ICSE 2023 EXAMINATION
SPECIMEN QUESTION PAPER
PHYSICS
(SCIENCE PAPER-1)

Maximum Marks : 80
Time allowed : Two hours
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 question are given in brackets [ ].

SECTION A

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

***Question* 1**

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

(i) S.I. unit of moment is :

(a) kgf·m (b) Nm (c) gf·m (d) Ncm

Ans. (b) Nm

(ii) Which of the following is the correct expression for gain in kinetic energy, if initial velocity is not zero ?

(a) $k = \frac{1}{2}mv^2$ (b) $k = \frac{mv^2}{4}$ (c) $k = \frac{mv^2}{2t}$ (d) $k = \frac{1}{2}m(v^2 - u^2)$

Ans. (d) $k = \frac{1}{2}m(v^2 - u^2)$

(iii) The energy conversion, when an oscillating pendulum moves from mean to extreme position is :

(a) Kinetic to potential (b) Potential to kinetic

(c) Potential to kinetic to potential (d) Kinetic to potential to kinetic

Ans. (a) Kinetic to potential

(iv) Which of the following nuclear radiations can be stopped by a sheet of paper ?

(a) Alpha (b) Beta (c) Gamma (d) None of these

Ans. (a) Alpha

(v) When seven spectral colours pass through a glass block from air, then which one of the following statements is correct ?

(a) In the glass block, speed of blue light > speed of yellow light.

(b) In the glass block, speed of green light > speed of orange light.

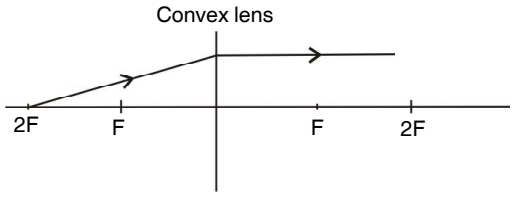
(c) In the glass block, speed of violet light > speed of red light.

(d) In the glass block, speed of orange light > speed of indigo light.

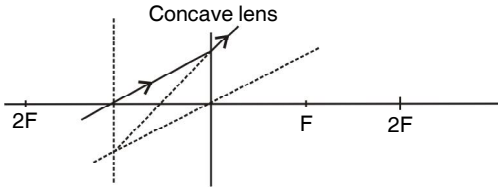
Ans. (d) In the glass block, speed of orange light > speed of indigo light

(vi) In which of the following diagrams is the refraction not correct ?

(a)



(b)



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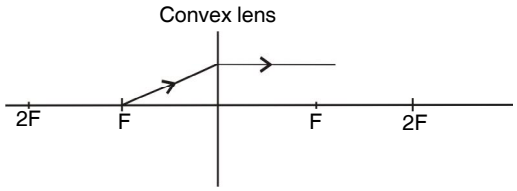
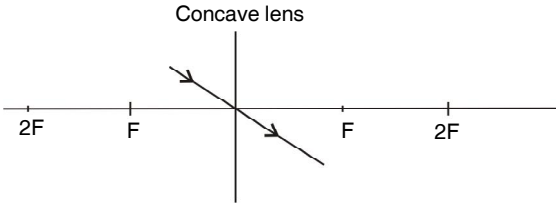
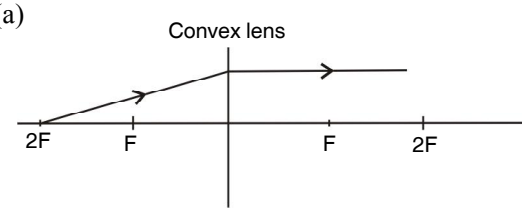


(d)



Ans. (a)

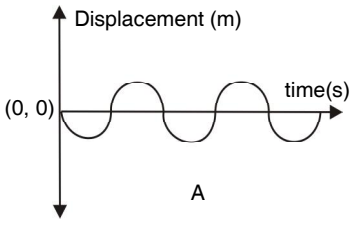


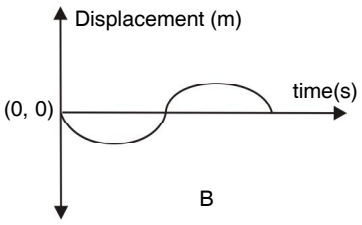
(vii) The characteristic of sound which enables to differentiate between two sounds of different intensities is :

