ICSE 2025 EXAMINATION

Sample Question Paper - 10

Physics

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

General Instructions:

1. *Attempt **all** questions from **Section A** and **any three** questions from **Section B**.*
2. *The intended marks of questions or parts of questions are given in brackets [ ].*

SECTION A

*(Attempt **all** questions)*

Question 1

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

i) If the velocity of a moving car is halved, its kinetic energy would
   (a) Remain same
   (b) Double
   (c) Become Half
   (d) Become one-fourth

ii) Choose the incorrect statement among the following related to friction.
   (a) It is difficult to run on sand as the force of friction is small.
   (b) Friction is necessary in everyday life.
   (c) Friction causes wear and tear of the moving machinery parts.
   (d) The co-efficient of friction increases on increasing the area of contact.

iii) A prism is said to be in minimum deviation when
   (a) Angle of incidence > Angle of emergence
   (b) Angle of incidence < Angle of emergence
   (c) Angle of incidence = Angle of emergence
   (d) Angle of incidence = 0°

iv) The SI unit of current is:
   (a) coulomb
   (b) ampere
   (c) watt
   (d) pascal

v) **Assertion (A)**: Crowbar is a class I lever.
Reason (R): For Class I levers, the fulcrum and the lever are at two ends and load is somewhere in between effort and fulcrum.
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) Assertion is false but reason is true
(d) Assertion is true reason is false

vi) A real object is placed in front of a concave lens of focal length 'f' at its principal focus. Then the image is formed at:
(a) optical centre
(b) infinity
(c) at a distance 2f
(d) at a distance f/2

vii) The sun can be seen before the actual sunrise by about
(a) 4 minutes
(b) 1 minute
(c) 20 minutes
(d) 2 minutes

viii) We should not use earphones continuously because
(a) The music becomes boring
(b) Continuous exposure leads to hearing impairment
(c) Earphones would be damaged
(d) Music player cannot support

ix) Specific heat capacity of substance X is 1900 $Jkg^{-1}°C^{-1}$ means:
(a) Substance X absorbs 1900 J for 1°C rise in temperature
(b) 1 kg of substance X absorbs 1900 J heat for 1°C rise in temperature
(c) 1 kg of substance X absorbs 1900 J heat to increase the temperature
(d) 1 kg of substance X absorbs 1900 J heat to cool down by 1°C

x) It is due to which property of a body that it tends to remain in the position of rest?
(a) Momentum
(b) Inertia of rest
(c) Inertia of motion
(d) Its mass

xi) Plants are protected from wilting during summer due to:
(a) high specific latent heat of vaporization of water
(b) low specific latent heat of vaporization of water
(c) high specific heat capacity of water
(d) low specific heat capacity of water

xii) Find x in the following nuclear reaction.

$_1H^2 + _1H^2 \rightarrow _2He^3 + x + 3.3$ MeV

(a) Meson
(b) Neutron
(c) Positron
(d) Electron

xiii) The direction of induced current is obtained by

(a) Fleming's left-hand rule
(b) Right-hand thumb rule
(c) Left-hand thumb rule
(d) Fleming's right-hand rule

xiv) The lens which is used to correct myopia (shortsightedness) is

(a) Both convex and concave
(b) Concave lens
(c) Converging lens
(d) Convex Lens

xv) How much work is done, when 1 coulomb of charge moves against a potential difference of 1 volt?

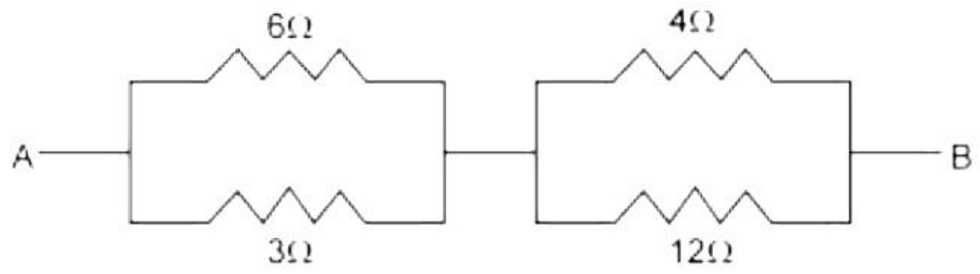
(a) 1 joule
(b) 2 joules
(c) 0.5 joule
(d) 1.5 joule

Question 2

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

(a) The basic principle of a nuclear bomb is based on _____ [controlled/uncontrolled] reaction.
(b) A concave lens is also known as a _____ [converging/diverging/flat] lens.
(c) In a _____ [series/parallel] combination of resistor, current has a single path for its flow.
(d) The point through which the resultant of the weights of all the particles of the body acts is called the _____ [centre of gravity/ centre of mass/gravitational equilibrium].
(e) The uniform linear motion is an _____ [unaccelerated/ accelerated] motion, while a uniform circular motion is an _____ [unaccelerated/accelerated] motion.

ii) Find the equivalent resistance between A and B. [2]



iii) [2]

(a) How will the image formed by a convex lens be affected if the central portion of the lens is wrapped by a black paper as shown in the diagram given below?

