ICSE 2025 EXAMINATION

Sample Question Paper - 2

Physics

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

General Instructions:

1. Answers to this paper must be written on the paper provided separately.

*2. You will **not** be allowed to write during the first **15** minutes.*
This time is to be spent in reading the question paper.

3. The time given at the head of the paper is the time allotted for writing the answers.

*4. **Section A** is compulsory. Attempt **any four** questions from **Section B**.*

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

SECTION A (40 Marks)
Attempt all Questions from this Section

Question 1

(i) If car A is travelling at the speed of 80 km/h and car B at 60 km/h in the same direction, what is the velocity of the car A relative to the car B?
a) 10 km/h
b) 20 km/h
c) 30 km/h
d) 40 km/h

(ii) If you whirl a stone on the end of the string and the string suddenly breaks what will happen to the stone?
a) Fly directly towards you.
b) Spiral in towards your hand.
c) Spiral away from your hand.
d) Fly off along the tangent to its circular path.

(iii) The equations of motion can be derived by using
a) Distance-time graph
b) Displacement-time graph
c) Velocity-time graph for uniform acceleration
d) Velocity-time graph for non-uniform acceleration

(iv) Newton's law of gravitation is applicable to
a) Objects in solar system
b) Planets and stars only
c) Objects on Earth only
d) All **bodies in the** universe

(v) **Assertion**: When compared to a hollow tennis ball, a solid cricket ball is more difficult to stop.
Reason: Inertia of an object is inversely proportional to its mass.
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) The same body is immersed in two liquids A and B in succession. The extent to which the body sinks in liquid B is less than in liquid A. What are the conclusions that could be derived from such an observation?
a) Density of liquid B is more than liquid A
b) Density of liquid A is more than liquid B
c) No such conclusion can be made
d) Density of the solid is less than the liquid in both

(vii) A typical solar cell can produce about _____ electricity.
a) 7W
b) 10 W
c) 0.7 W
d) 0.5 W

(viii) What is the major problem in harnessing nuclear energy?
a) Splitting of the nuclei
b) Duration for which the reaction has to be sustained.
c) Safe disposal of the spent fuel
d) Conversion of nuclear energy into electrical energy.

(ix) An observer moves towards a stationary plane mirror at a speed of 4 m/s. The speed of image with respect to mirror is,
a) 4 m/s towards the mirror
b) 8 m/s towards the mirror
c) 4 m/s away from the mirror
d) 8 m/s away from the mirror

(x) The size of the image formed by the convex mirror is
a) Always smaller than the size of the object
b) Always greater than the size of the object
c) Same as the size of the object
d) Depends on the position of the object

(xi) Rahul is standing 35 cm in front of a plane mirror. The mirror is moved 2 cm towards Rahul. What will be the distance between Rahul and his image?
a) 74 cm
b) 64 cm
c) 66 cm
d) 76 cm

(xii) Which of the following is correctly arranged in the increasing order of speed of sound in steel, distilled water, sea water and oxygen?
a) Steel > Distilled water > Sea water > Oxygen
b) Oxygen < Distilled water = Sea water < Steel
c) Oxygen < Distilled water < Sea water < Steel
d) Steel < Distilled water = Sea water < Oxygen

(xiii) The instrument used to control current in an electric circuit is
a) Ammeter
b) cell
c) plug key
d) Rheostat

(xiv) What is the function of a key (or switch) in an electric circuit?
a) To put on current in a circuit.
b) To put off current in a circuit.
c) To put on or off current in a circuit.
d) To control the rate of current flowing through the circuit.

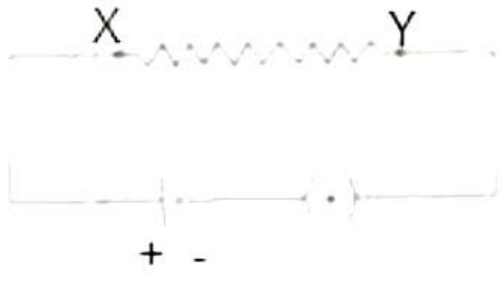
(xv) If the field lines in a magnetic field are parallel and equidistant, the magnetic field is
a) non uniform
b) uniform
c) zero
d) nothing can be decided

Question 2

(i) Complete the following by choosing the correct answers from the bracket: [6]
a) Sound wave is a _____ *[longitudinal/ electromagnetic/transverse]* wave.
b) When ice melts, its temperature _____ *[increases/ decreases/remains constant].*
c) When a spring is held fixed at one end and the other end is stretched, the spring tends to regain its original shape due to _____ *[Restoring Force/ Tensile Force/ Compressive Force].*
d) Nuclear fusion reactions are also known as _____ *[thermo-nuclear/chain-reaction]* reactions.
e) A glass rod is rubbed with silk. The charge on the glass rod is _____ *[Positive/Negative],* and the charge on the silk is _____ [Positive/Negative].