(a) Quality (b) Amplitude (c) Pitch (d) Loudness

Ans. (d) Loudness

(viii) The ratio of wavelength of A : wavelength of B is :





(a) 5 : 2

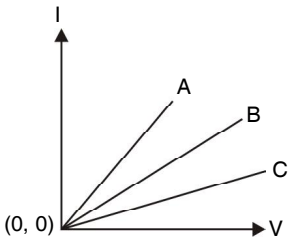
(b) 1 : 2

(c) 2 : 1

(d) 2 : 3

Ans. (b) 1 : 2

(ix) The graph shows I against V relation for three conductors A, B and C. Choose the correct relation for the resistors of A, B and C.



(a) $R_A > R_B > R_C$ (b) $R_B > R_C < R_A$

(c) $R_C > R_B < R_A$ (d) $R_C > R_B > R_A$

Ans. (d) $R_C > R_B > R_A$

(x) Which of the following is the correct colour code of the three wires-live, neutral and earth ?

(a) Live : Green Neutral : Red Earth : Yellow (b) Live : Brown Neutral : Red Earth : Blue

(c) Live : Brown Neutral : Blue Earth : Yellow (d) Live : Blue Neutral : Brown Earth : Green

Ans. (c) Live : Brown Neutral : Blue Earth : Yellow

(xi) When a conductor carrying current is placed in a magnetic field perpendicular to it, then the direction of the force experienced can be found out using :

(a) Lenz's law (b) Fleming's left hand rule

(c) Fleming's right hand rule (d) Right hand thumb rule

Ans. (b) Fleming's left hand rule

(xii) Choose the correct statement.

Latent heat absorbed :

(a) Is independent of the mass of the substance.

(b) Is directly proportional to the increase in the temperature of the substance.

(c) Is directly proportional to the specific heat capacity of the substance.

(d) Is directly proportional to the specific latent heat of the substance.

Ans. (d) Is directly proportional to the specific latent heat of the substance.

(xiii) Which of the following liquids is the most suitable for radiators in cars ?

(a) Liquid P with specific heat capacity 4000 $Jkg^{-1}K^{-1}$.

(b) Liquid Q with specific heat capacity 2000 $Jkg^{-1}K^{-1}$.

(c) Liquid R with specific heat capacity 1500 $JKg^{-1}K^{-1}$.

(d) Liquid S with specific heat capacity 2100 $Jkg^{-1}K^{-1}$.

Ans. (a) Liquid P with specific heat capacity 4000 $Jkg^{-1}K^{-1}$.

(xiv) While entering from medium A to medium B if light slows down, then :

(a) $\angle i < \angle r$ (b) $\angle i = \angle r$ (c) $\angle i > \angle r$ (d) $\angle i \leq \angle r$

Ans. (c) $\angle i > \angle r$

(xv) The phenomenon of light that causes the diamond to glitter is :

(a) Refraction (b) Total internal reflection

(c) Reflection (d) Absorption

Ans. (b) Total internal reflection

Question 2

(i) (a) How many pulleys are there in a movable block of a block and tackle system with velocity ratio 5 ? **[3]**

Ans. There are 2 pulleys in a movable block of a block and tackle system with velocity ratio 5.

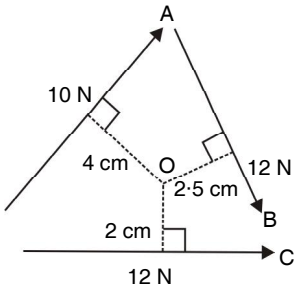
(b) A radioactive nucleus emits a beta particle. Does the position of daughter nucleus change in a periodic table as compared to the parent nucleus ?

Ans. Yes. The position of daughter nucleus changes and shifts one place higher in a periodic table as compared to the parent nucleus after emitting a beta particle.

(c) To which electrically charged plate, the beta radiations will deflect while passing through an electric field ?

Ans. Beta radiations will deflect towards the positively charged plate.