(b) When does a ray of light neither refract nor deviate while passing through a glass block?

Question 3

i) Answer the following questions. [3]

(a) State Snell's law of refraction of light.

(b) Name a single pulley in which displacement of load and effort is not the same.

(c) State one advantage of this pulley.

ii) Distinguish between a real image and a virtual image. [2]

iii) Name the part of the spectrum which extends to both sides of the visible spectrum. Give one application of each of these radiations. [2]

iv) Why does the loudness of the sound heard by a plucked wire increase when it is mounted on a board? [2]

v) An electric bulb is rated 500 W, 240 V. What information does this convey? [2]

vi) What is the effect of neutron to-proton ratio $\left(\frac{n}{p}\right)$ in a nucleus when [2]

(a) An electron is emitted?

(b) A positron is emitted?

vii) Sound waves travel with a speed of about 330 m/s. [2]

(a) What is the wavelength of sound whose frequency is 550 Hz?

(b) What will be the wavelength of sound if its frequency is doubled, as mentioned in the previous case?

Section B

Attempt *any four* questions from this section

Question 4

(i) [3]

(a) When do we apply Fleming's right-hand rule?

(b) State Fleming's right-hand rule.

(c) How does the magnetic field due to a current-carrying conductor vary with the amount of current flowing through the conductor?

(ii) Calculate the heat energy released when 5.0 kg of steam is converted to water at 100°C. Express your answer in SI units (Specific latent heat of vaporisation of steam is 2268 kJ/kg). [3]

(iii) [4]

(a) How many alpha and beta particles are emitted when the Uranium nucleus $^{238}_{92}U$ decays to Lead $^{206}_{82}Pb$?

(b) State two factors on which the rate of emission of electrons from a heated surface depends.

(c) State the energy change that occurs when a magnet is moved inside a coil with a galvanometer at its ends. Name this phenomenon.

Question 5

(i) [3]

(a) State the law of conservation of energy.

(b) Name the chief energy transformation that occurs

(1) In a loudspeaker

(2) In an electrical cell (primary).

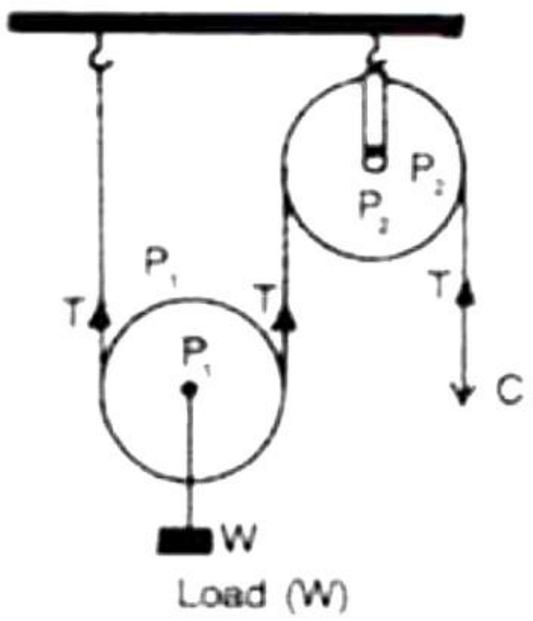
(ii) [3]

a. Define a simple machine.

b. State the basic principle of a simple machine.

c. Can a simple machine act as a force multiplier and a speed multiplier at the same time?

(iii) The figure shows the combination of a movable pulley P_1 with a fixed P_2 used for lifting a load W. [4]



(a) State the function of the fixed pulley P_2.

(b) If the string's free end moves through a distance x, find the distance by which the load W is raised.

(c) Calculate the force that must be applied at C to raise the load W = 20 kgf, neglecting the weight of the pulley P_1 and air friction.

Question 6

(i)

(a) A glass slab is placed over a page on which the word VIBGYOR is printed, with each letter corresponding to its colour. [3]

1. Will the image of all the letters be in the same place?
2. If not, state which letter will be raised to the maximum. Give reasons to support your answer.

