

**ICSE Board
Class IX Physics
Paper – 4 Solution**

SECTION I

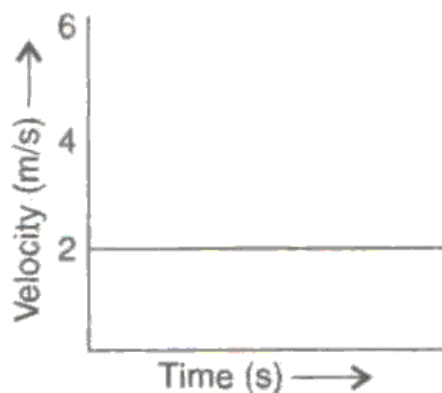
Answer 1

(a)

- i. Easily accessible
- ii. Invariable
- iii. Easily reproducible

(b) Any phenomenon which repeats itself after a fixed interval of time can be used to measure time, e.g. rotation of the earth, oscillations of a pendulum.

(c)



(d) Force = Rate of change of momentum = 3 N.

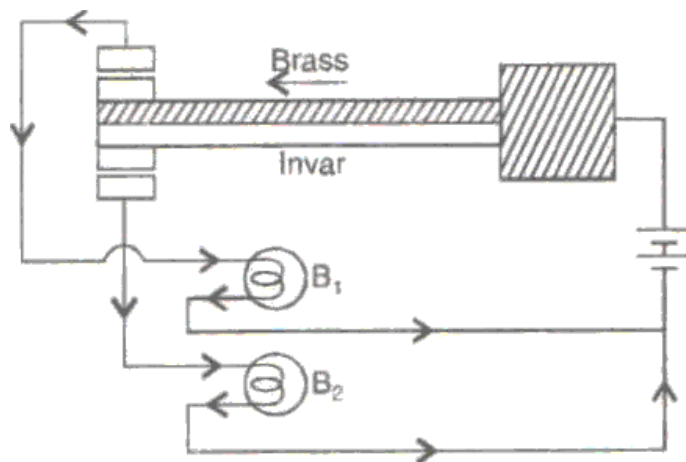
(e) The gradual rise in the atmospheric pressure means that the weather is slowly changing to dry season due to decrease in moisture in the air. While the sudden rise in pressure means that air flows from that place to other surrounding low pressure areas. This indicates extremely dry weather.

Answer 2

- (a) The force of attraction between the earth and any other body is called gravity.
- (b) $1 \text{ atm} = 1.013 \times 10^5 \text{ Pa}$
- (c) $W = mg = 12 \text{ kg} \times 10 \text{ N/kg} = 120 \text{ N}$
i. Force exerted by earth on the body = 120 N
ii. Force exerted by the body on the earth = 120 N.
- (d) The coefficient of linear expansion of brass is more than that of iron. On heating, the diameter of cork will increase more than the diameter of the hole and will fit tightly. On the other hand, if the iron cork is cooled down, then it will contract and will become loose. So, in order to remove the cork, we will cool it. On cooling, cork will contract more than the hole; hence, it will become loose. So, we will cool it.
- (e) No, the air in the room will be heated. This is due to the motion of the fan, the speed of air molecules will also increase. We feel cold due to evaporation of our sweat.

Answer 3

(a)



- (b) Liquids (except mercury) are heated by convection not by conduction. The density of liquid changes as it is heated. When a liquid in a vessel is heated, the bottom part of the liquid gets heated first, becomes less dense, moves upward and is replaced by the colder and denser liquid from the top. So, if we would heat liquid from the surface then convection would not take place and the whole of the liquid would not become hot.
- (c) If we extend three arrows, they meet at a point. So, the arrows will hit the deer if it is at the point where all the three arrows meet.

(d) An image is formed, when the reflecting surface is quite regular. The surface of a book is quite irregular and light gets scattered by it. Hence, we can read a book due to scattered light but are unable to see our own image in it.