(ii) (a) Name the force which produces maximum moment about O. **[2]**



Ans. Force A (*i.e.* 10 N) produces the maximum moment about O.

(b) Calculate this moment in S.I. unit.

Ans. Moment of force = Force A × perpendicular distance of force from O

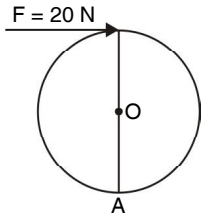
= 10 × 0·04 = **0·4 Nm**

(iii) State two factors that affect the centre of gravity of the body. **[2]**

Ans. 1. Shape of the body.

2. Distribution of mass within the body.

(iv) If the moment of F about the centre of a wheel O is 6 Nm, then calculate the moment of F about A. [2]



Ans. Moment of force = Force × perpendicular distance of force from O

$$6 = 20 \times r$$

or $$r = \frac{6}{20} = 0{\cdot}3 \text{ m}$$

Now moment of force F about A = Force × Perpendicular distance of force from A (*i.e.* diameter of wheel)

$$= 20 \times 2r$$

$$= 20 \times 2 \times 0{\cdot}3 = \mathbf{12\ Nm}$$

(v) If kinetic energy of a moving body is 40 J, then what will be its kinetic energy when its velocity is doubled ? [2]

Ans. K.E. $= \frac{1}{2}\ mv^2$ $\quad\therefore$ if v = 2v

then K.E. $= \frac{1}{2}\ m(2v)^2 = 4[\frac{1}{2}\ mv^2]$

Thus new K.E. is 4 times

i.e. 4 × 40 J = **160 J**

(vi) A freely suspended pendulum in air is disturbed once and left to oscillate on its own : [2]

(a) Name the type of vibrations.

Ans. Damped vibrations.

(b) State one way to decrease the frequency of this vibration.

Ans. By increasing the length of the pendulum.

(vii) Two copper wires A and B are of same length present at temperature 30°C. Radius of A is twice the radius of B. [2]

(a) Which wire has greater resistance ?

Ans. Wire B.

(b) Which wire will have greater resistivity ?

Ans. Both wires will have the same resistivity.

Question 3

(i) A lens X can form an image on the screen. [2]

(a) Name the lens X.

Ans. Convex lens.

(b) Is it possible for this lens to form magnified image ?

Ans. Yes, it is possible for this lens to form a magnified image.

(ii) (a) Is it possible to switch off an appliance by placing the switch in a neutral wire ? [2]

Ans. Yes.

(b) Is it possible for current to flow between a neutral and an earth wire ?

Ans. No.

(iii) State two factors that affect the strength of an electromagnet. [2]

Ans. 1. Number of turns of winding in the solenoid.

2. Current through the solenoid.

(iv) Calculate the heat absorbed by 200 g ice at 0°C to change to water at 60°C. [Specific heat capacity of ice = 2100 J kg^{-1} K^{-1}, specific heat capacity of water = 4200 J kg^{-1} K^{-1}, specific latent heat of ice = 336000 J kg^{-1}]. [2]

Ans. Given $m = 200\ g = \frac{200}{1000}\ kg$, $s_w = 4200\ J\ kg^{-1}\ K^{-1}$ and $L = 336000\ J\ kg^{-1}$

Total heat absorbed by ice at 0°C to change to water at 60°C

= Heat energy taken by ice to melt at 0°C + Heat energy taken by melted ice to raise its temperature to 60°C

$\therefore \quad Q = Q_1 + Q_2$

$= mL + ms_w \Delta t$

$= \frac{200}{1000} \times 336000 + \frac{200}{1000} \times 4200 \times 60$

$= 67200 + 50400 =$ **117600 J**

(v) What are background radiations ? **[2]**

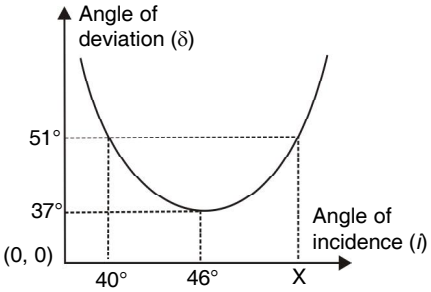
Ans. The background radiations are the radioactive radiations (such as α, β and γ) to which we all are exposed, even in absence of a visible radioactive source. Example : radiations from potassium (K-40), Carbon (C-14) present inside our body and also from cosmic radiations.

