ICSE 2024 EXAMINATION

PHYSICS

SAMPLE PAPER - 3

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 [ ].

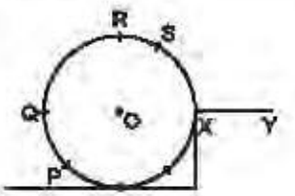
SECTION - A (40 Marks)

(Attempt *all* questions from this Section)

Question 1 : Choose the correct answers to the questions from the given options: [15]

(i) The condition for equilibrium of a body is:
(a) Resultant of all the linear forces acting on the body should be zero.
(b) Resultant of all the moment of forces acting about the turning point should be zero.
(c) Both (a) and (b) (d) None of these

(ii) The diagram alongside shows a heavy roller, with its axle at 'O', which to be pushed upward on the pavement XY by applying minimum force. This force should be applied at



(a) P (b) Q
(c) R (d) S

(iii) A force of 13 N, produces a moment of couple of magnitude 14.3 Nm. The arm of couple in such a situation is:
(a) 1.1 m (b) 0.11 m (c) 11 m (d) 1.3 m

(iv) One kilocalorie is the amount of heat required to raise the temperature of:
(a) 1 g of water through 1°C (b) 1 kg of water through 10°C
(c) 1 kg of water through 1°C (d) 100 g of water through 1°C.

(v) A boy of mass 40 kg, runs up a flight 50 stairs, each measuring 30 cm. The potential energy gained by the boy is:
[Take $g = 10\ ms^{-2}$]
(a) 4000 J (b) 4500 J (c) 5000 J (d) 6000 J

(vi) A bullet of mass 0.1 kg is moving with a momentum of 20 $kgms^{-1}$. The kinetic energy of the bullet is:
(a) 2200 J (b) 1800 J (c) 2000 J (d) 1600 J

(vii) A uniform plank of a see-saw is 5 m long is supported at its centre. A boy weighing 40 kgf sits at a distance of 1.5 m from one end, whereas as a girl weighing 25 kgf sits at distance x from the centre of plank, such that plank is balanced. The magnitude of x is:
(a) 1.5 m (b) 1.6 m (c) 1.4 m (d) 1.7 m

(viii) An actual pulley system of velocity ratio 5 has actual mechanical advantage less than 5. It is because:
(a) a part of effort is wasted in overcoming friction at movable parts.
(b) a part of effort is wasted in overcoming load of movable block.
(c) both (a) and (b) (d) none of these

(ix) A block of metal has a thermal capacity of 500 $JºC^{-1}$ and its specific heat capacity is $0.4Jg^{-1}ºC$. The mass of block is:
(a) 1250 g (b) 1200 g (c) 1150 g (d) 1100 g

(x) The base of cooking pan is made thicker and heavy because:
- (a) It lowers heat capacity of pan
- (b) It increases heat capacity of pan
- (c) Food does not get charred and keeps hot for a longer time
- (d) Both (b) and (c)

(xi) Icebergs are carried thousands of kilometres away, without melting substantially because:
- (a) They are too huge and do not melt easily.
- (b) The ice has a very low sp. latent heat and hence they melt slowly
- (c) The ice has highest sp. latent heat of fusion and hence they melt slowly
- (d) Sea water is too cool and hence prevents cooling.

(xii) When a ray of light travels from optical dense medium to an optically less dense medium, it:
- (a) gets reflected at the interface of media.
- (b) it bends towards the normal, at the point of incidence.
- (c) it does not deviate and continues along straight line path
- (d) it bends away from the normal at the point of incidence.

(xiii) Magnitude of lateral displacement caused by a glass block in the path of light:
- (a) Increases with the increase in thickness of glass slab.
- (b) Decreases with the increase in the angle of incidence.
- (c) Decreases with the increase in refractive index.
- (d) Decreases with the increase in thickness of glass slab.

(xiv) When an object moves slowly from infinity to the optical centre of a convex lens, the image formed by the lens:
- (a) also moves towards the optical centre of the lens
- (b) also moves away from the optical centre of lens.
- (c) becomes smaller in size.
- (d) becomes virtual.

