# ICSE Solved Paper 2020
# PHYSICS

## Class-X

*(Maximum Marks : 80)*

*(Time allowed : Three hours)*

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*Section **I** is compulsory. Attempt **any four** questions from **Section II**.*

*The intended marks for questions or parts of questions are given in brackets [].*

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| SECTION-I | (40 Marks) |
|---|---|

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

**1. (a) (i) Define moment of force.** **2**

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

**Ans. (i)** The product of magnitude of force and the perpendicular distance of line of action of force from the axis of rotation is known as the moment of force. It is also known as torque.

**(ii)** Since, the SI unit of moment of force is Newton metre, i.e., Nm and the CGS unit of moment of force is dyne cm.

So, the required relationship between the SI and CGS unit of moment of force will be $1\,\text{Nm} = 10^5\,\text{dyne} \times 10^2\text{cm} = 10^7\,\text{dyne cm}$

**(b) Define a kilowatt hour. How is it related to joule ?** **2**

**Ans.** One kilowatt hour is defined as the electrical energy which is consumed by the appliance of 1 kW power in duration of 1 hour.

$\because$ 1 kilowatt hour = 1 kilowatt × 1 hour

= 1000 watts × 1 hour

$\{\because$ 1 kilowatt = 1000 watts$\}$

= 1000 watts × 3600 s

$\{\because$ 1 hour = 3600 s$\}$

and $\{\because 1\,\text{watt} = \dfrac{1\,\text{J}}{\text{s}}\}$

$= 1000 \times \dfrac{\text{J}}{\text{s}} \times 3600\,\text{s}$

= 3600000 J

$\boxed{1 \text{ kilowatt hour} = 3.6 \times 10^6 \text{ J}}$

So, this is the required relation between kilowatt hour and Joule.

**(c) A satellite revolves around a planet in a circular orbit. What is the work done by the satellite at any instant? Give a reason.** **2**

**Ans.** It is given that a satellite is revolving around the Earth, So, let us represent the given situation through the following diagram, at particular instant.
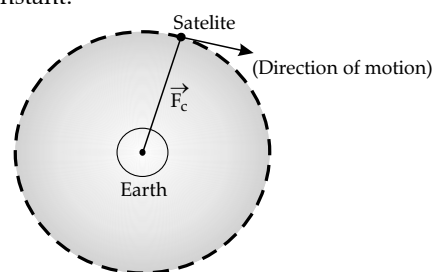


**Note:** When the direction of acting force on the body is perpendicular to the direction of displacement, then work done remains zero. So, in this given situation, the work done by the satellite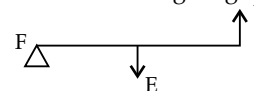 at any instant will be zero. It is because the centripetal force $(\vec{F}_c)$ is perpendicular to the direction of the displacement /motion.

**(d) (i) Identify the class of the lever shown in the diagram below :** **2**
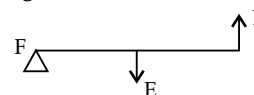


**(ii) How is it possible to increase the M.A. of the above lever without increasing its length ?**

**Ans. (i)** Consider the following diagram of lever,



The given diagram is of class III lever, because Effort(E) is lying between Fulcrum(F) and Load(L).

**(ii)** As Mechanical Advantage $= \dfrac{\text{Effort arm}}{\text{load arm}}$.

So, if the distance of the effort from the fulcrum is increased, then the mechanical advantage of the above lever will also be increased without increasing its length.

**(e) Give one example of each when : 2**
    **(i) Chemical energy changes into electrical energy.**
    **(ii) Electrical energy changes into sound energy.**

**Ans. (i)** In case of primary cell, chemical energy changes into electrical energy as it is used to convert stored chemical energy into electrical energy.

    **(ii)** In case of electric bell, the electrical energy changes into sound energy as the sounds produced by the electrical signals is converted into a form of sound energy.

**2. (a) A crane 'A' lifts a heavy load in 5 seconds, whereas another crane 'B' does the same work in 2 seconds. Compare the power of *n* crane 'A' to that of crane 'B'. 2**

**Ans.** According to question, crane A lifts a heavy load is 5 seconds and crane B does the same work in 2 seconds.

$$\because \quad \text{Power} = \frac{\text{work done}}{\text{time taken}}$$

∴ For crane A,

$$P_A = \frac{W}{5s} \qquad \qquad ...(i)$$

$$\{\because \text{For crane A}, t = 5\ s\}$$

and for crane B,

$$P_B = \frac{W}{2s} \qquad \qquad ...(ii)$$

$$\{\because \text{For crane B}, t = 2\ s\}$$

On dividing eqns. (i) and (ii), we get

$$\frac{P_A}{P_B} = \frac{\dfrac{W}{5}}{\dfrac{W}{2}} \Rightarrow \frac{P_A}{P_B} = \frac{2}{5}$$
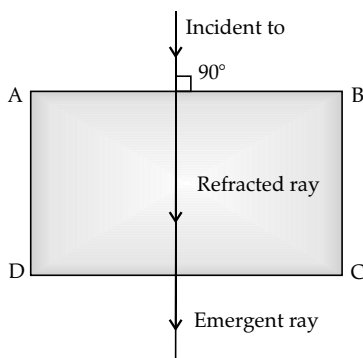
or $\boxed{P_A = 1.4\ P_B}$

i.e., the power of crane A is 0.4 times to that of crane B.