SECTION B

*(Attempt any **four** questions)*

Question 4

(i) The diagram (not drawn to the scale) below shows the graphical relation between angle of deviation and angle of incidence, when light passes through a triangular prism of angle 62° of a certain glass material. **[3]**



(a) State the angle of minimum deviation of this prism and the corresponding angle of incidence.

Ans. Angle of minimum deviation $\delta_{min} = 37°$

Corresponding angle of incidence $i = 46°$

(b) Calculate the value of X.

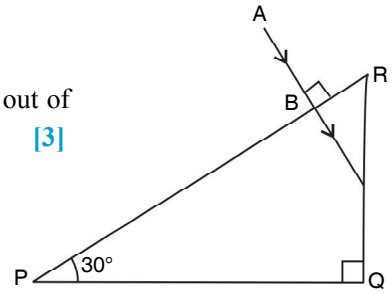
Ans. Using relation $i_1 + i_2 = A + \delta$

Here $A = 62°$, $i_1 = 40°$, $\delta = 51°$ and $i_2 = ?$

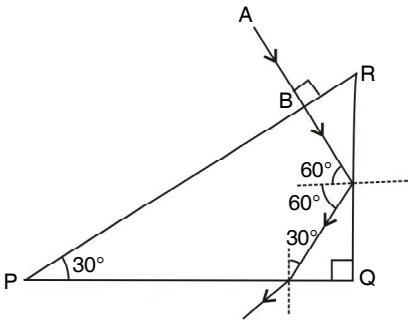
$\therefore \quad 40 + i_2 = 62 + 51$

or $\quad i_2 = 73°$

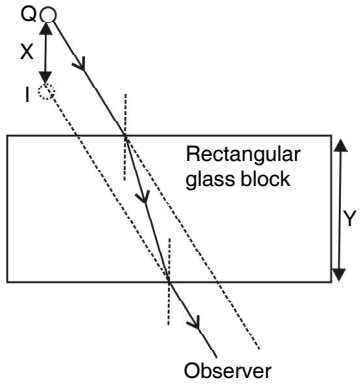
(ii) Redraw and complete the path of the ray AB till it emerges out of the prism of critical angle 42°. **[3]**



Ans.



(iii) The diagram given alongside shows that an observer sees the image of an object O at I. **[4]**



(a) Name and define the phenomenon responsible for seeing the image at a different position.

Ans. Refraction; the change in the direction of the path of light when it passes from one transparent medium to another transparent medium is called refraction.

(b) State the effect on X when :

1. Y increases 2. Y decreases

Ans. 1. X increases when Y increases.

2. X decreases when Y decreases.

Question 5

(i) An object of height 20 cm is placed in front of a lens at a distance of 50 cm. Its virtual, diminished image is formed at a distance of 15 cm. **[3]**

(a) Identify the type of the lens.

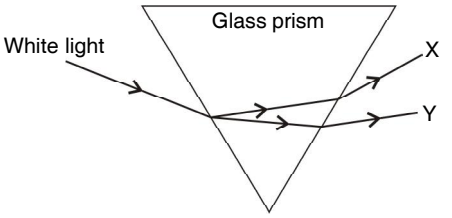
Ans. Concave lens.

(b) Calculate the focal length of the lens.

Ans. Given : $u = -50$ cm and $v = -15$ cm

Now $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ or $\frac{1}{(-15)} - \frac{1}{(-50)} = \frac{1}{f}$ or $\frac{1}{f} = \frac{-1}{15} + \frac{1}{50}$ or $\frac{1}{f} = \frac{-7}{150}$ or $f = \mathbf{-21{\cdot}43\ cm}$

(ii) The diagram given alongside shows the extreme colours of a visible spectrum (X and Y). **[3]**



(a) Identify the colours X and Y.