(ii) [3]

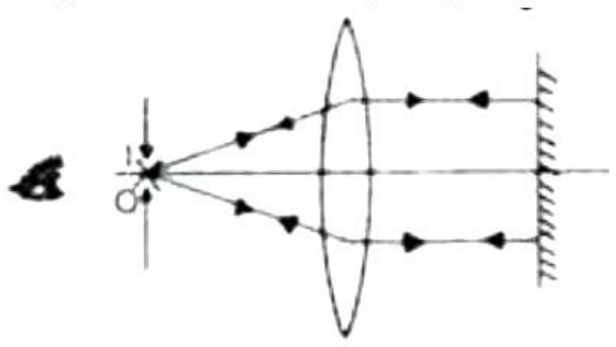
(a) What is meant by refraction?

(b) Express the refractive index μ of a medium.

1. In terms of the velocity of light
2. In terms of the angle of incidence i in the air and the angle of refraction r in a denser medium.

(c) If a ray of light passes from medium I to medium II without any change in direction, what can be said about the refractive indices of these media (angle i is not 0°)?

(iii) The ray diagram below illustrates the experimental setup for determining the focal length of a converging lens using a plane mirror. [4]



(a) State the magnification of the image formed.
(b) Write two characteristics of the image formed.
(c) What is the name given to the distance between the object and the optical centre of the lens in the diagram?
(d) Which lens has greater power, a convex lens with a focal length of 20 cm or a concave lens with a focal length of 30 cm?

Question 7

(i) Water falls from a height of 50 m. Calculate the rise in temperature of water when it strikes the bottom. g = 10 ms^{-2}, specific heat capacity of water = 4200 $Jkg^{-1}°C^{-1}$. [3]

(ii) [3]
(a) What is the difference between kW and kWh?
(b) Prove that 1 kWh = 3.6 MJ.
(c) What is the practical unit of power?

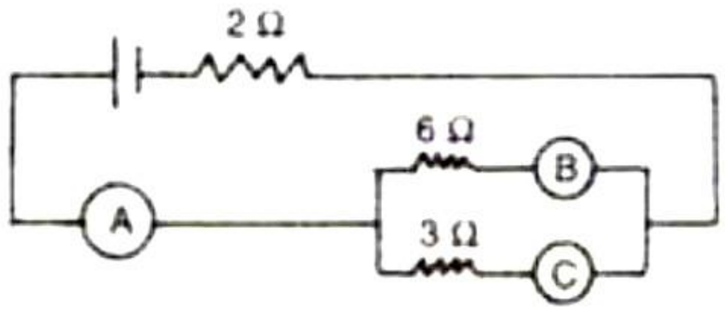
(iii)
(a) What is the difference between echo and reverberation? [4]
(b) Calculate the minimum distance between the object and the source at which the echo can be distinctly heard.
(c) Can sound be clearly heard on the surface of the moon?

Question 8

(i) An electrical appliance is rated 1500 W, 250 V. This appliance is connected to 250 V mains. Calculate: [3]
(a) Current drawn
(b) Electrical energy consumed in 6 hours
(c) Cost of electrical energy at Rs 2.50 per kWh

(ii) [3]
(a) How can you prepare an electromagnet?
(b) What do you mean by electromagnetic induction? What is the necessary condition for electromagnetic induction?

(iii) In the following figure, A, B and C are three ammeters. Ammeter B reads 0.5 A. (All the ammeters have negligible resistance.) [4]