(xv) During spear fishing a fisherman aims at the:
- (a) tail of fish
- (b) head of fish
- (c) slightly ahead of the head of fish
- (d) none of these

ANSWERS

(i) (c) **(ii)** (b) **(iii)** (a) **(iv)** (c) **(v)** (d) **(vi)** (c) **(vii)** (b) **(viii)** (c) **(ix)** (a) **(x)** (d)
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Question 2

(i) What is nuclear fusion? Write an equation for it. [3]

(ii) A convex lens can be used for burning dry grass, by focussing the rays of sun. Show by drawing a diagram. [2]

(iii) What is the nature of lens and its focal length, if its power is –2.5 D? [2]

(iv) (a) What is range of wavelength of ultraviolet rays in Å? [2]
(b) Name the phenomenon which takes place when ultraviolet rays are focussed on barium platinocyanide

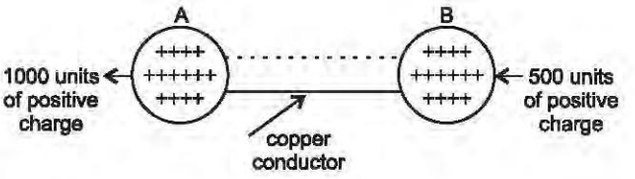
(v) (a) Which is most visible colour of white light? [2]
(b) Which colour of white light has maximum angle of deviation?

(vi) (a) What are reverberation?
(b) Name and explain how reverberation are produced during thunderstorm. [2]

(vii) What is meant by noise pollution? Write the name of one source of sound that causes noise pollution. [2]

Question 3

(i) Diagram alongside shows two insulated copper spheres charged positively and connected by a copper conductor. Copy the diagram and show:
- (a) Direction of conventional current by arrow head in copper conductor.
- (b) Direction of electronic current by arrow head in dotted line. [2]



(ii) Electric energy of 5000 J is required to move a charge of 200 coulombs in a conductor. Calculate the potential difference at the ends of conductor. [2]

(iii) A wire of specific resistance 0.0004 ohm-cm and of length 100 cm has a resistance of 2.0 ohms. Calculate the area of cross-section of wire. [2]

(iv) State Faraday's two laws of electromagnetic induction. [2]

(v) ${}_{Z}P^{A} \longrightarrow {}_{Z+1}Q^{A}$; Radioactive nuclei P changes Q by emitting a radioactive particle.

(a) Which amongst P and Q is parent and daughter nuclei?

(b) Name the particle emitted by P. [2]

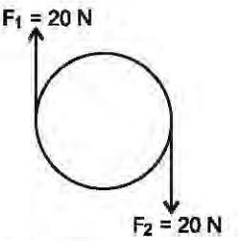
SECTION - B (40 Marks)

(Attempt *any four* questions from this Section)

Question 4

(i) A flat cardboard equilateral triangular in shape is suspended by passing a common pin through a narrow hole at one end of its corner. Draw a diagram to show its position in the state of rest. In the diagram mark the position of suspension by the letter A and centre of gravity (centre of mass) by letter B. [3]

(ii) (a) Forces F_1 and F_2 are applied on a circular body such that moment of force is 16 Nm in clockwise direction. What is the radius of circular body. [4]



(b) State the energy changes taking place in following cases.

1. Water in the dam rotates the turbine, connected to a generator.
2. Exposure of photographic film in sunlight.

(iii) A load of 220 kg is pulled vertically by a crane through a height of 16 m in 40 s. Calculate:

[$g = 10ms^{-2}$ and 1HP = 750 W].

(a) Force acting in upward direction.

(b) Total work done

(c) Horse power of engine pulling the rope. [3]

Question 5

(i) State three functions of a simple machine. [3]

(ii) A machine displaces a load of 150 kgf through a distance 4.0 m, when an effort of 15 kgf acts through a distance of 60 m. Calculate (a) velocity ratio, (b) mechanical advantage, (c) % age effeciency of machine. [3]

(iii) (a) What is a pulley? [4]

(b) Mechanical advantage of single fixed pulley is always less than 1. Why is this pulley commonly used?