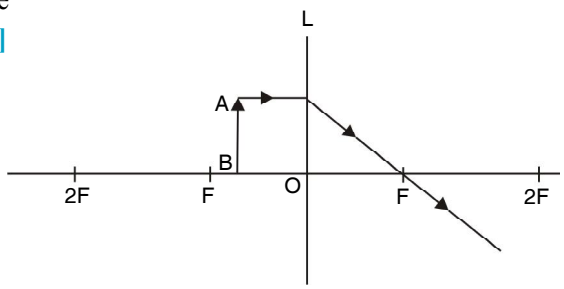
Ans. Colour X — Violet

Colour Y — Red

(b) Which colour has a greater speed in vacuum ?

Ans. Both colours have the same speed in vacuum.

(iii) The diagram given alongside shows an object AB kept in front of the lens. The path of one ray coming from the object is shown. **[4]**

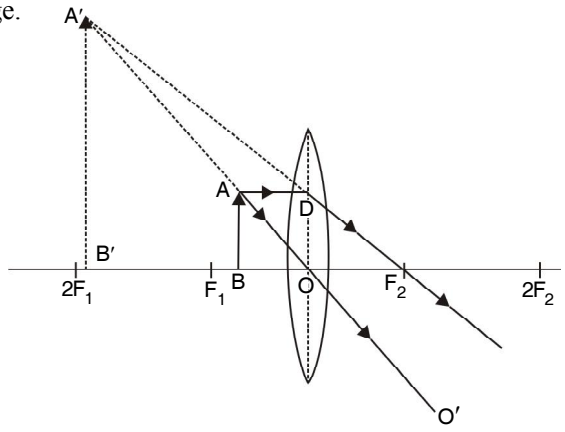


(a) Name the lens L.

Ans. Lens L is convex.

(b) Redraw and complete the ray diagram showing the formation of the image.

Ans. A′B′ is the image.

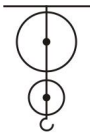


(c) In which optical instrument is this kind of image formed ?

Ans. Magnifying glass or simple microscope.

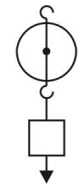
Question 6

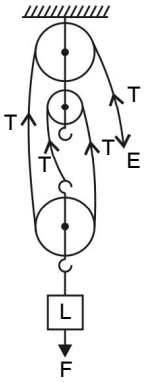
(i) The diagram given alongside shows a block and tackle system : **[3]**



(a) Copy and redraw the labelled diagram showing the correct connection of tackle, direction of the forces involved to obtain the maximum V.R. and convenient direction.

Ans.





(b) Calculate the M.A. of this pulley system if its efficiency is 80%.

Ans. V.R. = 3

η = 80% or 0·8

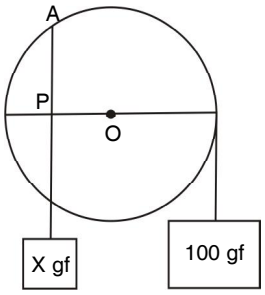
We know $\eta = \frac{\text{M.A.}}{\text{V.R.}}$

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

= 0·8 × 3

M.A. = **2·4**

(ii) The adjacent diagram shows a wheel of diameter 40 cm fixed on a wall capable of rotating around its centre O. If the wheel rotates in an anticlockwise direction, then : **[3]**



(a) Calculate the clockwise moment.

Ans. Given D = 40 cm.

$\therefore\ r = \frac{D}{2} = \frac{40}{2} = 20$ cm

Clockwise moment = 100 gf × 20 cm = 2000 gf cm.

(b) State whether X = 100 gf or X < 100 gf or X > 100 gf.

Ans. X is > 100 gf.

(c) Give a reason for your answer.

Ans. The wheel is rotating in an anticlockwise direction which implies that the clockwise moment is smaller than anticlockwise moment. Also perpendicular distance of force × gf is smaller which clearly indicates [X gf × OP > 100 gf × 20] that X gf > 100 gf.

(iii) A coconut of mass 450 g falls from the top of an 80 m high tree. **[4]**

(a) Calculate the potential energy possessed by the coconut when it is at the top of the tree.

Ans. P.E. = mgh = $\frac{450}{1000} \times 10 \times 80 = 360$ J

(b) Without calculation, state the kinetic energy with which it strikes the ground and state the principle involved to arrive at this answer. $g = 10\ ms^{-2}$.