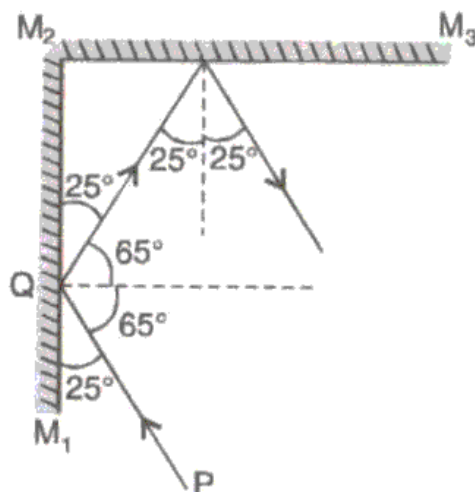
(e) A convex mirror is used as a reflector in street lamps so as to diverge light over a larger area.

Answer 4

(a)

- i. Medium should have elasticity.
- ii. Particles of the medium must have inertia.
- iii. There should be some force of attraction between the neighbouring particles of the medium.

(b)



(c) Points (B and H) and (E and J) are in the same phase.

(d) Inside the earth's core, the temperature is very high and due to this, iron is in its molten state. In molten state, iron loses its ferromagnetic properties. Hence, iron cannot be regarded as the source of Earth's magnetism.

(e) Copper is a good conductor of electricity. Therefore, it conducts the current flowing through it without offering much resistance. Also, since copper is a diamagnetic material, it does not get magnetized due to the current passing through it. Hence, it does not disturb the current in the circuit and is used for electrical purposes.

SECTION II

Answer 5

(a) Let 'm' be the mass of copper in the alloy,

Then, the mass of zinc in the alloy = $(12.9 - m)$ g

Volume of copper in the alloy = $\frac{m}{8.9} \text{ cm}^3$

Volume of zinc in the alloy = $\frac{(12.9 - m)}{7.1} \text{ cm}^3$

Apparent loss of mass of brass = $12.9 - 11.3 = 1.6$ g

Volume of the piece of brass = Volume of the water displaced by it

$$= \frac{1.6 \text{ g}}{1 \text{ g/cm}^3} = 1.6 \text{ cm}^3$$

Volume of copper and zinc in the alloy piece = Volume of the brass piece

$$\frac{m}{8.9} + \frac{12.9 - m}{7.1} = 1.6$$

$$\frac{7.1 m + 8.9(12.9 - m)}{8.9 \times 7.1} = 1.6$$

$$7.1 m + 8.9(12.9 - m) = 1.6 \times 8.9 \times 7.1$$

Solving this equation, we get $m = 7.61$ g

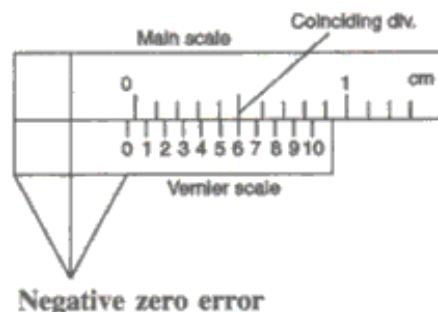
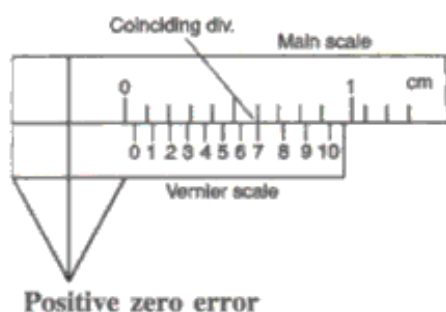
(b) Least count of a vernier caliper is the least distance which can be measured accurately by it. It is also called the vernier constant.

On bringing the movable jaw in contact with the fixed jaw, if the zero of the main scale coincides with the zero of the vernier scale, then the given vernier is free from zero error, but if zero of the vernier scale does not coincide with the zero of the main scale, the vernier is said to have zero error.

Zero error is equal to the distance between the zero of the main scale and the zero of the vernier scale. Zero error is of two kinds viz. positive zero error and negative zero error.

The zero error is said to be positive if on bringing both the jaws together, the zero mark of the vernier is on the right hand side of the zero mark of the main scale.

The zero error is said to be negative, if on bringing both the jaws together, the zero mark of the vernier is on the left side of the zero of the main scale.



(c) Second's pendulum is that pendulum whose time period is 2 s.

We know that the time period of a pendulum is directly proportional to the square root of its length, that is, $T \propto \sqrt{l}$. Thus, the time period for pendulum Q of length 0.5 m is less than the time period of pendulum P of length 2 m. Hence, pendulum Q will make more oscillations per minute.