**(b) A ray of light falls normally on a rectangular glass slab. 2**
**Draw a ray diagram showing the path of the ray till it emerges out of the slab.**

**Ans.** When a ray of light falls normally on a rectangular glass slab, then it will be shown as follows :
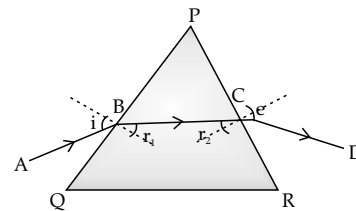


So, in the given case, Angle of incidence = Angle of refraction = Angle of emergence = 0

i.e., $\angle i = \angle r = \angle e = 0$

Hence, the above ray diagram is the required ray diagram which shows the path of the ray till it emerges out of the slab.

**(c) 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**
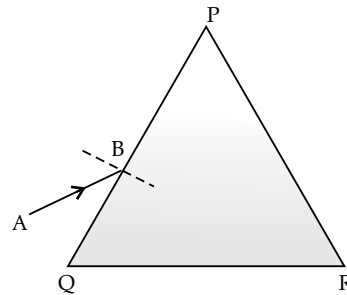


**Ans.**



In the given ray diagram,
$$\angle i = \text{Angle of incidence}$$
$$\angle e = \text{Angle of emergence}$$
$\angle r_1$ and $\angle r_2$ are the angle of refractions.
$$AB = \text{Incident ray}$$
$$BC = \text{Refracted ray}$$
$$CD = \text{Emergent ray}.$$

So, this is the required path of the monochromatic light ray AB incident on the surface PQ of equilateral glass prism PQR till it emerges out of the prism due to refraction.
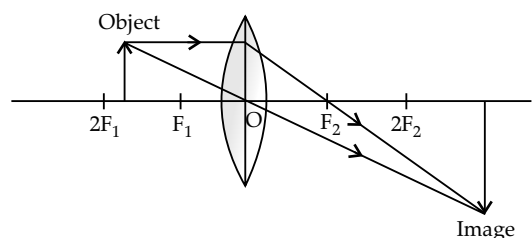
**(d) Where should an object be placed in front of a convex lens in order to get : 2**
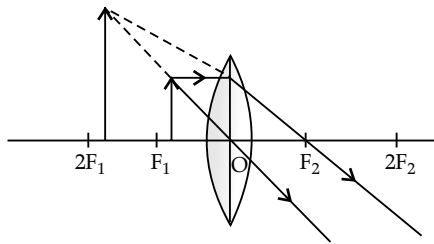**(i) an enlarged real image**
**(ii) enlarged virtual image ?**

**Ans. (i)** To get an enlarged real image, the object should be placed (in front of a convex lens) between F and 2F.



**(ii)** To get an enlarged virtual image, the object should be placed (in front of a convex lens) between F and O.

**(e) A pond appears to be 2.7 m deep. If the refractive index of water is $\frac{4}{3}$, find the actual depth of the pond.** **2**

**Ans.** Actual depth of pond = ?

Apparent depth of pond = 2.7 m.

Refractive index of water = $\frac{4}{3}$

∴ Refractive index of medium

$$= \frac{\text{Real depth or Actual depth}}{\text{Apparent depth}}$$

∴ $\frac{4}{3} = \frac{\text{Actual depth}}{2.7\,\text{m}}$

⇒ Actual depth = $\frac{4}{3} \times 2.7$ m

= $4 \times 0.9$ m

⇒ | Actual depth = 3.6 m |

**3. (a) The wave lengths for the light of red and blue colours are nearly $7.8 \times 10^{-7}$ m and $4.8 \times 10^{-7}$ m respectively.**

**(i) Which colour has the greater speed in a vacuum ?**

**(ii) Which colour has a greater speed in glass ?** **2**

**Ans. (i)** Since, speed does not change in vacuum, therefore, all colours will move with the same speed, i.e., with the speed of light ($3 \times 10^{\wedge 8}$ m/s).