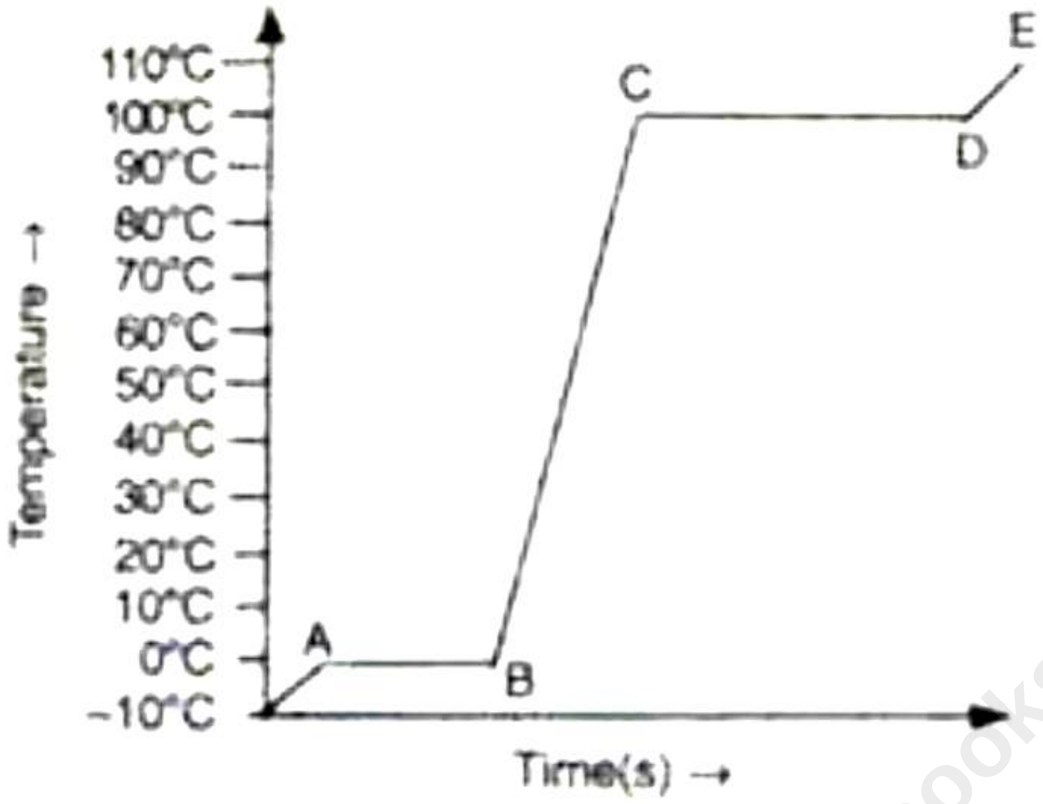


Calculate:
(a) Readings in ammeters A and C
(b) Total resistance of the circuit

Question 9

(i) A radar is able to detect the reflected waves from an enemy's aeroplane after a time interval of 0.02 ms. If the velocity of the wave is 3×10^8 ms^{-1}, calculate the distance of the plane from the radar. [3]

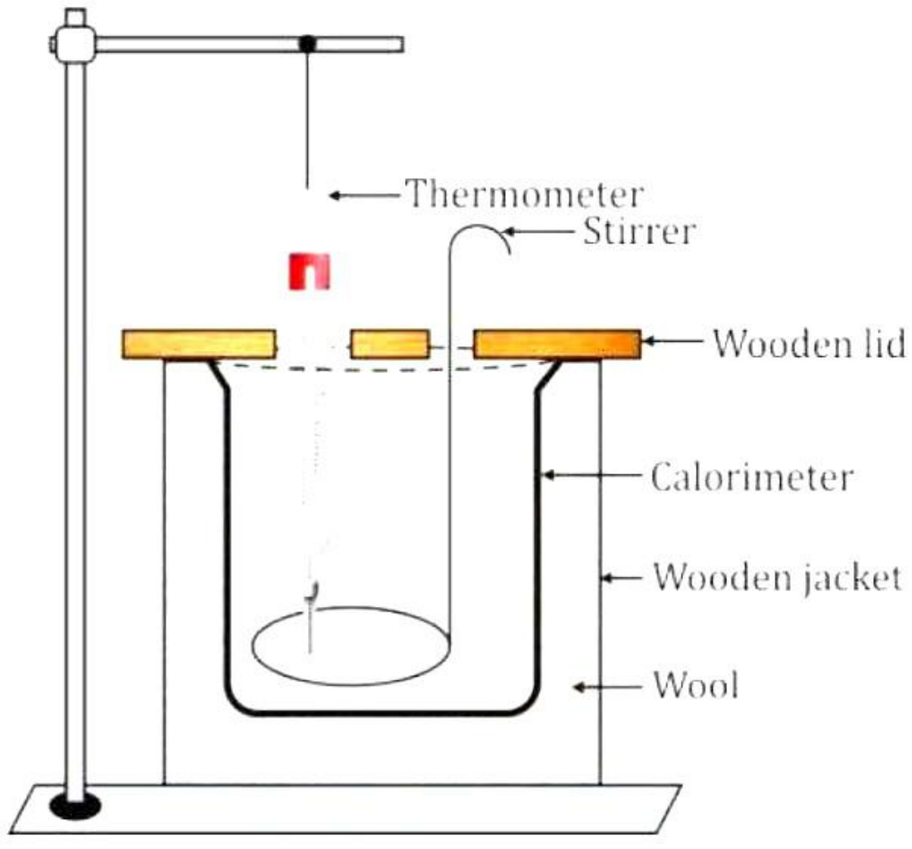
(ii) A piece of ice is heated at a constant rate. The variation of temperature with the heat input is shown in the graph given below: [3]



a. What is represented by AB and CD?

b. What conclusion can you draw regarding the nature of ice from the above graph?

