the effort arm is always longer than load arm, therefore, its mechanical advantage is greater than 1.

(vii) (a) The time for which the sound lasts in the ear is called persistence of hearing.

(b) The time for which sound lasts in a healthy ear (persistence of hearing) is 1/10s (or 0. 1s).

Question 3

(i) (a) What do you understand by the term free vibrations as applied to sound energy? [2]

(b) Give two examples of free vibrations.

(ii) Why does an odd piece of cutlery start vibrating violently when a note of some particular frequency is played? [2]

(iii) (a) State and define practical unit of current. [2]

(b) A current 5 A, flows through a circuit for 1 hour. What is charge flowing through the conductor?

(iv) Give two differences between electric resistance and electric specific resistance. [2]

(v) (a) Distinguish between a kilowatt and kilowatt hour. [2]

(b) How many horse power is in one kilowatt?

Solution :

(i) (a) The periodic vibrations produced by a body having constant amplitude in the absence of any external force are called free vibrations.

(b) 1. A tuning fork struck gently produces free vibrations.

2. String of musical instruments on being struck produces free vibrations.

(ii) At that moment, the natural frequency of the piece of cutlery and the frequency of the note of the musical instrument correspond to each other. Thus, resonance takes place and the piece of cutlery vibrates with increased amplitude, there by producing rattling sound.

(iii) (a) Practical unit of current is ampere (A). It is defined as the current flowing through a conductor, when a charge of 1 coulomb flows through it in one second.

(b) Q = It = 5A × 3600 s = 18000 C.

(iv) 1. Electrical resistance is the opposition or obstruction offered by a conductor on the passage of drifting electrons through it, whereas specific resistance is the property of a particular conducting material which does not change with the shape or size of material.

2. Resistance measured as a ratio of potential difference at the ends of conductor to the current flowing through it, whereas, specific resistance is the resistance offered by a conductor of unit length and unit area of cross-section.

(v) (a) Kilowatt is the unit of power, where as kilowatt-hour is the commercial unit of electric energy.

(b) 746 W = 1 H.P

$\therefore$ 1 kW = 1000 W = $\frac{1000}{746}$ H.P = **1·34 H.P**.

SECTION - B (40 Marks)

(Attempt *any four* questions from this Section)

Question 4

(i) On what factors does the position of centre of gravity of a body depend? [2]

(ii) (a) A boy of mass 30 kg is sitting at a distance of 2 m from the middle of see saw where should a boy of mass 40 kg sit so as to balance the see-saw. [2]

(b) How many joules is equal to 10^{24} eV?

(iii) (a) Two bodies P and Q have mass m and $\frac{m}{2}$ and velocities v and 2 v respectively. [2]

What is ratio of K.E. of A and K.E. of B? [4]

(b) A brick of mass 5.0 kg is taken from ground floor to the third floor, through a vertical height of 9 m in 10 s.

Calculate: [g = 10 ms^{-2}]

(1) Gain in P. E.

(2) Power required to take brick to 3rd floor.

Solution :

(i) 1. Centre of gravity is determined by the shape and size of body.

2. Centre gravity is determined by the distribution of mass within the body.

(ii) (a) Let the body of mass 40 kg sit at distance 'x' from the centre of see-saw

$\therefore$ Taking moments about the centre of see-saw

40 kg × x = 30 kg × 2 m

$\therefore$ $x = \frac{60}{40}$ m = **1·5 m**

(b) 1eV = 1·6 × 10^{-19} J

$\therefore$ 10^{24} eV = 1·6 × 10^{-19} × 10^{24} J = **1·6 × 10^5 J**.

(iii) (a) K.E of P = $\frac{1}{2}mv^2$

K.E of Q = $\frac{1}{2}.\frac{m}{2}(2v)^2 = mv^2$

$\therefore$ K.E of P : K.E of Q = $\frac{1}{2}mv^2 : mv^2$ = **1 : 2.**

(b) 1. Gain in P.E = mgh = 5 kg × 10 ms^{-2} × 9 m = 450 kg m^2 s^{-2} = **450 J**.

2. Power = $\frac{\text{Work or Energy}}{\text{Time}} = \frac{450\text{ J}}{10\text{ s}}$ = 45 Js^{-1} = **45 W**.

Question 5

(i) 40 g of water (specific heat capacity 4200 Jkg^{-1}) is heated when temperature rises by 20 K. When the same amount of heat energy is supplied to 120 g of a liquid its temperature rises by 25 K. Calculate: [4]

(a) Amount of heat energy absorbed by water.