**(ii)** It is given that wavelength of red light, $\lambda_{\text{Red}} = 7.8 \times 10^{-7}$ m and

wavelength of blue light $\lambda_{\text{blue}} = 4.8 \times 10^{-7}$ cm

∵ Velocity = wavelength × frequency

⇒ $V = \lambda f$ ...(i)

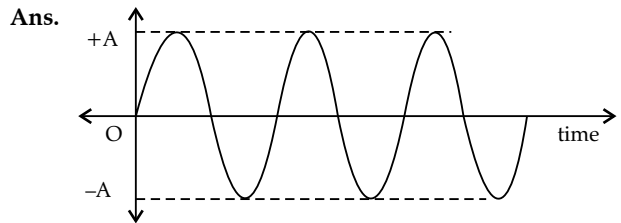As we know that frequency of light does not change when it enters into a medium, i.e., $f$ is constant.

∴ eqn. (i) becomes

$V \alpha \lambda$ ...(ii)

As given

$\lambda_{\text{red}} > \lambda_{\text{blue}}$ ...(iii)

from eqns (ii) and (iii), we get

| $V_{\text{red}} > V_{\text{blue}}$ |

It means that the red colour light will have greater speed in glass.

**(b) Draw a graph between displacement from mean position and time for a body executing free vibration in a vacuum.** **2**

**Ans.**



This is the required graph between the displacement from mean position and time for a body executing free vibrations in a vacuum.

**(c) A sound wave travelling in water has wavelength 0.4 m.** **2**

**Is this wave audible in air ? (The speed of sound in water= 1400 ms$^{-1}$)**

**Ans.** It is given that a sound wave is travelling in water has wavelength of 0.4 m, i.e., $\lambda = 0.4$ m

Speed of sound in water, $V = 1400$ ms$^{-1}$

∵ Velocity = wavelength × Frequency

⇒ $V = \lambda \times f$

⇒ $f = \frac{V}{\lambda} = \frac{1400}{0.4} = \frac{14000}{4} = 3500$ Hz

As we know that audible frequency ranges between 20 Hz to 20,000 Hz.

And the obtained value of frequency, i.e., 3500 Hz lies between this range, i.e., in between 20 Hz and 20,000 Hz.

So, yes this sound wave is audible in water.

**(d) Why does stone lying in the sun get heated up much more than water lying for the same duration of time ?** **2**

**Ans.** The stone lying in the sun get heated much more than water lying for the same duration of time. It is because the specific heat capacity of stone is less than that of water, due to which the temperature of stone is more.

**(e) Why is it not advisable to use a piece of copper wire as fuse wire in an electric circuit ?** **2**

**Ans.** It is not advisable to use a piece of copper wire as fuse wire in an electric circuit. It is because copper has low specific resistance and high melting point, due to which it will not break (fuse) during the overloading in the circuit.

**4. (a) Calculate the total resistance across AB :** **2**
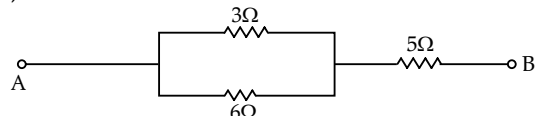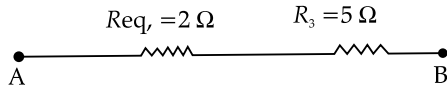


**Ans.** Consider the given diagram,
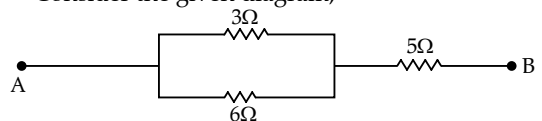


Let $R_1 = 3\Omega$

$R_2 = 6\Omega$

$R_3 = 5\Omega$

It can be seen from the figure that $R_1$ and $R_2$ are in parallel.

So, their equivalent, $Req_1 = \dfrac{R_1 R_2}{R_1 + R_2}$

$\Rightarrow \qquad Req_1 = \dfrac{3 \times 6}{3 + 6} = \dfrac{18}{9} = 2\Omega$

Now, the above given diagram can be shown as follows

$$Req_1 = 2\,\Omega \qquad R_3 = 5\,\Omega$$

A ————⌇⌇⌇———————⌇⌇⌇———— B

$\because$ $Req_1$ and $R_3$ are in series.

$\therefore$ equivalent resistance across AB will be

$R_{AB} = Req_1 + R_3 = (2 + 5)\,\Omega = 7\Omega$.