(iii) Priya had a calorimeter filled with water at room temperature (27° C) and an iron ball weighing 0.1 kg. [4]



Answer the following questions based on the given information.

[Consider: Specific heat capacity of water = 4200 J/kg K]

(a) State the working principle of calorimetry and also provide the mathematical expression for the same.

(b) What would be the specific heat capacity of the iron ball if Priya placed it inside a calorimeter and observed that 5000 J of heat energy is required to raise the temperature by 10° C?

(c) Find the heat energy required to raise the temperature of 1 kg of water from 27° C to 57°.

(d) When an iron ball is heated to 400 K and dropped in a calorimeter of mass 0.5 kg filled with 1 kg water at temperature 300 K. After stirring the water, what will the thermometer record the final temperature?

Solution

SECTION A

Solution 1

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

i) Correct answer – d: Become one-fourth
Kinetic Energy = (1/2) mv^2. This implies that the kinetic energy is directly proportional to velocity squared. If the velocity of a body is halved then its kinetic energy becomes one-fourth.

ii) Correct answer – a: It is difficult to run on sand as the force of friction is small.
It is difficult to run on sand as the force of friction is large.

iii) Correct answer – c: Angle of incidence = Angle of emergence
When the angle of incidence is equal to the angle of emergence then the prism is said to be in minimum deviation.

iv) Correct answer – b: ampere
The SI unit of current is ampere. It is denoted as A.

v) Correct answer – d: Assertion is true reason is false
For class I levers, fulcrum is in between the effort and the load.

vi) Correct answer – d: f/2
By drawing a ray diagram, it will be clear that the image will be formed at a distance f/2 from the concave lens when the object is placed at its principal focus.

vii) Correct answer – d: 2 minutes.
The sun can be seen before the actual sunrise by about 2 minutes.

viii) Correct answer – b: Continuous exposure leads to hearing impairment
Continuous exposure to tolerable levels can cause hearing impairment due to constant stress on ear drums.

ix) Correct answer – b: 1 kg of substance X absorbs 1900 J heat for 1°C rise in temperature.
Specific heat capacity of substance X is 1900 $Jkg\text{-}1°C^{-1}$ means that 1 kg of substance X absorbs 1900 J of heat for a 1°C rise in temperature, as specific heat capacity is the amount of heat energy required to raise the temperature of 1 kg of a substance by 1°C.

x) Correct answer – b: Inertia of rest
A body will tend to remain in the position of rest due to its inertia of rest.

xi) Correct answer – a: high specific latent heat of vaporization of water
Plants are protected from wilting during summer due to high specific latent heat of vaporization of water (2260000 J/kg); water from the soil does not evaporate quickly by the heat of the sun. As a result, plants are protected from wilting in the sun during summer.

xii) Correct answer – b: Neutron
When two deuterium nuclei ${}_1H^2$ fuse, nucleus of helium isotope ${}_2He^3$ is formed and 3·3 MeV energy is released.

xiii) Correct answer – d: Fleming's right-hand rule
Fleming's right-hand rule gives the direction of induced current in a conductor moving in a magnetic field.

xiv) Correct answer – b: concave lens
Myopic person is not able to see distant objects clearly. As the concave lens is a diverging lens, it diverges the coming rays to meet them on retina. Thus, it is used for a myopic eye.

xv) Correct answer – a: 1 J

$$V = \frac{W}{Q}$$

$$\rightarrow 1V = \frac{W}{1\,Q}$$

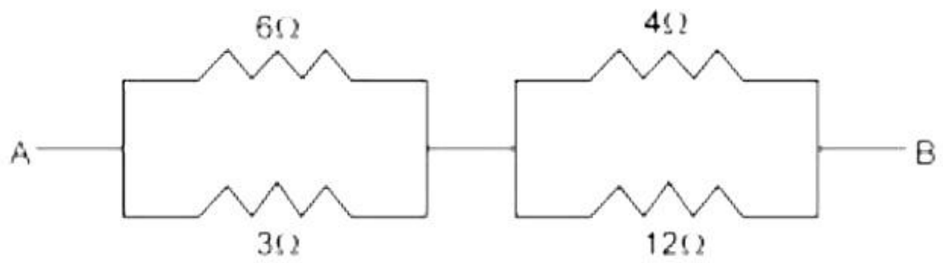
$$\rightarrow \therefore W = 1\ J$$

Solution 2

i)