(b) Specific heat capacity of the liquid.

(ii) (a) What do you understand by the term kelvin zero? [1]

(b) 200 g of water at 20 ºC is placed in the freezing chamber of a refrigerator. It is found that after one hour the water changes to ice at –20 ºC. If the specific heat capacity of ice is 2100 $Jkg^{-1}°C^{-1}$, specific latent heat of ice is 336 $kJkg^{-1}$, and the specific heat capacity of water is 4200 $Jkg^{-1}ºC^{-1}$, calculate: [5]

(1) heat energy given out by water at 20ºC to attain temperature of 0ºC

(2) heat energy given out by water at 0ºC to form ice at 0ºC

(3) heat energy given out by ice at 0ºC to attain temperature of –20ºC.

(4) total heat energy extracted by refrigerator in one hour.

(5) Rate of extraction of heat in terms of unit of power.

Solution :

(i) (a) Amount of heat energy absorbed by water = $mc\theta_R$

$$= 40\ g \times 4{\cdot}2\ \frac{J}{g°C} \times 20\ °C = \mathbf{3360\ J}$$

(b) Amount of heat energy absorbed by the liquid = $m.c\theta_R$

$$= 120\ g \times c \times 25\ °C$$

Also amount of heat energy absorbed by the liquid = 3360 J

$$\Rightarrow 120\ g \times c \times 25\ °C = 3360\ J$$

Specific heat capacity of liquid (c) = $\frac{3360\ J}{120 \times 25\ g°C} = \mathbf{1{\cdot}12\ Jg^{-1}\ °C^{-1}}$.

(ii) (a) Theoretical temperature at which value of given mass of an enclosed gas becomes zero is called kelvin zero. Its theoretical value is – 273 °C.

(b) 1. Heat energy given out by water at 20°C to attain temperature of 0 °C

$$= mc\theta_f = 0{\cdot}2\ (kg) \times 4200\ (J\ kg^{-1}\ °C^{-1}) \times 20\ °C = \mathbf{16800\ J}$$

2. Heat energy given out by water at 0°C to form *ice* at 0 °C

$$= mL_{ice} = 0{\cdot}2\ kg \times 336 \times 10^3\ J\ kg^{-1} = \mathbf{67200\ J}$$

3. Heat energy given out by ice at 0 °C to attain temperature of – 20 °C

$$= mc\theta_f = 0{\cdot}2\ kg \times 2100\ J\ kg^{-1}\ °C^{-1} \times 20°C = \mathbf{8400\ J}$$

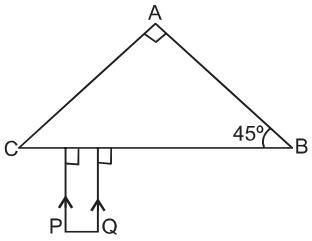
4. Total heat energy extracted in one hour (3600 s)

$$= (16800 + 67200 + 8400)\ J = \mathbf{92400\ J}$$

5. Rate of extraction of heat = $\frac{92400\ J}{3600\ s} \simeq 26\frac{J}{s} = \mathbf{26\ W}$.

Question 6

(i) (a) Diagram alongside shows a right angled isosceles prism ABC of refractive index 1.5. An object PQ is placed in front of side BC. Copy the diagram and complete it, showing clearly how the image of PQ is formed. [4]



(b) What do you understand by the following terms? [2]

(1) dispersion of light

(2) Monochromatic light.

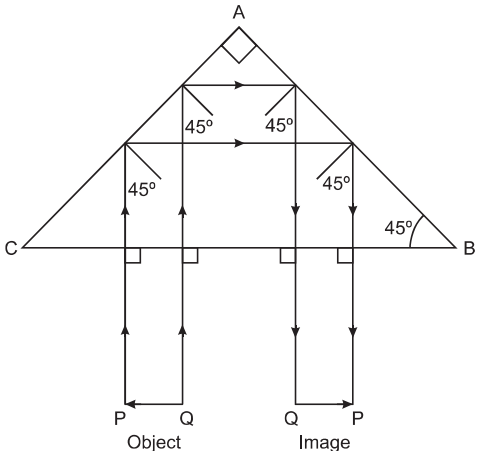
(ii) (a) Define refractive index of a medium 'm' with respect to air. [1]

(b) Calculate the speed of light in water, when speed of light in air is 3×10^8 ms^{-1} and reparative index of water is 4/3. [1]

(c) A coin is placed under a glass block of thickness 2.5 cm. Calculate the height through which coin appears raised, if refractive index of glass is 1.5. [2]

Solution :

(i) (a) Diagram shown alongside.