(c) Draw a diagram to show a single pulley having velocity ratio 2.

Question 6

(i) Explain the following as clearly as possible. [4]

(a) A wise farmer always waters his fields in the evening, if the forcast is frost.

(b) Wet soils do not get as hot as dry soils in summer.

(ii) A piece of brass of mass 200 g and at 100 °C is placed in 400 g of turpentine oil, contained in a copper calorimeter of mass 50 g and at 15 °C. The final temperature recorded is 25 °C. Calculate

[SHC of brass = 370 $Jkg^{-1}°C^{-1}$ and S.H.C. of copper is 400 $Jkg^{-1}°C^{-1}$] [6]

(a) Heat energy lost by brass.

(b) Heat energy gained by turpentine oil

(c) Heat energy gained by calorimeter.

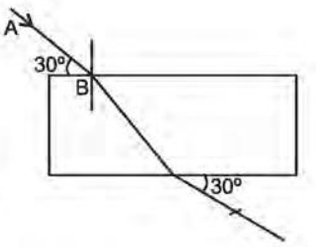
(d) Total heat energy gained.

(e) Specific heat capacity of turpentine oil.

Question 7

(i) (a) Diagram alongside shows the path taken by a ray of light through a rectangular glass slab.

Copy the diagram and show lateral displacement of the ray AB by letters PQ.



[5]

(b) State three factors on which lateral displacement depends.

(ii) An object is placed at a distance of 24 cm from a convex lens of focal length 8 cm.

(a) Calculate the distance of image from the lens. [2]

(b) Calculate magnification of lens. [1]

(c) What is the nature of image? [1]

(d) What is the power of lens? [1]

Question 8

(i) A vibrating tuning fork is placed close to the mouth of a burette filled with water. The tap of the burette is opened and the water level gradually starts falling. It is found that sound from tuning fork becomes very loud for a particular length of the water column.

(a) Name the phenomenon taking place when this happens. [1]

(b) Why does sound becomes very loud for this length of water column? [2]

(ii) (a) What is meant by the terms (1) amplitude (2) frequency of a wave? [2]

(b) Explain why stringed musical instruments, like guitar are provided with hollow box. [2]

(iii) (a) Name the transformer used in the power transmitting station of a power plant. [3]

(b) What type of current is transmitted from the power station?

(c) At what voltage is this current available to our household?

Question 9

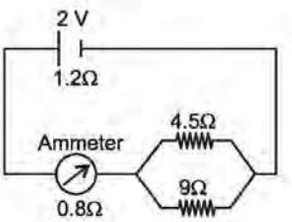
(i) The relationship between potential difference and electric current in a circuit is stated in the form of a law. [4]

(a) Name and state the law.

(b) What does slope V–I of the graph for a conductor represent?

(c) Name the material used for making conducting wires.

(ii) A cell of emf 2 V and internal resistance 1.2 Ω connected to an ammeter of resistance 0.8 Ω and two resistors 4.5 Ω and 9.0 Ω in parallel as shown in diagram alongside.



(a) What would be the reading of ammeter? [3]

(b) What is the potential difference across the terminals of cell? [1]

(c) What is potential difference across resistors in parallel? [1]

(d) What is the magnitude of current in 4.5 Ω resistor? [1]

❖ ❖ ❖

SOLUTION

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

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SECTION - A (40 Marks)

(Attempt *all* questions from this Section)

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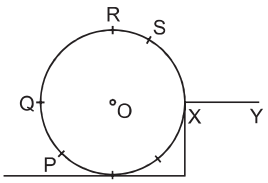

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(v) A boy of mass 40 kg, runs up a flight 50 stairs, each measuring 30 cm. The potential energy gained by the boy is:

[Take g = 10 ms^{-2}]