(ii) Amplitude of a transverse wave is 1.5 m and wavelength is 5 m. If the velocity of wave is 300 m/s, find the frequency of the wave. [2]

(iii) In the given circuit diagram, you are asked to measure the current in the resistance wire XY and potential difference across it. Name the instruments that you would use.[2]



Question 3

(i) Will the weight of 1 kg of iron and 1 kg of cotton be the same in air? Explain. [2]

(ii) A body, whose volume is 100 cm^3, weighs 1 kg in the air. Find its weight in water. (Density of water = 10^3 kg m^3, g= 10 m/s^2) [2]

(iii) Give the order of magnitude of the following [3]

i. Height of Mount Everest = 9×10^3m

ii. Mass of a virus = 1×10^{-15} kg

iii. Life expectancy of a man = 2×10^9 s

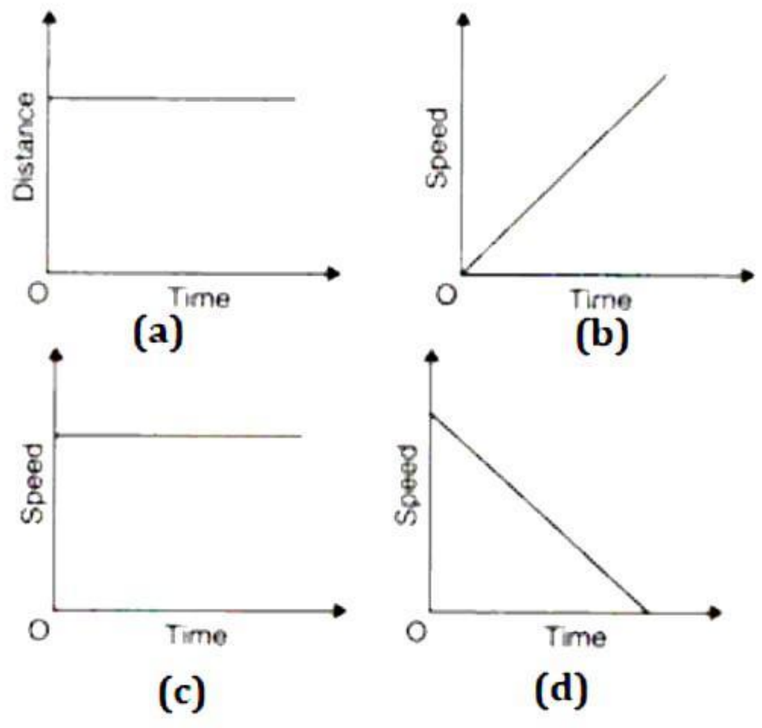
iv. A speck of dust = 7×10^{-10} kg.

(iv) Two bodies of masses m_1 and m_2 are released from heights h_1 and h_2, respectively. Obtain the ratio of the time taken by both the bodies to reach the earth. [2]

(v) Explain why deep-sea divers need special protective wear. [2]

(vi) In summer, why do dogs hang their tongue while lying under trees? [2]

(vii) Define retardation. Which of the following graph represents uniform retardation? [2]



SECTION B (40 Marks)

Attempt *any four* Questions from this Section

Question 4

(i) What is the function of ratchet in a screw gauge? A screw gauge has positive error of 7 divisions such that its main scale is marked in half mm and circular scale has 100 divisions. The spindle of the screw advances by 1 division on one complete revolution. If the screw gauge reading is 9 divisions on the main scale and 67 divisions on the circular scale for the diameter of a wire, calculate [4]

a) Pitch

b) Least count and

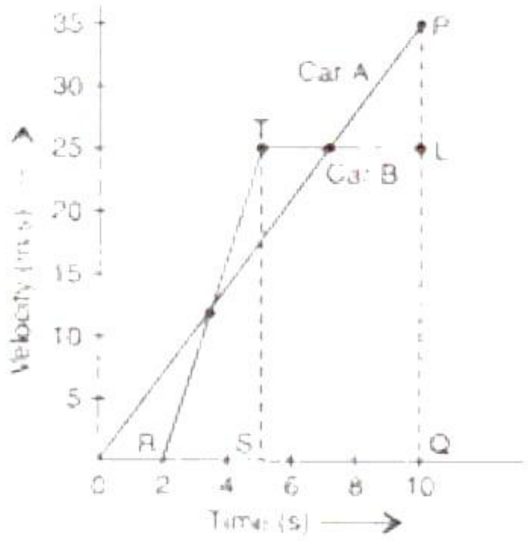
c) Corrected diameter.