**(b) Two metallic blocks P and Q having masses in ratio 2:1 are supplied with the same amount of heat. If their temperatures rise by same degree, compare their specific heat capacities.　　2**

**Ans.** Consider a metallic block having mass '$m$', specific heat capacity 'S', gains heat energy 'Q' after rising the temperature '$\Delta T$', then the relation among them is given by,

$\because \qquad\qquad Q = mS\Delta T \qquad ...(i)$

For block A,

$\qquad\qquad$ Mass $= 2m$,

$\qquad$ Specific heat capacity $= S_P$

$\qquad\qquad$ temperature $= \Delta T$

For block B,

$\qquad\qquad$ Mass $= m$

$\qquad$ Specific heat capacity $= S_Q$

$\qquad\qquad$ temperature $= \Delta T$

As per question,

$\qquad\qquad Q_P = Q_Q \qquad ...(ii)$

$\therefore$ from eqns. (i) and (ii), we get

$\qquad 2m\, S_P\, \Delta T = m\, S_Q\, \Delta T$

$\Rightarrow \qquad\qquad 2S_P = S_Q$

$\Rightarrow \qquad\qquad \boxed{S_P = \dfrac{1}{2}S_Q}$

It means that specific heat capacity of block P is half of the capacity of block Q.

**(c) 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**
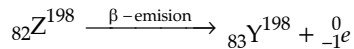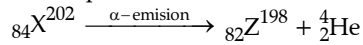
**(i) Zero**

**(ii) Maximum ?**

**Ans.** It is given that when a current carrying conductor is placed in a magnetic field, it experiences a mechanical force ($F = i\,B\,L\,\sin\theta$).

(i) So, the force experienced will be zero when the angle between the magnetic field and the length of the conductor is 0°.

(ii) And the force experienced will be maximum when the angle between the magnetic field and the length of conductor is 90°.
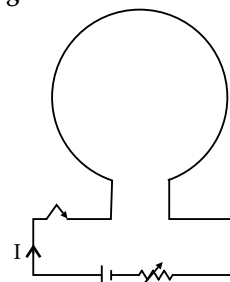
**(d) A nucleus $_{84}X^{202}$ of an element emits an alpha particle followed by a beta particle. The final nucleus is $_a Y^b$. Find $a$ and $b$.　　2**

**Ans.** According to the question, a nucleus $_{84}X^{202}$ of an element emits an alpha particle followed by a beta particle

$_{84}X^{202} \xrightarrow{\;\alpha - \text{emision}\;} {}_{82}Z^{198} + {}_2^4 He$

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

$\therefore \qquad \boxed{a = 83 \text{ and } b = 198}$

**(e) The diagram below shows a loop of wire carrying current I :　　2**



**(i) What is the magnetic polarity of the loop that faces us ?**

**(ii) With respect to the diagram how can we increase the strength of the magnetic field produced by this loop ?**

**Ans. (i)** The magnetic polarity of the loop, that faces us will be clockwise, i.e., south pole.

**(ii)** We can increase the strength of the magnetic field produced by the loop in the given diagram, by.
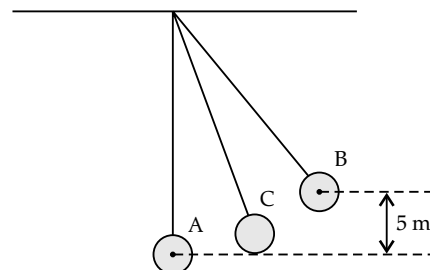
1. increasing number of turns of coil.

2. increasing the current.

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## SECTION-II　　　　　　　　　　(40 Marks)

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

**5. (a) The figure below shows a simple pendulum of mass 200 g. It is displaced from the mean position A to the extreme position B. The potential energy at the position A is zero. At the position B the pendulum bob is raised by 5 m.　　3**

**(i)** What is the potential energy of the pendulum at the position B ?

**(ii)** What is the total mechanical energy at point C ?

**(iii)** What is the speed of the bob at the position A when released from B ?

(Take g = 10 ms$^{-2}$ and there is no loss of energy.)

**Ans.** Consider the given diagram,
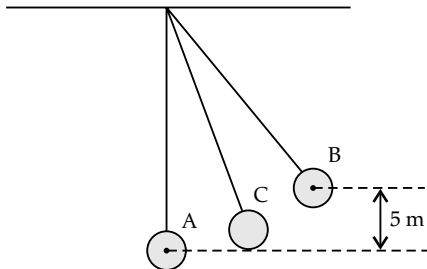


It is given that

Mas of simple pendulum, $m$ = 200g =0.2kg.
Potential energy at position A is zero, i.e., $PE_A = 0$.

**(i)** Potential energy at position PE, $PE_B = mgh$
= 0.2 × 10 × 5 = 10 J.

**(ii)** Whenever the bob of the pendulum rotates, then mechanical energy remains same at all the points according to the law of conservation of mechanical energy.
∴ Mechanical energy at point $C$ = 10 J.

**(iii)** As the bob is rotating, so the potential energy of bob at position B will get converted into kinetic energy at point A.