Ans. K.E. = P.E. = 360 J

This is in accordance with the principle of conservation of total mechanical energy.

Question 7

(i) A person standing in front of a cliff fires a gun and hears its echo afer 3s. If the speed of sound in air is 336 ms^{-1}: **[3]**

(a) Calculate the distance of the person from the cliff.

Ans. Given time of echo, $t_1 = 3s$, $V = 336\ ms^{-1}$

Let the person be at distance d_1 from the cliff.

Using $V = \frac{2d_1}{t_1}$ or $2d_1 = V \times t_1$ or $d_1 = \frac{V \times t_1}{2} = \frac{336 \times 3}{2} =$ **504 m**

(b) After moving a certain distance from the cliff he fires the gun again and this time the echo is heard 1·5 s later than the first. Calculate distance moved by the person.

Ans. Now $t_2 = t_1 + 1{\cdot}5 = 3 + 1{\cdot}5 = 4{\cdot}5$ s

Again $d_2 = \frac{V \times t_2}{2} = \frac{336 \times 4{\cdot}5}{2} =$ **756 m**

Distance moved by the person away from cliff = 756 – 504 = **252 m**

(ii) (a) A radioactive nucleus X emits an alpha particle followed by two beta particles and forms nucleus Y. What is the general name of the elements X and Y ? **[3]**

Ans. ${}^{A}_{Z}X \rightarrow {}^{A-4}_{Z-2}X + {}^{4}_{2}He \rightarrow {}^{A-4}_{Z}Y + {}^{0}_{-1}e + {}^{0}_{-1}e$

X and Y have the same atomic number, thus they are isotopes.

(b) If the atomic number of Y is 80 then what is the atomic number of X ?

Ans. Atomic number of X is also 80.

(c) If the atomic mass number of Y is 189 then what is the atomic mass number of X ?

Ans. If mass number of Y is 189, then mass number of X = 189 + 4 = **193**

(iii) A boy tunes a radio channel to a radio station 93·5 MHz. **[4]**

(a) Name and define the scientific wave phenomenon involved in tuning the radio channel.

Ans. Resonance. When the frequency of the externally applied periodic force on a body is equal to its natural frequency, the body readily begins to vibrate with an increased amplitude. This phenomenon is called resonance.

(b) Now, what is the frequency of the channel ? Convert this frequency into S.I. unit.

Ans. Frequency of the channel is 93·5 MHz.

Conversion into S.I. unit = $93{\cdot}5 \times 10^6$ Hz

Question 8

(i) (a) What is the meaning of the statement 'the power rating of an appliance is 60 W, 220 V' ? **[3]**

Ans. It means that when the appliance is operated on a power supply of 220 V, the electric power consumed by it is 60 W, *i.e.* it consumes 60 J of electrical energy in 1 second.

(b) In which wire is the fuse connected in a circuit ?

Ans. Live wire.

(c) State the function of main switch in an electric current.

Ans. The main switch is used to switch on or off the main supply. It is a double pole switch and disconnects both the live and neutral wires simultaneously.

(ii) (a) Copy and complete the following nuclear reaction. **[3]**

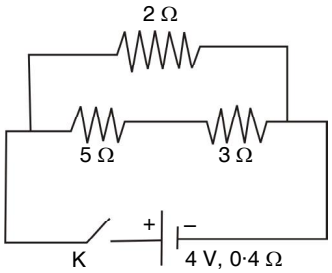
$_{86}^{-}Rn \rightarrow {}^{218}_{-}Po + {}^{4}_{2}\alpha$

Ans. $^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + {}^{4}_{2}\alpha$

(b) What will be the effect on the radiation emitted in the above reaction when it is allowed to pass through an electric field ? [Be specific in your answer].

Ans. The radiation, α-particle, being positive gets deflected towards the negative plate in the electric field. The disintegration is not affected by electric field.

(iii) Observe the given circuit diagram and answer the questions that follow : **[4]**



(a) Calculate the resistance of the circuit when the key K completes the circuit.

Ans. Resistance 5Ω and 3Ω are connected in series.