Answer 6

(a)

i. Acceleration of the car = $\frac{(30 - 0) \text{ m/s}}{(10 - 0) \text{ s}} = 3 \text{ m/s}^2$

ii. Retardation of the car = $\frac{(0 - 30) \text{ m/s}}{(25 - 10) \text{ s}} = \frac{-30}{15} \text{ m/s}^2 = -2 \text{ m/s}^2$

iii. Maximum velocity of the car = 30 m/s.

iv. Initial velocity of the car = 0 m/s

v. Final velocity of the car = 0 m/s

vi. Distance covered by the car in first 10 s = Area of $\triangle ACO$

$$= \frac{1}{2} \times 30 \text{ m/s} \times 10 \text{ s} = 150 \text{ m}$$

vii. Distance covered by the car in last 15 s = Area of $\triangle ACB$

$$= \frac{1}{2} \times 30 \text{ m/s} \times 15 \text{ s} = 225 \text{ m}$$

viii. Average speed of the car = $\frac{(150 \text{ m} + 225 \text{ m})}{25 \text{ s}} = 15 \text{ m/s}$

(b) We know that, $s = ut + \frac{1}{2} at^2$

Here, since the body starts from rest, $u=0$

$$s = 0 \times t + \frac{1}{2} at^2 = 0 + \frac{1}{2} at^2$$

$$s = \frac{1}{2} at^2$$

$s \propto t^2$ (as the body is moving with uniform acceleration).

(c) Speed is the distance travelled by a body in a unit time. Velocity is the rate of change of displacement of a body with time.

Yes, rest and motion are relative terms. A body at rest with respect to one body may be in motion with respect to another body.

Answer 7

(a) Mass is the measure of its inertia

$$\therefore \text{Inertia of P: Inertia of Q} = m: 5m \\ = 1:5$$

$$\text{Momentum of P: Momentum of Q} = m \times 5v: 5m \times v \\ = 5mv: 5mv \\ = 1:1$$

Force required to stop a body is directly proportional to its mass.

$$\therefore \text{Force required for P: Force required for Q} = m: 5m \\ = 1:5$$

(b) For pulling a cart or for running, the horse pushes the earth with its feet in the backward direction and the reaction of the earth makes it move in the forward direction, but in case of empty space, the action of the horse's feet does not get any reaction force. This makes it impossible for the horse to run in an empty space.

(c) Arctic Ocean is mainly covered by ice which reflects a large percentage of sun's energy back into space especially during summer.

If the ice in the Arctic Ocean melts at a high rate, then one day there will be no ice in the Arctic Ocean. Instead of reflecting a large percentage of solar energy, it will absorb more than 60% of it and get much warmer. There will be a tremendous change in the chemical exchange between the atmosphere and ocean which might become dangerous up to an unknown extent.

Answer 8

(a) Thermometer T_1 will record a higher temperature because black surfaces are good absorbers of heat than shining surfaces. Thus, the can painted black absorbs more heat than the polished one and so thermometer T_1 records a higher temperature.

When the cans are kept in a room, the thermometer T_1 will record a lower temperature because black surfaces are good radiators of heat. So, water in blackened can cools quickly compared to the shining can.

(b) Following are the characteristics of heat (or thermal) radiations: (any three)

- i. Heat radiations travel in a straight line.
- ii. Heat radiations travel in all directions.
- iii. Heat radiations do not require material medium for their propagation.
- iv. Heat radiations travel with the speed of light i.e. 3×10^8 m/s.
- v. Heat radiations can be reflected and refracted.

(c) Energy flow in the ecosystem is governed by the laws of thermodynamics.

First law of thermodynamics: Energy can neither be created nor destroyed, but it can be transformed from one form to another.

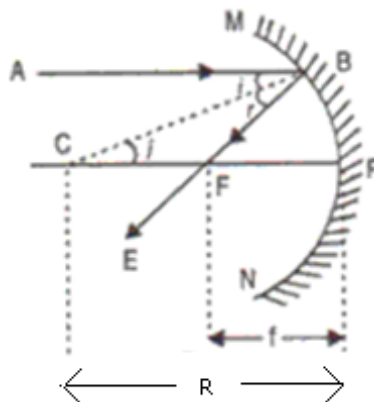
Second law of thermodynamics: During the process of transformation of energy, a part of it is lost to the surroundings in the forms which cannot be used again. However, the total energy of the system remains constant.