∵ KE at position A, $KE_A = \dfrac{1}{2} mv^2$

⇒ $10 = \dfrac{1}{2} \times 0.2 \times v^2$

⇒ $100 = v^2$

⇒ $\boxed{v = 10 \, \text{ms}^{-1}}$

**(b)** **(i)** With reference to the direction of action, how does a centripetal force differ from a centrifugal force during uniform circular motion ? **3**

**(ii)** Is centrifugal force the force of reaction of centripetal force ?

**(iii)** Compare the magnitudes of centripetal and centrifugal force. **3**

**Ans. (i)** With reference to the direction of motion, both centrifugal force and centripetal force acts in opposite direction. Centripetal force acts towards the centre while centrifugal force acts radially outwards.

**(ii)** No, the centrifugal force is not the force of reaction at centripetal force. It is because the action-reaction pair of forces acts on two bodies,, but here it is acting on a single body.

**(iii)** The magnitudes of centripetal and centrifugal force are equal.

**(c)** A block and tackle system of pulleys has velocity ratio 4. **4**

**(i)** Draw a neat labelled diagram of the system indicating clearly the points of application and direction of load and effort.

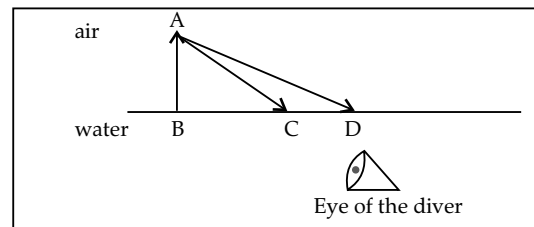**(ii)** What will be its V.R. if the weight of the movable block is doubled ?

**Ans. (i)**
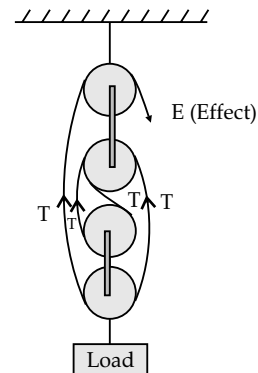


So, this is the required diagram.

**(ii)** ∴ Velocity ratio is always equals to $n$.

So, if the weight of movable block is doubled, then its mechanical advantage will get effected but the velocity ratio will remain constant.

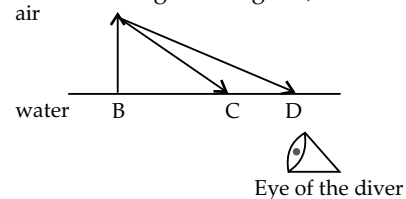**6. (a)** A diver in water looks obliquely at an object AB in air. **3**



**(i)** Does the object appear taller, shorter or of the same size to the diver ?

**(ii)** Show the path of two rays AC and AD starting from the tip of the object as it travels towards the diver in water and hence obtain the image of the object.
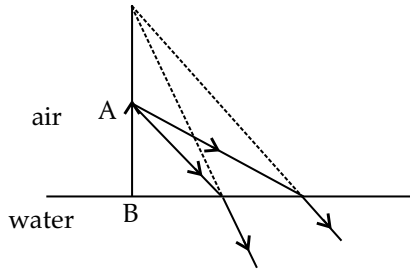
**Ans.** Consider the given diagram,



**(i) and (ii)**

As we know that when a ray of light enters from air to water, i.e., from rarer to denser medium, it bends toward the normal. So, the above diagram will become as follows :
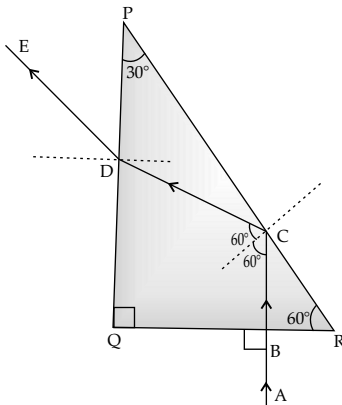
air A

water B

 Eye of the Diver

Hence, from the above diagram, it can be said that the object will appear taller.

**(b) Complete the path of the ray AB through the glass prism in PQR till it emerges out of the prism. Given the critical angle of the glass as 42°.** 3

P

30°

Q B R

A

**Ans.**

P

E

30°

D

60° C
60°

60°

Q B R

A
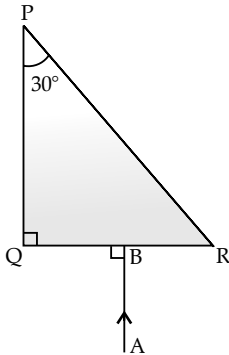
**(c) A lens of focal length 20 cm forms an inverted image at a distance 60 cm from the lens.** 4

**(i) Identify the lens.**

**(ii) How far is the lens present in front of the object' ?**

**(iii) Calculate the magnification of the image.**

**Ans. (i)** As per the information given in the question, we can conclude that the given lens is a convex lens because the formed image is inverted.