(b) 1. **Dispersion :** The phenomenon due to which white light (compound light) splits into component colours on passing through a glass prism is called dispersion of light.

2. A light of a single colour (or single wavelength) is called monochromatic light.

(ii) (a) Refractive index of 'm' = $\dfrac{\text{Velocity of light in air or vacuum}}{\text{Velocity of light in the medium '}m\text{'}}$

(b) Speed of light in water = $\dfrac{\text{Speed of light in air}}{\text{Refractive index in water}}$

$$= \frac{3\times10^{8}(\text{ms}^{-1})}{4/3}$$

$$= \mathbf{2{\cdot}25 \times 10^{8}\ ms^{-1}}.$$

(c) Let the coin be raised through height 'x'

$\therefore$ Real depth of coin = 2·5 cm

Apparent depth of coin = 2·5 cm – x

Now, Refractive Index = $\dfrac{\text{Real depth}}{\text{Apparent depth}}$

$$\Rightarrow 1{\cdot}5 = \frac{2{\cdot}5\ \text{cm}}{2{\cdot}5\ \text{cm} - x}$$

$$\Rightarrow 2{\cdot}5\ \text{cm} - x = \frac{2{\cdot}5}{1{\cdot}5}\ \text{cm} = 1.67\ \text{cm}$$

$$\Rightarrow x = 2.5 - 1.67$$

$$x = \mathbf{0{\cdot}83\ cm}.$$

Question 7

(i) (a) What changes, if any take place in the characteristics of a musical sound when the following increase: [2]

(1) amplitude;

(2) frequency.

(b) A man standing between two cliffs fires a gun and hears two echoes after every one second. The distance between the man and nearest cliff is 170 m. Calculate (1) velocity of sound (2) distance between two cliffs. [3]

(ii) (a) How the resistance of a conductor related to its: [2]

(1) length

(2) area of cross-section.

(b) Four resistances of 4 Ω each are joined to form a rectangle. What is the equivalent resistance of the rectangle between: [3]

(1) Two adjacent corners

(2) Two opposite corners

Solution :

(i) (a) 1. With the increase in amplitude the loudness of sound increases.

2. With the increase in frequency the pitch of sound increases, *i.e.* sound becomes shrill.

(b) 1. Velocity of sound = $\frac{2\,(\text{Distance of nearest cliff})}{\text{Time}} = \frac{2 \times 170\,\text{m}}{1\text{s}} = \mathbf{340\ ms^{-1}}$.

2. Distance of second cliff from source of sound = $\frac{v \times t}{2} = \frac{340\text{ms}^{-1} \times 2s}{2} = \mathbf{340\ m}$

$\therefore$ Distance between the cliffs = 170 m + 340 m = **510 m**.

(ii) (a) 1. Resistance of a conductor (R) is directly proportional to its length.

2. Resistance of a conductor (R) is inversly proportional to its area of cross-section.

(b) 1. Resistance between two adjacent corners :

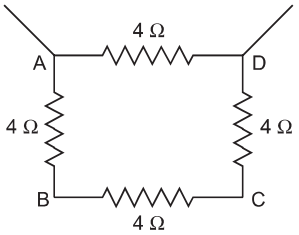
Resistance of AB, BC and CD in series

$$R_1 = 4 + 4 + 4 = 12\ \Omega$$

$\therefore$ Resistance of R_1 and AD in parallel

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{12} = \frac{3+1}{12} = \frac{4}{12} = \frac{1}{3}.$$

$\therefore$ Equivalent resistance, $\mathbf{R_p = 3\ \Omega}$.