(a) The basic principle of a nuclear bomb is based on uncontrolled reaction.
(b) A concave lens is also known as a **converging** lens.
(c) In a **series** combination of resistor, current has a single path for its flow.
(d) The point through which the resultant of the weights of all the particles of the body acts is called the **centre of gravity.**
(e) The uniform linear motion is an **unaccelerated** motion, while an uniform circular motion is an **accelerated** motion.

ii)



Effective resistance of a parallel combination of 6 Ω and 3 Ω resistors are given by

$$R_1 = \frac{6 \times 3}{6 + 3} = 2\,\Omega$$

Effective resistance of a parallel combination of 4 Ω and 12 Ω resistors is given by

$$R_2 = \frac{4 \times 12}{4 + 12} = 3\,\Omega$$

Equivalent resistance between A and B = 2 Ω + 3 Ω = 5 Ω

iii)

(a) If the central portion of the convex lens is wrapped by a black paper, then there will be no effect on the image formed.

(b) A ray of light does not refract or deviate when the refractive index of the block remains the same as that outside it or when the ray strikes normal to the surface of the glass block.

Solution 3

i)

(a) The ratio of the sine of the angle of incidence I to the sine of the angle of refraction is constant for the pair of given media.

i.e., $\frac{\sin i}{\sin r} = constant$

(b) A single movable pulley is another example of a pulley in which the load displacement and effort are not the same. The effort is applied in one direction while the load moves in the same direction in a single movable pulley. The displacement of the load, on the other hand, is twice that of the displacement of the effort. This means that the load moves twice as far as the effort for a given amount of effort.

(c) The mechanical advantage of a movable pulley exceeds one. Thus, the load can be lifted using a single movable pulley with an effort equal to half the load (in an ideal situation), i.e., the single movable pulley acts as a force multiplier.

ii)

Real image	Virtual image
1. A real image is formed due to actual intersection of the refracted (or reflected) rays. 2. A real image can be obtained on a screen. 3. A real image is inverted with respect to the object. 4. Example - The image of the distant object formed by a convex lens.	1. A virtual image is formed when the refracted (or reflected) rays meet if they are produced backwards. 2. A virtual image cannot be obtained on a screen. 3. A virtual image is erect with respect to the object. 4. Example - The image of an object formed by a concave lens.

iii) Ultraviolet Spectrum and Infra-red Spectrum

Application:

Ultraviolet – It is used to sterilize water.

Infra-red - It is used for photography at night or when it is misty and foggy.

iv) A vibrating string having a small surface area does not produce much sound and transfers very little of its vibrational energy into the air and therefore, produces only a feeble sound. If vibrations are transferred to a larger surface, such as a board, the air will be disturbed more effectively and a louder sound will therefore, be produced.

v) This means that the power of the bulb is 500 watt and its potential is 240 volts.

$P = 500\ W,\ V = 240\ V$

$P = V^2 / R$

$R = V^2 / P = (240)^2 / 500 = 115.2\ \Omega$

$R = 115.2\ \Omega$

$V = IR$

$I = V / R = 240 / 115.2 = 2.08\ A$

Thus, the current in the bulb is 2.08 Ampere and the resistance of the bulb is 115.2 Ω.

vi)

(a) When an electron is emitted from a nucleus, there will be no change in the n/p ratio

(b) When a positron is emitted, the ratio increases (number of protons decreases).

vii)

(a)

$\nu = 330\text{m/s}$

$f = 550\text{Hz}$

$\lambda = ?$

$\nu = f \times \lambda$

$330 = 550 \times \lambda$

$\lambda = 0.6\text{m}$

(b) Because sound travels faster in solid.

Section B

Attempt *any four* questions from this section.

Solution 4

(i)

(a) Fleming's right-hand rule is used for finding the direction of induced current in a coil/wire rotated in a magnetic field.

(b) Fleming's right-hand rule states that if the first three fingers of the right hand are stretched mutually perpendicular to each other such that the forefinger points in the direction of the magnetic field, the thumb indicating the direction of its motion, then the middle finger would show the direction of induced current.

(c) On increasing the current in the conductor, the magnetic field produced also increases.

(ii) Given,

Mass of steam m = 5 kg

Temperature of steam = 100°C

Temperature of water = 100°C

Specific latent heat of vaporisation of steam, L = 2268 kJ/kg

Heat energy released is H = mL = 5 × 2268 = 11340 kJ

(iii)

(a) Let x = no. of α decays and y = no. of β decays.

During alpha decay, the product nucleus has mass no. 4 less and atomic no. 2 less than that of the parent nucleus. The mass number remains constant during beta decay, but the atomic no. Increases by 1.