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Question 2

(i) What is nuclear fusion? Write an equation for it. [3]
(ii) A convex lens can be used for burning dry grass, by focussing the rays of sun. Show by drawing a diagram. [2]
(iii) What is the nature of lens and its focal length, if its power is –2.5 D? [2]
(iv) (a) What is range of wavelength of ultraviolet rays in Å? [2]
(b) Name the phenomenon which takes place when ultraviolet rays are focussed on barium platinocyanide
(v) (a) Which is most visible colour of white light? [2]
(b) Which colour of white light has maximum angle of deviation?
(vi) (a) What are reverberation?
(b) Name and explain how reverberation are produced during thunderstorm. [2]
(vii) What is meant by noise pollution? Write the name of one source of sound that causes noise pollution. [2]

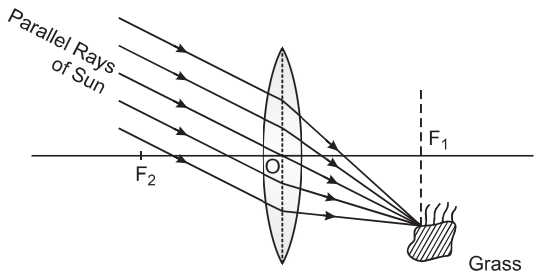
Solution :

(i) The process of combining lighter nuclei (atomic weight less than 20) into heavier nuclei with the release of energy is called nuclear fusion.

Two deuterium nuclei fuse to form a nucleus of tritium, ordinary hydrogen and release energy.

$_1H^2 + {}_1H^2 \rightarrow {}_1H^3 + {}_1H^1 + 88.2 \times 10^9$ J.

(ii)



Convex lens used for burning grass

(iii) Lens is **concave** as power is negative.

Focal length (in cm.) $= \frac{100}{\text{Power}} = \frac{100}{2{\cdot}5} =$ **40 cm.**

(iv) (a) Range of ultraviolet rays in between 4000 Å and 100 Å.

(b) Fluorescence is the phenomenon which takes place.

(v) (a) Orange colour is the most visible colour of white light.

(b) Violet colour of white light has maximum angle of deviation.

(vi) (a) Reverberation : Formation of multiple echoes from various reflectors present surrounding of the source of sound, thereby producing rolling sound are called reverberations.

(b) When the lightning produces a crack of thunder, it is reflected from various reflectors such as buildings, hillocks, etc., thereby producing multiple echoes and hence producing reverberation.

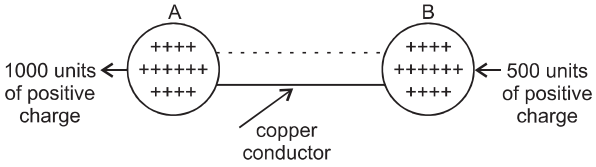
(vii) The disturbance produced in the environment by undesirable loud and harsh sound from various sources is called noise pollution.

On roads, the vehicles of various kinds and unnecessary blowing of horns cause noise pollution.

Question 3

(i) Diagram alongside shows two insulated copper spheres charged positively and connected by a copper conductor. Copy the diagram and show:

(a) Direction of conventional current by arrow head in copper conductor.



(b) Direction of electronic current by arrow head in dotted line. [2]

(ii) Electric energy of 5000 J is required to move a charge of 200 coulombs in a conductor. Calculate the potential difference at the ends of conductor. [2]

(iii) A wire of specific resistance 0.0004 ohm-cm and of length 100 cm has a resistance of 2.0 ohms. Calculate the area of cross-section of wire. [2]

(iv) State Faraday's two laws of electromagnetic induction. [2]

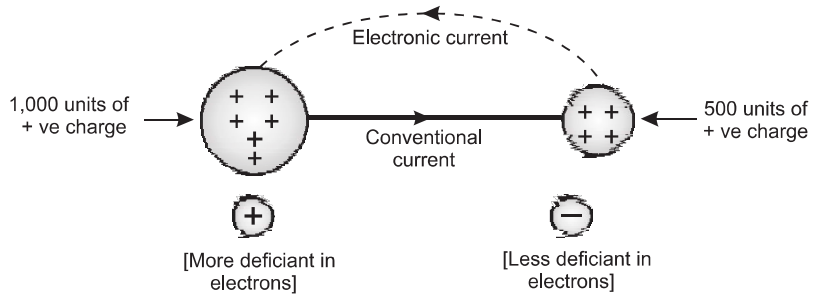
(v) ${}_{Z}P^{A} \longrightarrow {}_{Z+1}Q^{A}$; Radioactive nuclei P changes Q by emitting a radioactive particle.