(ii) A girl standing on an oscillating swing sits down. How does the time period of a swing get affected? What happens to its frequency of oscillation? [3]

(iii) Define the term volume. Mass of a sphere of radius 1.4 m is 500 kg. Calculate the density of the material of the sphere. [3]

Question 5

(i) Given figure shows a velocity-time graph for two cars A and B starting from the same point in the same direction. [4]



Calculate the following:

a) Acceleration of car A.

b) Acceleration of car B between 2s - 5 s.

c) At what time intervals, both cars have same velocity?

d) Which car is ahead after 10 s and how much?

(ii) Derive the first equation of motion. [3]

(iii) A stone dropped from the top of a cliff reaches ground level in 4 s and buries itself 0.8 m into the mud. Calculate, [3]

a) height of cliff

b) final velocity of stone on reaching level and

c) retardation produced by the mud. Take $g = 9.8\ m/s^2$.

Question 6

(i) It is experienced that in our daily life Newton's first law is contradicted. Comment. [3]

(ii) Sound takes 3 s to reach a certain distance from the source placed in air. How much time will it take to reach the same distance when the source is in water? Take speed of sound in air as 330 m/s and in water as 1650 m/s. [3]

(iii) Define coefficient of linear expansion. Give its SI unit. State the factors on which the thermal expansion of a solid depends. [4]

Question 7

(i) Describe an experiment to demonstrate thermal expansion in gases. [4]

(ii) The mercury falls by 8/15 parts between two standard points on a Celsius thermometer, when the boiling water at 100°C is allowed to cool to room temperature. Calculate room temperature in

(i) Celsius scale (ii) Fahrenheit scale. [3]

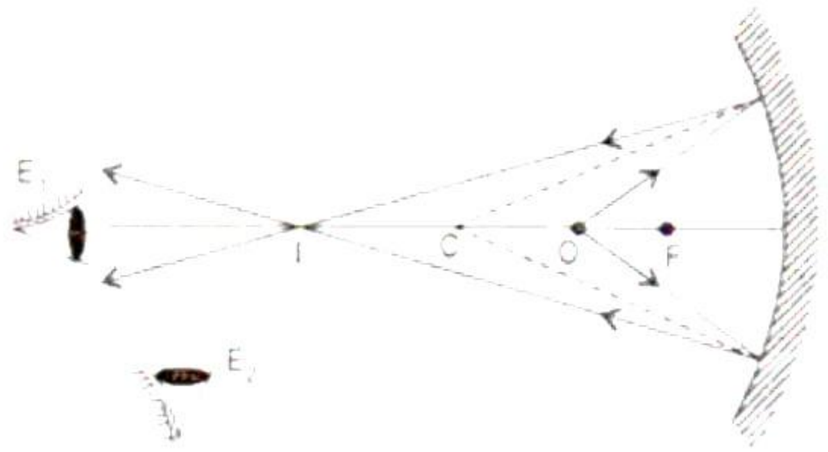
(iii) [3]

i. What is the difference in the wavelength of infrared rays emitted from the sun and that radiated from the earth?

ii. How is the size of a degree defined on the Celsius scale and on the Fahrenheit scale?

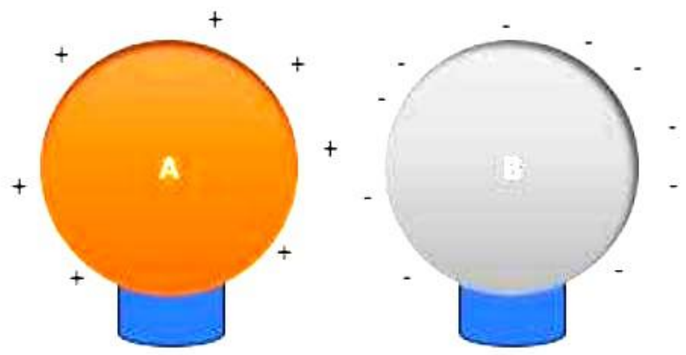
Question 8

(i) Given figure shows the image I of a point object O. How will you differentiate between point object and its image? [3]



(ii) Give three applications of plane mirrors. [3]

(iii) In a physics lab there where two charged spheres A and B, initially both were kept at some distance from each other in an enclosed box as shown in figure below.



After some time, the teacher bought both the sphere close to each other such that they are now in contact with each other. [4]

Answer the following questions based on the given information.

a) Which sphere is at higher potential before electrical contact based on convention?