$206 = 238 - 4x$ .....(i)

And $82 = 92 - 2x + y$ .....(ii)

From equation (i), we have

$4x = 238 - 206$

$\therefore x = 8$

Putting this value of x in equation (ii), we get

$82 = 92 - (2 \times 8) + y$

$\therefore y = 6$

∴ No. of alpha particles emitted = 8

No. of beta particles emitted = 6

(b) The rate of emission of electrons from a heated surface depends on

- Nature of the metal surface
- Temperature of the surface

(c) Mechanical energy is converted to electrical energy when a magnet is moved inside a coil. The phenomenon is 'electromagnetic induction'.

Solution 5

(i)

(a) The law of conservation of energy states that energy cannot be created or destroyed; the sum total of energy in a closed system remains unchanged, and energy only changes from one form to another.

(b)

(1) Electrical energy to sound energy

(2) Chemical energy to electrical energy

(ii)

(a) A machine is a device which acts as a force multiplier or a speed multiplier, allowing us to apply effort at a more convenient point in an easier direction.

(b) A simple machine works on the principle of the law of conservation of energy of a system, i.e., energy can neither be created nor be destroyed. It implies that for a perfect or ideal machine, work done on the machine, i.e., input, is equal to the work done by the machine, i.e., output.

(c) No, this is not possible. Machines which are force multipliers do not gain in speed, and machines which increase speed cannot multiply force.

(iii)

(a) The function of the fixed pulley P_2 is to change the direction of the application of effort to a convenient direction, i.e. downwards.

(b) If the free end of the string moves through the distance x, then the load W will rise by a distance of x/2.

(c) Let the force to be applied at C be equal to 'E'.
Given, load W = 20 kgf
In equilibrium, W = 2T and E = T

$$\therefore \text{Effort needed, } E = \frac{W}{2} = \frac{20\text{kgf}}{2} = 10 \text{ kgf}$$

Solution 6

(i)

(a)

(1) The image of all the letters will not be in the same place.

(2) The letter of violet colour (i.e. V) appears to be raised by the maximum amount, while the letter of red colour (i.e. R) appears to be raised by the minimum amount. Since

$$\text{apparent depth} = \frac{\text{real depth}}{\text{refractive index}}$$

and refractive index of glass is maximum for violet light and minimum for red light; therefore, the apparent depth is least for violet and most for red.

(ii)

(a) Refraction is the bending of light at the surface of separation, which occurs when it passes from one optical medium to another with different optical densities.

(b) (1) Refractive index, $\mu = \frac{\text{Speed of light in vacuum or air (c)}}{\text{Speed of light in that medium (v)}}$

(2) Refractive index, $\mu = \frac{\sin i}{\sin r}$

(c) The refractive index of medium I is the same as that of medium II.

(iii)

(a) Magnification = 1

(b) Characteristics of the image formed: Inverted and real

(c) The focal length of the lens

(d) The convex lens of smaller focal length (= 20 cm) has greater power since focal length is reciprocal of power.

Solution 7

(i) Potential energy possessed by falling water = mgh = m × 10 × 50 = 500 m

Heat absorbed by water = m c Δt = m × 4200 × Δt

By the law of conservation of energy, we have

Heat absorbed by water = PE of falling water

m × 4200 × Δt = 500 m

or $\Delta t = \frac{500}{4200} = 0.1190\ ^\circ C$

(ii)

(a) kW (kilowatt) is the unit of electrical power, and kWh (kilowatt-hour) is the unit of electrical energy consumed in one hour.

1 kilowatt = 1000 W

1 kilowatt-hour = 1 kilowatt × 1 hour = 3.6×10^6 J

(b) One kilowatt-hour is the electrical energy consumed by an electrical appliance of power 1 kW when it is used for 1 hour.

1 kilowatt-hour = 1 kilowatt × 1 hour

= 1000 watt × 1 hour

= 1000 J/s × (60 × 60 s)

= 3.6×10^6 J

= 3.6 MJ

(c) The practical units of power are watt-hour and kilowatt-hour.

(iii)

(a) Sound heard after reflection from a rigid obstacle is called an echo. To listen to the echo of a sound distinctly, the reflecting surface in the air should be at a minimum distance of 17 m from the listener. If the distance is less than 17 m, the reflected sound will reach the ears before the original sound dies out. In such a case, the actual sound mixes up with the reflected sound. Due to repeated reflections at the reflecting surface, the sound gets prolonged. This effect is known as reverberation.