**(ii)** Given, $f = 20$ cm

$v = 60$ cm

According to lens formula,

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

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

$\Rightarrow$ $$\frac{1}{u} = \frac{1}{60} - \frac{1}{20}$$

$\Rightarrow$ $$\frac{1}{u} = \frac{-2}{60}$$

$\Rightarrow$ $\boxed{u = -30\,\text{cm}}$

**(iii)** Magnification, $m = \dfrac{v}{u} = \dfrac{60}{-30} = -2$

**7. (a) Give reasons for the following :** 3
**During the day :**
**(i) Clouds appear white.**
**(ii) Sky appears blue.**

**Ans. (i)** As clouds scatter all the colours of sunlight (i.e., VIBGYOR scatter) in the sky during the day, therefore, due to this reason, the clouds appear white.

**(ii)** Sky appears blue because when the light enters from the sun into the sky, the air layers scatter only blue part of light more than any other colour.

**(b) (i) Name the system which enables us to locate underwater objects by transmitting ultrasonic waves and detecting the reflecting impulse.** 3

**(ii) What are acoustically measurable quantities related to pitch and loudness ?**

**Ans. (i)** SONAR, i.e., Sound Navigation and Ranging is a system which enables us to locate underwater objects by transmitting ultrasonic waves and detecting the reflecting impulse.

**(ii)** Frequency and Amplitude are respectively measurable quantities related to pitch and loudness.

**(c) (i) When a tuning fork [vibrating] is held close to ear, one hears a faint hum. The same [vibrating tuning fork] is held such that its stem is in contact with the table surface, then one hears a loud sound. Explain.** 4

**(ii) A man standing in front of a vertical cliff fires a gun. He hears the echo after 3.5 seconds. On moving closer to the cliff by 84 m, he hears the echo after 3 seconds. Calculate the distance of the cliff from the initial position of the man.**

**Ans. (i)** When a tuning fork is held close to ear, it has some sound energy. But when it is held such that its stem is in contact with the table surface, then due to the larger surface area of table top, it produces more vibrations with greater sound energy.

**(ii)** Let the man is standing infront of cliff at a distance of $d$ cm from the cliff.

So, when he moves closer (after hearing echo) to the cliff by 84 m, then the distance will be $(d – 84)$ cm.

∵ we know that

$$V = \frac{2d}{t}$$

Since, velocity will remain same in both cases, therefore,
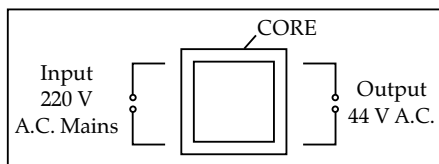
$$\frac{2d}{t_1} = \frac{2(d-84)}{t_2}$$

$$\{\because t_1 = 3.5\ s\ \ t_2 = 3\ s\}$$

$$\Rightarrow \quad \frac{2d}{3.5} = \frac{2(d-84)}{3}$$

$$\frac{2d}{7} = \frac{d-84}{3} \Rightarrow 6d = 7d - 588$$

$$\Rightarrow \quad \boxed{d = 588\ m}.$$

**8. (a)** The diagram below shows the core of a transformer and its input and output connections. **3**

**(i)** State the material used for the core.

**(ii)** Copy and complete the diagram of the transformer by drawing input and output coils.

**Ans. (i)** Soft iron core are made of thin laminated sheets which are eight (8) T or U shaped.

**(ii)** Since the input voltage is greater than the output voltage, therefore, the given transformer is a step-down transformer. So, the given diagram will become as follows :
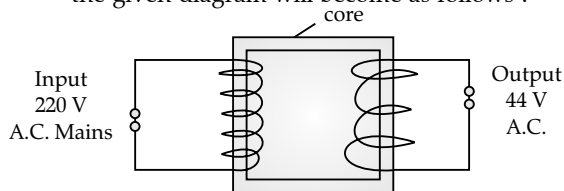
**(b) (i)** What are superconductors ? **3**

**(ii)** Calculate the current drawn by an appliance rated 110 W, 220 V when connected across 220 V supply.

**(iii)** Name a substance whose resistance decreases with the increase in temperature.

**Ans. (i)** The substances which have almost zero resistance at low temperatures, are called superconductors.

**(ii)** Current drawn by the appliance,

$$I = \frac{Power}{Voltage}$$

$$\Rightarrow \qquad I = \frac{P}{V}$$

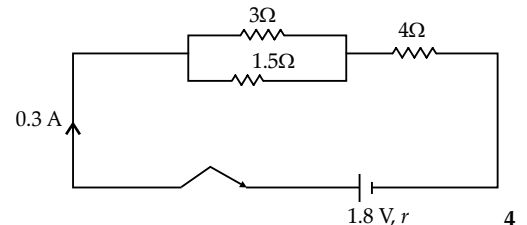$$\Rightarrow \qquad I = \frac{110\,W}{220\,V} = \frac{1}{2}\,A = 0.5\ A.$$