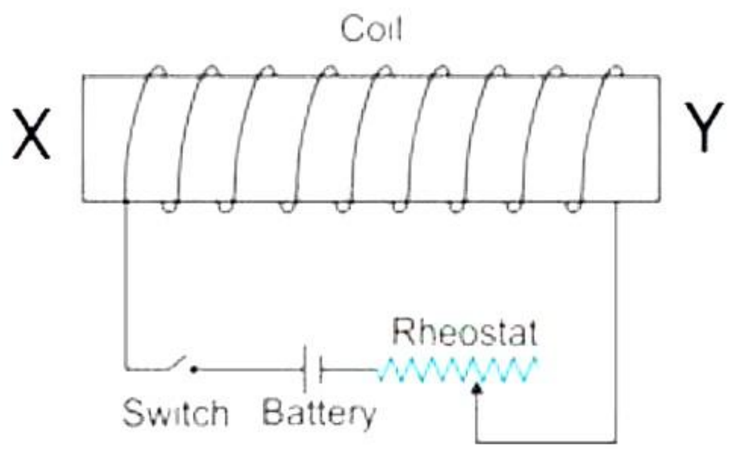
b) Which sphere is at lower potential before electrical contact based on convention?

c) In which direction conventional current flows?

d) In which direction electronic current flows?

Question 9

(i) An engineer wrapped copper coils around a soft iron bar XY. Which is then connected to a switch, battery and rheostat as shown below.



Answer the following questions based on the given information.

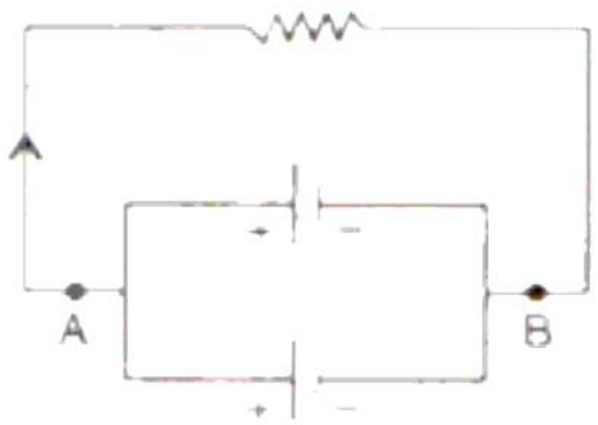
a) State the polarity at the ends X and Y as the switch is pressed.

b) What is an electromagnet? Name the material used for preparing an electromagnet.

c) Suggest two ways of increasing the strength of electromagnet so formed.

d) State two differences between an electromagnet and a permanent magnet.

(ii) In the given circuit diagram two cells are connected in parallel. Answer the following: [3]



a) What is the potential difference between points A and B if e.m.f. of each cell is 1.5 V?

b) How does the effective voltage of the two cells connected in series compare to their arrangement in parallel?

c) Are the cells in a conventional flash light connected in series or in parallel?

(iii) You are given following three bars exactly similar in size and shape: [3]

a) A permanent magnet

b) A bar of soft iron

c) A bar of non-magnetic substance.

Describe how you will identify each of the bars if only a piece of thread is supplied to you as the extra piece of apparatus.