Their equivalent resistance $R_1 = 5 + 3 = 8\ \Omega$

R_1 is in parallel connection with resistance 2 Ω.

$$\therefore\ R_2 = 1/\left(\frac{1}{8} + \frac{1}{2}\right) = \frac{8}{5} = 1{\cdot}6\ \Omega$$

Total resistance of the circuit = R_2 + r (internal resistance of the cell) = 1·6 + 0·4 = **2 Ω**

(b) Calculate the current through 3Ω resistance.

Ans. Total current in the circuit $I = \frac{E}{R + r} = \frac{4}{2} = 2A$

Let this current be divided into I_1 and I_2

$\therefore\ I_1 + I_2 = 2A$ ...(i)

and $I_1 \times 2 = I_2 \times 5 + I_2 \times 3$

$2\ I_1 = 8\ I_2$

$I_1 = 4\ I_2$

$\therefore\ 4\ I_2 + I_2 = 2A$

$5\ I_2 = 2A$

$I_2 = \frac{2}{5} =$ **0·4 A**

Question 9

(i) A metal piece present at 120°C is quickly dropped in a calorimeter of mass 80 g containing 200 g of water at 30°C. The final temperature attained by the mixture is 40°C. Calculate the thermal capacity of the metal piece. [Specific heat capacity of water = 4·2 $Jg^{-1}\ °C^{-1}$, Specific heat capacity of calorimeter = 0·4 $Jg^{-1}\ °C^{-1}$]. **[3]**

Ans. Let W $J°C^{-1}$ be the thermal capacity of the metal piece

Heat given by metal piece = $W \times \Delta t$

= $W(120 - 40) = 80\ WJ$

Heat taken by calorimeter = mst

= $80 \times 0{\cdot}4 \times (40 - 30) = 320\ J$

Heat taken by water = mst

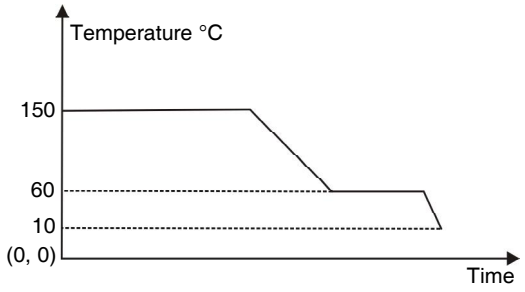
= $200 \times 4{\cdot}2 \times (40 - 30) = 8400\ J$

By principle of calorimetry, heat given = Heat taken

$80\ W = 320 + 8400$

$$W = \frac{8720}{80} =$$ **109 $J°C^{-1}$**

(ii) The diagram given below shows a cooling curve for a substance : **[3]**



(a) State the temperatures at which the substance condenses and solidifies respectively.

Ans. The temperature at which the substance condenses is 150°C and at which it solidifies is 60°C.

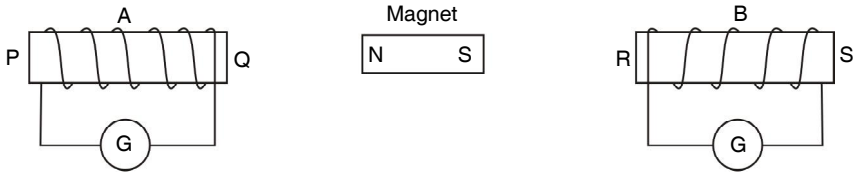
(b) State the temperature range in which the substance is in liquid state.

Ans. The temperature range is 60°C to 150°C.

(c) Why do we prefer ice to ice-cold water for cooling a drink ?

Ans. Ice is preferred 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 the drink liberates an additional 336 J of heat energy to 1 g ice than to 1 g ice cold water at 0°C.

(iii) The diagram below shows a magnet placed between two coils A and B. The magnet is moved along the axis towards coil B. **[4]**



(a) State the polarities induced at the ends Q and R of the coil due to the motion of the magnet.

Ans. Polarity at end Q = South pole

Polarity at end R = South pole

(b) Name the phenomenon due to which the current is induced in the coils.

Ans. Electromagnetic induction.

(c) Name the law which helps to find the polarities at the ends Q and R.

Ans. Lenz's law.