(a) Which amongst P and Q is parent and daughter nuclei?

(b) Name the particle emitted by P. [2]

Solution :

(i) Diagram shows direction of (a) conventional current (b) electronic current



(ii) Potential difference = $\frac{\text{Energy spent}}{\text{Charge moved}} = \frac{5000\text{ J}}{200\text{ C}} = \mathbf{25\ volt}$

(iii) $R = \rho\frac{l}{a}$ $\quad \therefore\ a = \frac{\rho l}{R} = \frac{0{\cdot}0004 \times 100}{2} = \mathbf{0{\cdot}02\ cm^2}$.

(iv) Faraday's law of electromagnetic induction :

1. Whenever the magnetic flux changes within a coil connected in a closed circuit an induced e.m.f. is set up at the terminals of coil, as long as magnetic flux varies.
2. The magnitude of induced emf is directly proportional to the rate of change of magnetic flux within the coil.

(v) (a) ${}_{Z}P^{A}$ is the parent nuclei.
${}_{Z+1}Q^{A}$ is the daughter nuclei.

(b) Beta particle (${}_{-1}e^{0}$) is emitted by P.

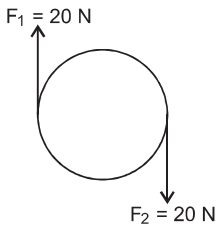
SECTION - B (40 Marks)

(Attempt *any four* questions from this Section)

Question 4

(i) A flat cardboard equilateral triangular in shape is suspended by passing a common pin through a narrow hole at one end of its corner. Draw a diagram to show its position in the state of rest. In the diagram mark the position of suspension by the letter A and centre of gravity (centre of mass) by letter B. [3]

(ii) (a) Forces F_1 and F_2 are applied on a circular body such that moment of force is 16 Nm in clockwise direction. What is the radius of circular body. [4]



(b) State the energy changes taking place in following cases.

1. Water in the dam rotates the turbine, connected to a generator.
2. Exposure of photographic film in sunlight.

(iii) A load of 220 kg is pulled vertically by a crane through a height of 16 m in 40 s. Calculate:
[g = 10ms^{-2} and 1HP = 750 W].

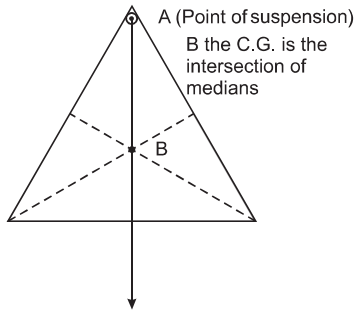
(a) Force acting in upward direction.

(b) Total work done

(c) Horse power of engine pulling the rope. [3]

Solution :

(i) Diagram shown alongside.



(ii) (a) Forces, F_1 and F_2 constitute a couple.

$\therefore$ Moment of force = Force × diameter of circle

$\Rightarrow$ 16 Nm = 20 N × diameter of circle

$\therefore$ Diameter of circle = $\frac{16}{20}\text{m} = 0{\cdot}8\text{ m}$

$\therefore$ Radius of circular body = $\frac{0.8\text{m}}{2} = \mathbf{0{\cdot}4\ m}$.

(b) 1. Water in the dam has potential energy. When the water flows to turbine the potential energy of water is converted first kinetic energy of water and then kinetic energy of turbine. The K. E. of turbine changes to mechanical energy of generator. The mechanical energy of generator then changes to electric energy.