Solution

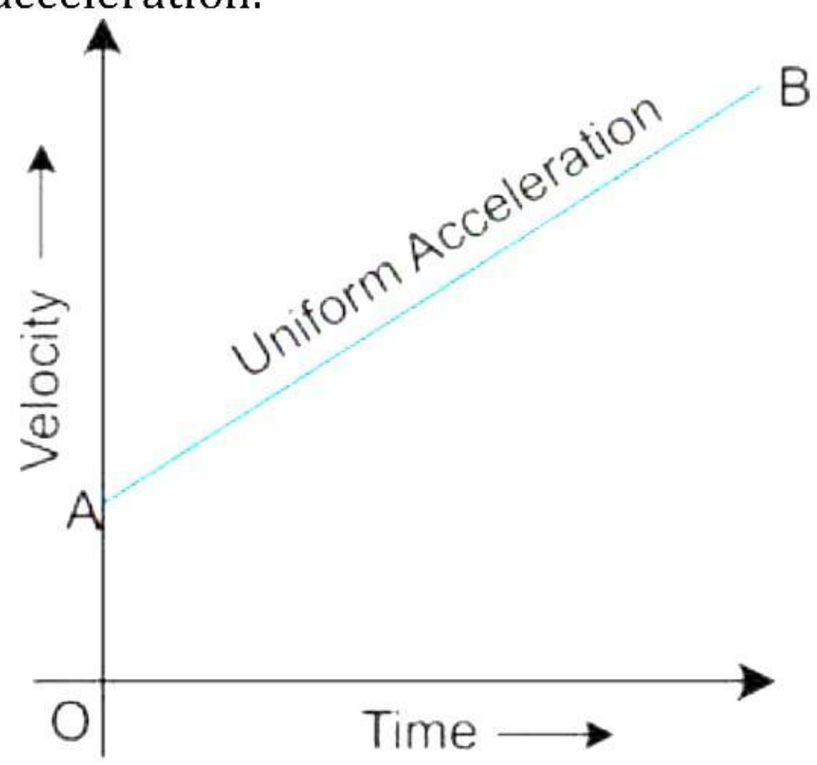
SECTION A

Solution 1

(i) Correct option - b) 20 km/h
The velocity of the car A relative to the car B is 80 km/h - 60 km/h = 20 km/h

(ii) Correct option - d) Fly off along the tangent to its circular path.
At any instance the direction of velocity of the stone is along the tangent to the circle drain at that point So it will fly off along the tangent to its circular path.

(iii) Correct option - c) Velocity-time graph for uniform acceleration
The equations of motion can be derived using the velocity-time graph for uniform acceleration.



(iv) Correct option - d) All bodies in the universe
Newton's law of gravitation is called because it is a universal law of gravitation because to all the bodies having mass.

(v) Correct option - d) Assertion is true reason is false.
Because a solid cricket ball has more mass than a hollow tennis ball, it is more difficult to stop due to its greater inertia. The reason is incorrect because an object's inertia is directly proportional to its mass, not inversely proportional.
Hence assertion is true reason is false.

(vi) Correct option - a) Density of liquid B is more than liquid A
The density of liquid B is more than liquid A as more upthrust is exerted on the body in liquid B and hence it sinks less.

(vii) Correct option - c) 0.7 W
A typical cell can produce about 0.7 W of electricity.

(viii) Correct option - c) Safe disposal of the spent fuel

The major hazard of nuclear power generation is the storage and disposal of spent or used fuels as the uranium decays into harmful subatomic particles (radiations) Improper nuclear-waste storage and disposal result in environmental contamination.

(ix) Correct option - a) 4 m/s towards the mirror

As the observer comes closer to the plane mirror the image also comes closer. Also, in the case of plane mirror, object distance image distance Hence, the speed of the image w.r.t mirror is also 4 m/s which moves towards the mirror.

(x) Correct option - a) Always smaller than the size of the object

The size of the image formed by the convex mirror is always smaller than the size of the object irrespective of the position of the object.

(xi) Correct option - c) 66 cm

When the mirror is moved 2 cm towards Rashmi, the distance between him and the mirror is 35-2=33 cm. Distance of Rashmi from mirror 33 cm. Thus, Distance of image from mirror = 33 cm Distance between Rashmi and his image = 33 cm + 33 cm = 66 cm

(xii) Correct option - c) Oxygen < Distilled water < Sea water < Steel

The speed of sound decreases as we go from solid to the gaseous state because the density of particles decreases from solid to gaseous. So, sound travels slowest in gases, faster in liquids and fastest in solids.

(xiii) Correct option -d) Rheostat

The instrument which is used to control current in an electric circuit is rheostat

(xiv) Correct option - c) To put on or off current in a circuit.

The function of a key (or switch) in an electric circuit is to put on or off current in a cut.

(xv) Correct option - b)

If the field lines in a magnetic field are parallel and equidistant the magnetic field is uniform.

Solution 2

(i)

a) Sound wave is a **longitudinal** wave.
b) When ice melts, its temperature **remains constant.**
c) When a spring is held fixed at one end and the other end is stretched, the spring tends to regain its original shape due to **Restoring Force.**
d) Nuclear fusion reactions are also known as thermo-nuclear reactions.
e) A glass rod is rubbed with silk. The charge on the glass rod is **positive** and the charge on the silk is **negative**.

(ii) Wavelength of the wave = 5m

Velocity of the wave = 300 m/s

$$\text{Frequency} = \frac{\text{Velocity}}{\text{Wavelength}} = \frac{300\,\text{m/s}}{5\,\text{m}} = 60\,\text{Hz}$$

(iii) To measure the current, an ammeter is connected in series with the resistor XY and to measure potential difference, we connect a voltmeter in parallel across the resistor XY.

Solution 3

(i) Yes, the weight of 1 kg iron and 1 kg cotton is same, i.e., 1 kg x 9.8 m/s^2 = 9.8 N.