2. Resistance between two opposite corners

Resistance of AB and AD in series

$$R_1 = 4 + 4 = 8\Omega$$

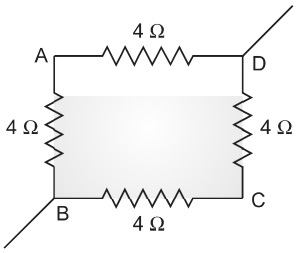
Resistance of BC and CD in series

$$R_2 = 4 + 4 = 8\Omega$$

$\therefore$ Equivalent (R_p) of R_1 and R_2 in parallel

$$\frac{1}{R_p} = \frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$$

$\therefore$ Equivalent resistance, $\mathbf{R_p = 4\Omega}$.



Question 8

(i) An electric bulb is rated 40 W-200 V and an electric heater is rated 1000 W-200 V. Answer the following questions:

(a) What is the ratio of resistance of filament of the bulb and resistance of the element of heater? [3]

(b) Does the power-voltage rating of an electric appliance help us to decide the type of connecting wires (leads) to be used by it? Explain. [2]

(c) In the above mentioned devices in Q:-8 (a) which of the two devices needs a thinner wire? [1]

(ii) (a) Why does the heating coil of an electric heater gets red hot, but not the connecting wires? [2]

(b) What is a solenoid? Draw magnetic field lines of force around a solenoid. [2]

Solution :

(i) (a) Resistance of filament of bulb (R_f) = $\frac{V^2}{P} = \frac{200 \times 200}{40} = 1000\ \Omega$.

Resistance of element of heater (R_h) = $\frac{V^2}{P} = \frac{200 \times 200}{1000} = 40\ \Omega$

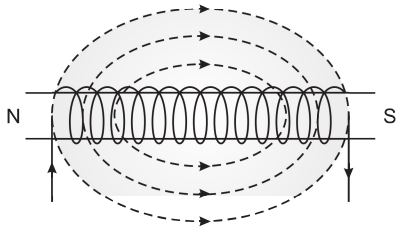
$\therefore$ Ratio of resistance of filament of bulb and element of heater = $R_f : R_h = 1000 : 40 = \mathbf{25 : 1.}$

(b) Yes, it does.

If the power ratings is high then we have to use thick wires to avoid any short circuit.

(c) The bulb needs thinner wire as the power rating is less.

(ii) (a) Heat energy produced is given by the expression I^2. R. *t*. As same amount of current flows through the connecting wires and the element of heater, therefore in a way heat produced in them is directly proportional to their resistance. Now, the resistance of connecting wires is almost zero, therefore no heat is produced in them and hence they remain cold. However, heating element has large resistance and hence, it gets red hot.



(b) An insulated copper coil wound over a hollow cardboard tube such, that its length is more than its diameter and behaves like a magnet on the passage of electric current is called solenoid.

Question 9

(i) (a) Name the colour code of the wire which is connected to the metallic body of an appliance. [3]

(b) Draw the diagram of a dual control switch when the appliance is switched 'ON'.

(ii) (a) Which particles are responsible for current in conductors? [3]

(b) To which wire of a cable in a power circuit should the metal case of a geyser be connected?

(c) To which wire should the fuse be connected?

(iii) (a) Thorium isotope $^{223}_{90}Th$ undergoes a alpha-decay and changes into radium (Ra). What is the atomic number and mass number of radium? [4]

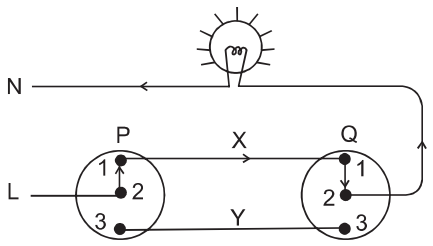
(b) If the thorium further undergoes two successive disintegration by emitting beta particle in each case to form nuclei X and Y, represents the reactions in the form of nuclear equation.

(c) From the nuclear equation starting from thorium find isotopes/isobars if formed.

Solution :

(i) (a) The wire connected to the metallic body of an electrical appliance is yellow or green on international standards.

(b)



(ii) (a) Drifting electrons

(b) Earth wire

(c) Live wire

(iii) (a) Atomic number of radium is 88 and mass number 219.

(b) $^{223}_{90}Th \xrightarrow{-\alpha} {}^{219}_{88}Ra \xrightarrow{-\beta} {}^{219}_{89}X \xrightarrow{-\beta} {}^{219}_{90}Y$

(c) Isotopes $^{223}_{90}Th$ and $^{219}_{90}Y$

Isobars $^{219}_{88}Ra$; $^{219}_{89}X$ and $^{219}_{90}Y$.

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