2. The light energy of the sun changes to chemical energy and exposes photographic film.

(iii) (a) Force acting upward = mg = 220 kg × 10 ms^{-2} = **2200 N**

(b) Total work done = $\vec{F} \times \vec{S}$ = 2200 N × 16 m = 35200 J

(c) Power of engine = $\frac{\text{Work}}{\text{Time}} = \frac{35200\text{ J}}{40\text{s}} = 880\text{ W}$

$\therefore$ Horse Power of engine = $\frac{880\ \text{W}}{750\text{s}}$ = **1·17 HP**.

Question 5

(i) State three functions of a simple machine. [3]

(ii) A machine displaces a load of 150 kgf through a distance 4.0 m, when an effort of 15 kgf acts through a distance of 60 m. Calculate (a) velocity ratio, (b) mechanical advantage, (c) % age effeciency of machine. [3]

(iii) (a) What is a pulley? [4]

(b) Mechanical advantage of single fixed pulley is always less than 1. Why is this pulley commonly used?

(c) Draw a diagram to show a single pulley having velocity ratio 2.

Solution :

(i) 1. A machine can multiply effort.

2. A machine can increase speed.

3. A machine can change the direction of effort in convenient direction.

(ii) (a) Velocity ratio = $\frac{\text{Distacne through which effort acts}}{\text{Distance through which load moves}} = \frac{60\ \text{m}}{4\ \text{m}} = \mathbf{15}$.

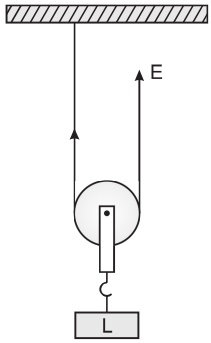
(b) Mechanical advantage = $\frac{\text{load}}{\text{effort}} = \frac{150\ \text{kgf}}{15\ \text{kgf}} = \mathbf{10}$.

(c) $\therefore$ % age efficiency = $\frac{\text{M. A}}{\text{V. R}} \times 100 = \frac{10}{15} \times 100 = \mathbf{66{\cdot}67\%}$

(iii) (a) Pulley is a flat circular disc, having a groove in its edge and capable of turning around a fixed point passing through its centre is called axle.

(b) Single fixed pulley helps in changing the direction of effort. For example, it is difficult to pull a bucket of water from a well with bare hands. However, if the rope is passed over a single fixed pulley and the effort is applied downward, as it becomes easy to do so, and the bucket is lifted up easily.

(c) Single fixed pulley with velocity ratio 2 is shown in diagram alongside.



Question 6

(i) Explain the following as clearly as possible. [4]

(a) A wise farmer always waters his fields in the evening, if the forcast is frost.

(b) Wet soils do not get as hot as dry soils in summer.

(ii) A piece of brass of mass 200 g and at 100 ºC is placed in 400 g of turpentine oil, contained in a copper calorimeter of mass 50 g and at 15 ºC. The final temperature recorded is 25 ºC. Calculate

[SHC of brass = 370 $\text{Jkg}^{-1}\text{°C}^{-1}$ and S.H.C. of copper is 400 $\text{Jkg}^{-1}\text{°C}^{-1}$] [6]

(a) Heat energy lost by brass.

(b) Heat energy gained by turpentine oil

(c) Heat energy gained by calorimeter.

(d) Total heat energy gained.

(e) Specific heat capacity of turpentine oil.

Solution :

(i) (a) Water has the highest specific heat capacity, i.e., 4200 J $\text{kg}^{-1}\ \text{°C}^{-1}$. This means one kg of water on cooling through 1°C will liberate 4200 J of heat which will be dissipated in atmosphere. Now when the farmer waters his fields in the evening and the temperature of atmosphere falls below 0°C, the water in the field will liberate huge amount of heat, which will not let the formation of frost. Thus, the crop of the farmer is saved from any damage due to frost bite.