(ii) Volume of the body = 100 cm^3 = 10^{-4} m^3 = Volume of the water displaced

Mass of the body = 1 kg

Weight of the body in air = 1 kg x 10 m/s^2 =10 N

Density of the water = 1000 kg/m^3

Mass = Density × volume

Mass of the water displaced = 10^3 kg/m^3 x 10^{-4} m^3 = 10^{-1} kg

Weight of the water displaced = Upthrust= 10^{-1} x 10 = 1N

Weight in the water = Weight of the body in air - Upthrust = 10-1=9 N

(iii) Order of magnitude is 10^n for a numerical value < 3.2 and 10^{n+1} for a numerical value> 3.2.

a) Height of Mount Everest = 9 x 10^3 m
   Order of magnitude = $10^{(3+1)}$ = 10^4 because 9 >3.2
b) Mass of a virus = 1 x 10^{-15} kg
   Order of magnitude = 10^{-15} as 1 < 3.2
c) Life expectancy of a man = 2 x 10^9 s
   Order of magnitude = 10^9 as 2 < 3.2
d) A speck of dust = 7 x 10^{-10} kg
   Order of magnitude = 10^{-9} as 7 > 3.2

(iv) According to the second equation of motion

$$h = ut + \frac{1}{2}gt^2$$

But acceleration due to gravity is independent of mass and since, the initial Velocity 'u' is zero (u=0), so, the equations for both the bodies will be:

$$h_1 = \frac{1}{2}gt_1^{\,2}$$

$$h_2 = \frac{1}{2}gt_2^{\,2}$$

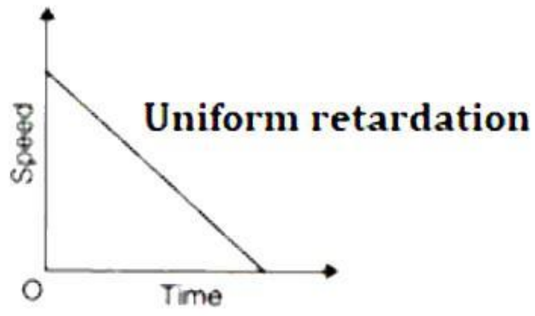
$$\frac{h_1}{h_2} = \frac{t_1^{\,2}}{t_2^{\,2}}$$

$$\frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$$

(v) Deep sea divers need special protective suits in order to prevent the loss of body heat to the cold water. Also, there is an increase in pressure as the depth of the water increases which causes difficulty in breathing and the special diver suits protect their body from such pressures. Water also exerts buoyancy on the body; so, the suits are provided with a weight belt to counteract this buoyancy.

(vi) Dogs have a high body temperature, and they hang their tongues out to let the heat out through their tongues. Salivating (producing spit or saliva) helps the dog to cool down its temperature when its tongue is hanging out. It's the way heat is lost during sweating. The saliva on the tongue evaporates by taking away heat from the tongue.

(vii) Retardation corresponds to the situation when velocity decreases with respect to time.



(d)

SECTION B

Solution 4

(i) Ratchet is attached to the screw by a spring. Its function is to save the stud from the excess pressure exerted by the flat end of the screw when the flat end of the screw is brought in contact with the stud i.e., further rotation given to the ratchet does not press the flat end against the stud.

a) $\text{Pitch} = \frac{0.5\text{ mm}}{1} = 0.5\text{ mm} = 0.05\text{ cm}$

b) $\text{Least count of the screw gauge} = \frac{0.05\text{cm}}{100} = 0.0005\text{ cm}$

$$\begin{aligned}\text{Diameter of the wire} &= 9 \times 0.05\text{ cm} + 67 \times 0.0005\text{ cm} \\ &= (0.45\text{ cm} + 0.0335\text{ cm}) \\ &= 0.4835\text{ cm}\end{aligned}$$

c) Correct diameter = Observed diameter - correction

$$\begin{aligned}&= 0.48535\text{ cm} - (7 \times 0.0005\text{ cm}) \\ &= 0.4835\text{ cm} - 0.0035\text{ cm} \\ &= 0.4800\text{ cm}\end{aligned}$$

(ii) When the girl sits on the swing, the centre of gravity of the swing is lowered i.e. the effective length of the swing increases and hence, the time period increases. As frequency of oscillation is inversely proportional to the time period, the frequency of oscillation decreases.

(iii) Volume of a body is the space occupied by it.