$$\Rightarrow \qquad \boxed{I = 0.5\ A}$$

**(iii)** We know that semiconductor's resistance decreases with the increase in temperature.
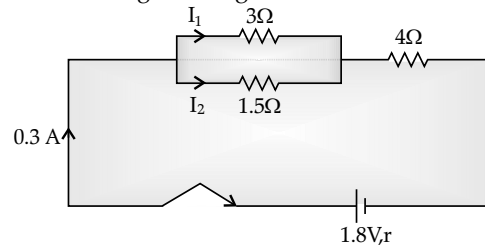
**For examples :** Silicon, Graphite, etc.

**(c)**

The diagram above shows three resistors connected across a cell of e.m.f.

**1.8 V and internal resistance $r$. Calculate :**

**(i)** Current through 3 Ω resistor.

**(ii)** The internal resistance $r$.

**Ans.** Consider the given diagram.

**(i)** Since, 3Ω and 1.5Ω resistor are in parallel combination. Therefore the potential difference across them will remain same.

Let $I_1$ be the current passing through 3Ω resistor and $I_2$ be the current passing through 1.5Ω resistor.

$$\Rightarrow V = 3\,I_1 \text{ and } V = 1.5\,I_2 \qquad \{\because V = IR\}$$

∵ potential difference across them is same,

$$\therefore \qquad 3I_1 = 1.5\,I_2$$

$$\Rightarrow \qquad I_1 = 0.5\,I_2$$

$$\Rightarrow \qquad I_1 = \frac{I_2}{2} \Rightarrow I_2 = 2I_1 \qquad \text{...(i)}$$

$$\because \quad I_1 + I_2 = I \qquad \{\because I = 0.3\ A\}$$

$$\Rightarrow I_1 + I_2 = 0.3 \qquad \text{...(ii)}$$

From eqns. (i) and (ii), we get

$$\Rightarrow I_1 + 2I_1 = 0.3$$

$$\Rightarrow \quad 3I_1 = 0.3$$

$$\Rightarrow \qquad I_1 = 0.1\ A \text{ and } I_2 = 2 \times 0.1 = 0.2\ A$$

$$\Rightarrow \qquad I_1 = 0.1\ A \text{ and } I_2 = 0.2\ A.$$

So, the current through 3Ω resistor will be, $I_1 = 0.1\ A$.

**(ii)** ∵ 3Ω and 1.5Ω resistors are in parallel combination,

$$\therefore \quad Req_1 = \frac{3 \times 1.5}{3 + 1.5} = \frac{4.5}{4.5} = 1Ω$$

Now, $Req_1$ and $4\Omega$ are in series combination, therefore, their equivalent resistance,

$$Req_2 = (1 + 4)\Omega = 5\Omega$$

$\therefore$ Total resistance, $R_{tot} = Req_2 +$ Internal resistance

$$\therefore \quad R_{tot} = (5 + r)\,\Omega \qquad \text{...(iii)}$$

$$\because \quad R_{tot} = \frac{V}{I} = \frac{1.8}{0.3} = 6\Omega \qquad \text{...(iv)}$$

$\therefore$ from equn (iii) and (iv), we get

$$5 + r = 6 \Rightarrow r = 6 - 5 = 1$$

$$\Rightarrow \quad \boxed{r = 1\Omega}$$

**9. (a) (i) Define heat capacity of a substance.** **3**

**(ii) Write the SI unit of heat capacity.**

**(iii) What is the relationship between heat capacity and specific heat capacity of a substance ?**

**Ans. (i)** The amount of heat which is to be supplied to a given mass of a material to produce a unit change in its temperature, is known as heat capacity.

**(ii)** The SI unit of heat capacity is joule per kelvin.

**(iii)** $\because$ Heat capacity = mass × specific heat capacity.

$$\Rightarrow \quad \boxed{C = mS}$$

So, this is the required relationship between heat capacity and specific heat capacity of a substance.

**(b) The diagram below shows the change of phases of a substance on a temperature vs time graph on heating the substance at a constant rate.** **3**

**(i) Why is the slope of CD less than slope of AB?**

**(ii) What is the boiling and melting point of the substance ?**
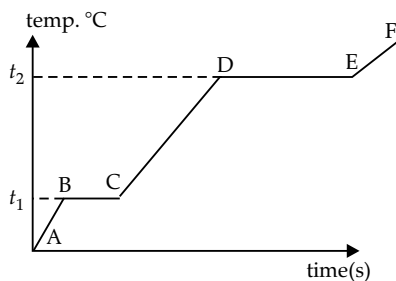


**Ans. (i)** In the given graph, AB represents the specific heat of solid phase and CD represents the specific heat of Liquid phase. Since, the specific heat of solid phase is always greater than that of liquid phase. So, due to this reason, the slope of CD is less than that of AB.