(b) Water in the wet soils can absorbs fairly large amount heat energy of sun, but its temperature will not rise appreciably because, it has the highest specific heat capacity. However, specific heat capacity of the dry soil is about five times less than water, hence temperature of dry soil rises rapidly.

(ii)

Substance	Mass	S.H.C.	Initial Temp.	Final Temp. = 25°C
Brass	200 g	0·37 $Jg^{-1}\,°C^{-1}$	100° C	$\theta_f = (100 - 25) = 75$ °C
Calorimeter	50 g	0·40 $Jg^{-1}\,°C^{-1}$	15 °C	$\theta_R = (25 - 15) = 10$ °C
Turpentine oil	400 g	? (x)	15 °C	

(a) Heat energy lost by brass = $mc\theta_f = 200 \times 0{\cdot}37 \times 75 =$ **5550 J**

(b) Heat energy gained by turpentine oil = $mc\theta_R = 400 \times x \times 10 =$ **4000 *x g* °C.**

(c) Heat energy gained by calorimeter = $mc\theta_R = 50 \times 0{\cdot}4 \times 10 =$ **200 J**

(d) Total heat energy gained = **4000 *x g* C° + 200 J**

(e) By the principle of calorimetry :

Heat energy gained by turpentine oil and calorimeter = Heat energy lost by brass.

$$\Rightarrow 4000\ x\ g\ °C + 200\ J = 5550\ J$$

$$\Rightarrow 4000\ x\ g\ °C = (5550 - 200)\ J = 5350\ J$$

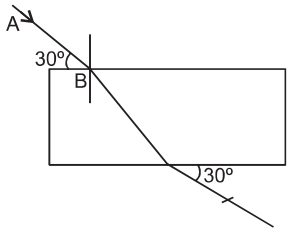
$$\therefore x = \frac{5350\,J}{4000 g\,°C} = \mathbf{1{\cdot}338\ Jg^{-1}\,°C^{-1}}.$$

Thus, specific heat capacity of turpentine oil = 1.338 $Jg^{-1}°C^{-1}$.

Question 7

(i) (a) Diagram alongside shows the path taken by a ray of light through a rectangular glass slab.

Copy the diagram and show lateral displacement of the ray AB by letters PQ. [5]



(b) State three factors on which lateral displacement depends.

(ii) An object is placed at a distance of 24 cm from a convex lens of focal length 8 cm.

(a) Calculate the distance of image from the lens. [2]

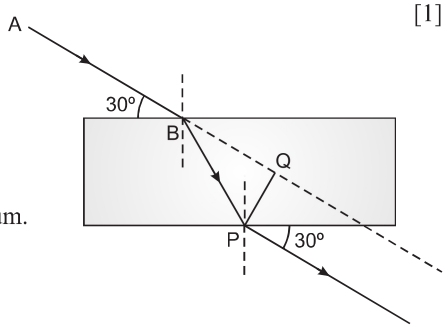
(b) Calculate magnification of lens. [1]

(c) What is the nature of image? [1]

(d) What is the power of lens? [1]

Solution :

(i) (a) Lateral displacement PQ is shown in diagram alongside.



(b) Factor controlling lateral displacement :

1. It is directly proportional to the thickness of refracting material.
2. It is directly proportional to the refractive index of material.
3. It is directly proportional to the angle of incidence in less dense medium.

(ii) (a) Distance of object from lens (u) = – 24 cm

Distance of image from lens (v) = ?

Focal length of lens (f) = + 8 cm

Applying $\frac{1}{v} - \frac{1}{u} = \frac{1}{f} \Rightarrow \frac{1}{v} - \frac{1}{-24} = \frac{1}{8} \Rightarrow \frac{1}{v} = \frac{1}{8} - \frac{1}{24}$

$$\Rightarrow \frac{1}{v} = \frac{3-1}{24} = \frac{2}{24} = \frac{1}{12}.$$

$\therefore$ $v =$ **12 cm.**

(b) $m = \frac{v}{u} = \frac{12\text{ cm}}{24\text{ cm}} =$ **0·5**

(c) Image is real, inverted and diminished.