Given: r =14 m, m=500 kg, ρ =?

$$\text{We know that } \rho = \frac{\text{Mass(m)}}{\text{Volume(V)}} = \frac{500\text{ kg}}{\frac{4}{3} \times \frac{22}{7} \times (1.4\text{m})^3} = \frac{500\text{kg}}{11.498\text{ m}^3} = 43.48\text{ kg/m}^3$$

Solution 5

(i)

a) $\text{Acceleration of car A} = \frac{(35 - 0)\text{ m/s}}{10\text{ s}} = 3.5\text{ m/s}^2$

b) $\text{Acceleration of car B between 2 s – 5 s} = \frac{(25 - 0)\text{m/s}}{3\text{s}} = 8.33\text{m/s}^2$

c) After 3 s velocity of both cars is 10 m/s and at 7s velocity of each car is 25 m/s.

d) Distance travelled by car A = Area of ΔOPQ

$$\begin{aligned}&= \frac{1}{2} \times \text{PQ} \times \text{OQ} = \frac{1}{2} \times 35\text{ m/s} \times 10\text{ s} \\ &= 175\text{ m}\end{aligned}$$

Distance travelled by car B = Area of trapezium RTLQ

$$= \frac{1}{2} \times (8 + 5)\text{ s} \times 25\text{ m/s} = 162.5\text{ m}$$

Car A is ahead by 175 - 162.5 = 12.5 m

(ii) Let a body be moving with initial velocity 'u'. After time 't', its velocity becomes 'v' and during this journey, uniform acceleration is 'a.'

We know that, $a = \frac{v - u}{t}$

$v = u + at$

(iii)

a) Given : $u = 0, t = 4s, g = 9.8\ m/s^2$

$h = ut + \frac{1}{2} gt^2$

$= 0 \times 4s + \frac{1}{2}\left(9.8\ m/s^2\right) \times \left(4s\right)^2 = 78.4\ m$

b) $v = u + gt$

$= 0 + (9.8\ m/s^2) \times 4\ s = 39.2\ m/s$

c) $u = 39.2\ m/s, v = 0, s = 0.8\ m$

$v^2 = u^2 + 2as$

$0 = (39.2)^2 + 2a \times 0.8$

$a = -\frac{39.2 \times 39.2}{1.6}\ m/s^2$

$a = -960.4\ m/s^2$

Solution 6

(i) When a ball is allowed to roll on the floor, it ultimately stops because of the frictional force exerted on it by the ground. Thus, the state of uniform motion of the ball changes due to external force (friction). On the Earth, every change in uniform motion of a body can be related with some external force acting on it; However, in free space, where no external force acts, state of motion described by the Newton's first law can be obtained and experienced.

(ii) Given $V_a = 330\ m/s$

$t = 3\ s$

Distance travelled by sound in air

$d_a = V_a \times t$

$= 330 \times 3 = 990\ m$

∴ Time taken by sound to travel 990 m in water

$= \frac{d_W}{V_W} = \frac{990\ m}{1650\ m/s} = 0.6\ s$

(iii) Coefficient of linear expansion of a material is defined as the fractional change in length per unit change in its temperature when a rod of that material is heated (or cooled).

Coefficient of linear expansions (α) =

$$\frac{\text{Change in length } (l_2 - l_1)}{\text{Original length } (l_1) \times \text{change in temperature} (t_2 - t_1)}$$

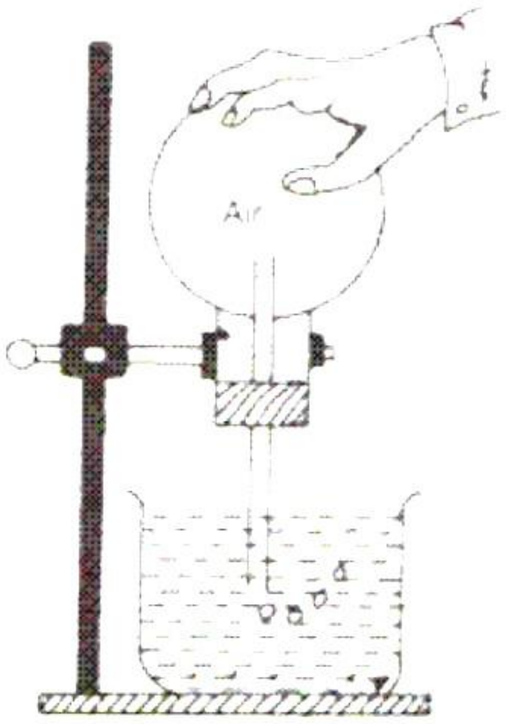
Its SI unit is K^{-1}.

Thermal expansion of a solid depends on the following factors:

i. Nature of the material.
ii. Initial dimension of the solid.
iii. Rise in temperature of the solid.