**(ii)** $t_2$ is the boiling point because, here solid is changing into liquid and $t_1$ is the melting point because, here liquid is changing into gas.

**(c) A piece of ice of mass 60 g is dropped into 140 g of water at 50°C. Calculate the final temperature of water when all the ice has melted.** **4**
**(Assume no heat is lost to the surrounding)**
**Specific heat capacity of water = 4.2 Jg⁻¹k⁻¹**
**Specific latent heat of fusion of ice = 336 Jg⁻¹**

**Ans.** For Ice,

$$\text{Mass} = 60\text{ g}$$
$$\text{Temperature} = 0°C$$

For water,

$$\text{Mass} = 140\text{g}$$
$$\text{Temperature} = 50°\text{ C.}$$

Let T be the final temperature of water. Now, apply Principle of Calorimetry,

$$\Rightarrow 60 \times 336 + 60 \times 4.2 \times T = 140 \times 4.2\,(50 - T)$$
$$\Rightarrow \quad 60 \times 336 = 4.2\,[140 \times 50 - 140T - 60T]$$
$$\Rightarrow \quad \frac{60 \times 336}{4.2} = 7000 - 200\,T$$
$$\Rightarrow \frac{60 \times 336 \times 10}{42} = 7000 - 200\,T$$
$$\Rightarrow \quad 4800 = 7000 - 200T$$
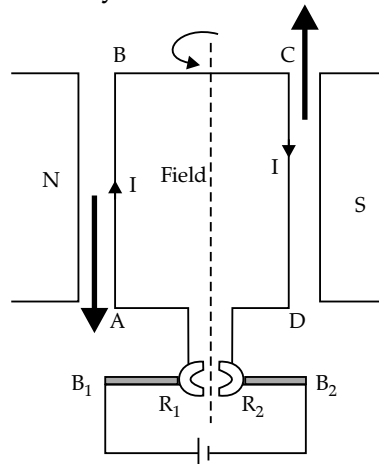$$\Rightarrow \quad 200\,T = 7000 - 4800$$
$$\Rightarrow \quad 200\,T = 2200$$
$$\Rightarrow \quad T = \frac{2200}{200}$$
$$\Rightarrow \quad \boxed{T = 11°C}\ .$$

**10. (a) (i) Draw a neat labelled diagram of a d.c. motor.** **3**

**(ii) Write any one use of a d.c. motor.**

**Ans.** **(i)**



**(ii)** D.C. motor is used to convert electrical energy into mechanical energy, such as in electric fan etc.

**(b) (i) Differentiate between nuclear fusion and nuclear fission.** **3**

**(ii) State one safety precaution in the disposal of nuclear waste.**

**Ans.** **(i)**

| | Nuclear Fusion | Nuclear Fission |
|---|---|---|
| **1.** | In this, smaller nuclei combines to form a larger one. | In this, a heavier nuclei breaks into the smaller nuclei. |
| **2.** | Takes place at high temperature | Takes place at very very high temperature |

**(ii)** The solid radioactive waste should be sealed in red bag and placed in a cardboard radioactive waste box.

**(c)** **An atomic nucleus A is composed of 84 protons and 128 neutrons. The nucleus. A emits an alpha particle and is transformed into a nucleus B.** **4**

**(i)** **What is the composition of B ?**

**(ii)** **The nucleus B emits a beta particle and is transformed into a nucleus C.**
**What is the composition of C ?**
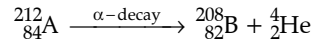
**(iii)** **What is mass number of the nucleus A ?**

**(iv)** **Does the composition of C change if it emits gamma radiations ?**

**Ans.** Nucleus A is composed of 84 protons and 128 neutrons.

∵ Mass number = Number of protons
+ number of neutrons
= 84 + 128
= 212

∴ The composition of nucleus A will be $^{212}_{84}A$

**(i)** Since, nucleus A emits an α-particle, i.e.,

$$^{212}_{84}A \xrightarrow{\alpha-decay} {}^{208}_{82}B + {}^{4}_{2}He$$

∴ The composition of nucleus B will be $^{208}_{82}B$

**(ii)** Since, nucleus B emits a β-particle, i.e.,

$$^{208}_{82}B \xrightarrow{\beta-decay} {}^{208}_{83}C + {}^{0}_{-1}e$$
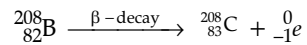
∴ The composition of nucleus C will be $^{208}_{83}C$.

**(iii)** The mass number of the nucleus A is 212.

**(iv)** If the nucleus C emits gamma radiations, then there will be no change in its composition.

❑❑❑