(d) Power of lens = $\frac{100}{\text{focal length (in cm)}} = \frac{100}{8} =$ **+ 12·5 D**

Question 8

(i) A vibrating tuning fork is placed close to the mouth of a burette filled with water. The tap of the burette is opened and the water level gradually starts falling. It is found that sound from tuning fork becomes very loud for a particular length of the water column.

(a) Name the phenomenon taking place when this happens. [1]

(b) Why does sound becomes very loud for this length of water column? [2]

(ii) (a) What is meant by the terms (1) amplitude (2) frequency of a wave? [2]

(b) Explain why stringed musical instruments, like guitar are provided with hollow box. [2]

(iii) (a) Name the transformer used in the power transmitting station of a power plant. [3]

(b) What type of current is transmitted from the power station?

(c) At what voltage is this current available to our household?

Solution :

(i) (a) It happens due to the phenomenon of resonance.

(b) At some particular length of the enclosed air column its natural frequency corresponds to the frequency of the tuning fork. Thus, resonance takes place with the result amplitude of vibration of tuning fork and enclosed air increases. Hence a loud sound is heard.

(ii) (a) 1. The maximum displacement of a vibrating particle from its mean position is called its amplitude.

2. The number of waves produced by a vibrating particle in one second is called its frequency.

(b) The hollow box contains large volume of trapped air. Thus, when the vibrating strings are impressed on the hollow box, a large volume of air vibrates with forced vibration producing a loud sound :

(iii) (a) Step-up transformer.

(b) Alternating current.

(c) 220 V in India.

Question 9

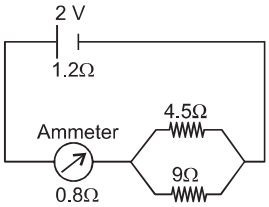
(i) The relationship between potential difference and electric current in a circuit is stated in the form of a law. [4]

(a) Name and state the law.

(b) What does slope V–I of the graph for a conductor represent?

(c) Name the material used for making conducting wires.

(ii) A cell of emf 2 V and internal resistance 1.2 Ω connected to an ammeter of resistance 0.8 Ω and two resistors 4.5 Ω and 9.0 Ω in parallel as shown in diagram alongside.



(a) What would be the reading of ammeter? [3]

(b) What is the potential difference across the terminals of cell? [1]

(c) What is potential difference across resistors in parallel? [1]

(d) What is the magnitude of current in 4.5 Ω resistor? [1]

Solution :

(i) (a) **Ohm's Law :** Temperature of a conductor remaining constant, the potential difference at the ends of conductor is directly proportional to current flowing through it.

(b) The V-I slope of graph represents resistance of conductor.

(c) Metals like copper, aluminium.

(ii) (a) Resistance of 4·5Ω and 9Ω in parallel

$$\frac{1}{R_p} = \frac{1}{4{\cdot}5} + \frac{1}{9} = \frac{2+1}{9} = \frac{3}{9} \therefore R_p = 3\Omega$$

Total external resistance = 3Ω + 0·8Ω = 3·8Ω

$$\therefore \text{Current in ammeter, } I = \frac{E}{R+r} = \frac{2}{3{\cdot}8+1{\cdot}2} = \frac{2}{5} = \mathbf{0{\cdot}4A}.$$

(b) Now, $I = \frac{E-V}{r}$

$$\Rightarrow 0{\cdot}4 = \frac{2-V}{1{\cdot}2} \Rightarrow 0{\cdot}48 = 2 - V$$

$\therefore$ V = 2 – 0·48 = **1·52 V**; The P.D. across the terminals of cell = 1.52 V.

(c) P. D across parallel resistors

$V = I.R_s = 0{\cdot}4 \times 3 = \mathbf{1{\cdot}2\ V}$

(d) $\therefore$ current in 4·5Ω resistor, $I = \frac{V}{R} = \frac{1{\cdot}2}{4{\cdot}5} = \mathbf{0{\cdot}27\ A.}$

V V V