(b) If 'd' is the distance between the observer and the obstacle and 'v' is the speed of sound, then the distance covered by the sound to reach the obstacle and to return is 2d. Thus, we have

$$t = \frac{\text{Total distance travelled}}{\text{Speed of sound}} = \frac{2d}{v} \; ; \; d = \frac{vt}{2}$$

By putting t = 0.1 s and v = 340 m/s in air at ordinary temperature, we get

$$d = \frac{340 \times 0.1}{2} = 17 \text{ m}$$

Thus, to hear the echo of a sound distinctly, the reflecting surface in the air should be at a minimum distance of 17 m from the listener.

(c) Material medium is necessary for the propagation of sound. On the moon, there is a vacuum, i.e. no air, so sound cannot propagate on the moon. Thus, sound cannot be heard on the surface of the moon.

Solution 8

(i) Given, power P = 1500 W, voltage V = 250 V

(a) Current I = P/V

$$\text{or } I = \frac{1500}{250} = 6 \text{ A}$$

(b) Electrical energy consumed in 6 hrs = power × time = $\frac{1500}{1000} \times 6 = 9$ kWh

(c) Cost of electrical energy at Rs 2.50 per kWh

= Electrical energy consumed × cost per unit

= 9 × 2.50 = Rs 22.5

(ii)

a) By placing a soft iron core inside a current-carrying solenoid coil.

b) Whenever there is a change in magnetic flux linked with a conductor, an induced emf is set up in it, which gives rise to induced current. This is known as electromagnetic induction.

The necessary condition for electromagnetic induction is that the induced emf lasts as long as there is a change in the magnetic flux linked with the conductor.

(iii)

(a) The current in ammeters B and C is inversely proportional to the resistance value in the parallel branch. Therefore,

$$\frac{\text{reading of ammeter C}}{\text{reading of ammeter B}} = \frac{6}{3} = 2$$

So, reading of ammeter C = 2 × 0.5 = 1.0 A

Hence, reading of ammeter A = (0.5 + 1.0) = 1.5 A

(b) Let the total resistance of the circuit be R.

So,

$R = 2 + R_p$

Here,

$$\frac{1}{R_P} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$$

$\therefore R = 2 + 2 = 4\Omega$

Solution 9

(i) Given, time t = 0.02 millisecond = 0.02×10^{-3} s

$c = 3 \times 10^8$ m/s

Let d be the distance of the plane from the radar.

So,

2d = velocity × time

$2d = 3 \times 10^8 \times 0.02 \times 10^{-3} = 6000$ m

Or

d = 3000 m = 3 km

(ii)

(a) AB corresponds to the time interval in which ice melts to form water.CD corresponds to the time interval when water (at 100°C) boils to form vapour (steam) at 100°C.

(b) Ice is pure because it melts at 0°C. The ice is initially at −10°C. It may have been formed under high pressure.

(iii)

(a) The working principle of calorimetry is based on the law of energy conservation, where the heat lost by a hot body equals the heat gained by a cold body.

i.e., Heat energy lost by A = Heat energy gained by B

$m_1c_1(t_1 - t) = m_2c_2(t - t_2)$

(b) Given that,

Heat energy, Q = 500 J

Change in temperature, Δt = 10 K

Mass of ball, m = 0.1 kg

Now,

The specific heat capacity of the iron ball, $c_1 = \frac{Q}{m\Delta t}$ ... ($\therefore m_1c_1\Delta t$)

$$\therefore c_1 = \frac{500}{0.1 \times 10} = 500\ J/kg\ K$$

(c) Given that,
Mass of water, m = 1 kg
Specific heat capacity of water, c = 4200 J/kg K
Change in temperature, $\Delta t = 57 - 27 = 30°C$ or 30 K
Now,
Heat energy required, $Q = mc\Delta T$
$\therefore Q = 1 \times 4200 \times 30 = 1{,}26{,}000$ J

(d) Given that,
Mass of water, $m_1 = 1$ kg
Mass of calorimeter, $m' = 0.5$ kg
Initial temperature of water & calorimeter, $t_2 = 300$ K
The final temperature of the iron ball, calorimeter & water, t = 350
Specific heat capacity of water, $c_2 = 4200$ J/kg K
Heat energy lost by an iron ball, $Q_1 = 46{,}000$ J
Specific heat capacity of calorimeter, c' =?
Now,
According to the principle of calorimetry,
Heat energy lost by iron ball = Heat energy gained by water and calorimeter
$m_1c_1(t_1 - t) = m_2c_2(t - t_2) + m'c'(t - t_2)$
$46000 = 1 \times 4200 \times (350 - 300) + 0.5 \times c' \times (350 - 300)$
$46000 - 21000 = 25c'$
$c' = 25000/25 = 1000$ J/kg K