Solution 7

(i) Thermal expansion of gases:



Take a round bottom flask which is filled with air and closed with a one holed rubber cork. A narrow capillary tube is passed through the rubber stopper and the flask is supported on a tripod in an inverted position as shown in the figure; so that, the end of the capillary tube is under water. Now, heat the flask gently with a spirit lamp. You will observe bubbles coming out from the capillary tube. This shows that air has expanded on heating and it escapes from the flask. Like air, all other gases also behave in the same way.

(ii) Number of divisions between lower fixed point (ice point) and upper fixed point (steam point) on Celsius scale = 100

$$\therefore \frac{8}{15} \text{ of Celsius scale} = \frac{8}{15} \times 100 = 53.33\,^{o}C$$

$$\therefore \text{Temperature of Celsius scale} = \left(100 - 53.33\right)^{o}C = 46.67\,^{o}C$$

$$\text{Temperature on Fahrenheit scale} = \frac{9}{5} \times C + 32 = \frac{9}{5} \times 46.67 + 32$$

$$= 116.006\,^{o}F \; ; 116.01\,^{o}F$$

(iii)

i. The infrared rays emitted from the sun have shorter wavelength than the infrared rays radiated from the earth.
ii. A degree on Celsius scale is 1/100th part of the interval between the ice point and the steam point. A degree on Fahrenheit scale is 1/180th part of the interval between the ice point and the steam point.

Solution 8

(i) Point object will be seen from different positions of the eye, but the image will be observed only when the reflected rays will enter into the eye. In position E_1 of the eye, both the object and the image will be seen while in position E_2 only the object will be seen.

(ii) Three applications of plane mirrors are:

- Plane mirrors are used in many optical instruments.
- Plane mirrors are used in periscopes and kaleidoscopes.
- They are used in dressing rooms for viewing oneself.

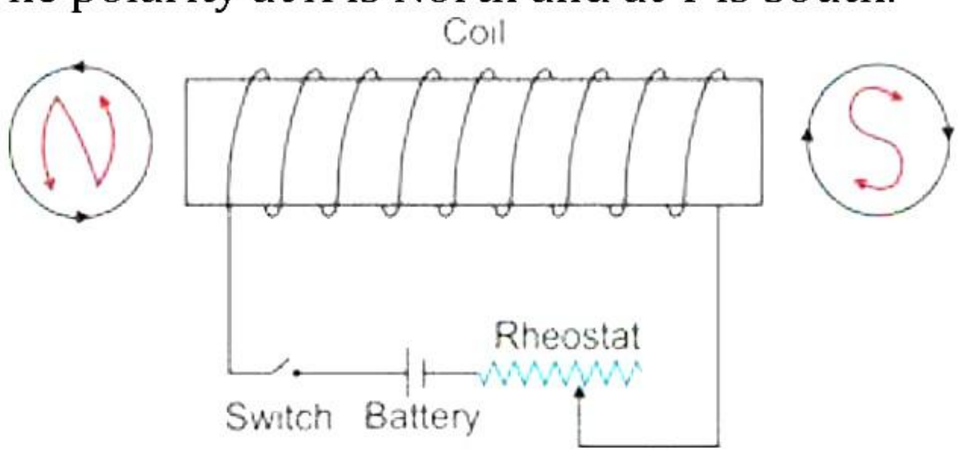
(iii)

a) According to convention, sphere A is at higher potential.
b) According to convention, sphere B is at lower potential.
c) Conventional current flows from sphere A to sphere B.
d) The electronic current flows from sphere B to sphere A.

Solution 9

(i)

a) The polarity at X is North and at Y is South.



b) An electromagnet is a temporary strong magnet made from a piece of soft iron when current flows in the coil wound around it. It is an artificial magnet. The material used for preparing an electromagnet is soft iron.

c) By increasing the number of turns of winding in the solenoid, the strength of the electromagnet can be increased.

d)

Electromagnet	Permanent magnet
It is made up of soft iron	It is made up of steel
The magnetic field strength can be changed	The magnetic field strength cannot be changed
Electromagnets of very strong field can be made.	Permanent magnets are not so strong.

(ii)

a) The potential difference between points A and B is 1.5 V as the voltage in parallel combination of the cells remains the same.
b) In series combination, e.m.f. of cells is added i.e., 3 V which is twice the effective voltage in parallel arrangement of two cells.
c) The cells in a conventional flashlight are connected in series.

(iii) Suspend each of the three bars separately by means of a thread. We will observe that one bar sets itself in a particular direction even after being disturbed and the other two can stay in any direction. The one having a fixed direction will be a permanent magnet. Remove this bar and bring it near the other bars. One of them will be attracted by the magnet bar at both the ends. This is the soft iron bar. The third bar will be of a non-magnetic substance.