Answer 9

(a) The distance between the pole and centre of curvature of a mirror is called the radius of curvature.

Consider a concave mirror MN of radius of curvature R and focal length f. P is the pole of mirror, F is its principal focus and C is its centre of curvature, then $PC = R$ and $PF = f$.

A ray AB parallel to principal axis is incident on the concave mirror at point B. By definition of principal focus, it travels along F after reflection from the mirror. The line joining from C to B is normal on the mirror at B. Therefore, angle of incidence $\angle ABC = i$



From law of reflection,

Angle of incidence $\angle i =$ Angle of reflection $\angle r$

$$\therefore \angle ABC = \angle FBC$$

But $\angle BCF = \angle ABC$

$$\angle BCF = \angle FBC$$

$\therefore \triangle BCF$ is an isosceles triangle. Hence, $CF = FB$.

If aperture of a mirror is small, point B is very near to P, so $FB \cong FP$

$$\therefore CF = FP$$

$$\text{or } FP + CF = FP + FP$$

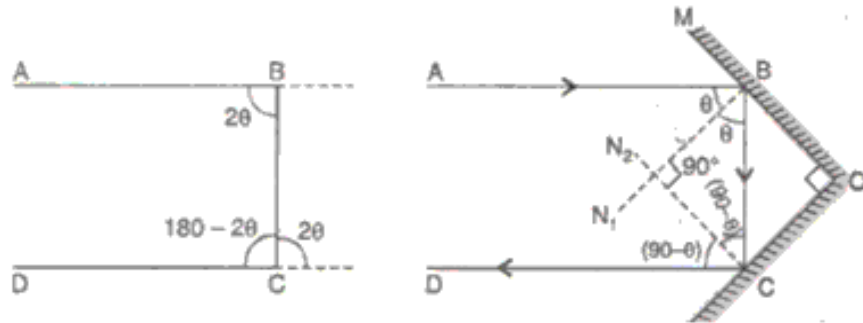
$$\text{or } FP + CF = 2FP$$

$$\therefore FP = \frac{FP + CF}{2} = \frac{PC}{2}$$

$$\text{or, } f = \frac{1}{2}R$$

Thus, the radius of curvature of a concave mirror is twice its focal length.

(b)



It is clear from the geometry that $AB \parallel CD$ i.e., incident ray AB is parallel to reflected ray CD but the direction is reversed.

(c) Wavelength is the distance between two consecutive crests (or troughs) of a transverse wave.

OR

It is the distance between two consecutive compressions (or rarefactions) of a longitudinal wave.

OR

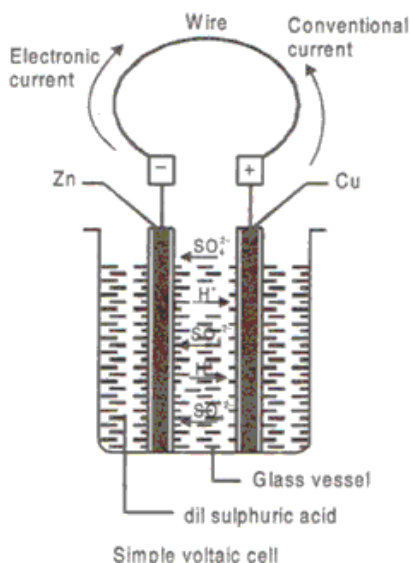
It is the distance between two nearest particles of the wave which are in the same phase.

Answer 10

- (a) When a glass rod is rubbed with silk, it gets positively charged.
- A has negative charge, B is neutral and C has positive charge.
 - All the three spheres A, B and C will have negative charge.
 - A has negative charge and both, B and C have positive charge.
 - All the three spheres have positive charge in each case i, ii and iii.

(b)

i.



- In a simple voltaic cell, there are two defects:
 - Polarization.
 - Local action.
- E.m.f. of a voltaic cell is 1.08 V.

(c) The completed table is given below:

Nature of bar	Action on compass needle	
	North pole	South pole
Non-magnetic	No action	No action
Magnetic	Attracted	Attracted
North pole of a bar magnet	Repelled	Attracted
South pole of a bar magnet	Attracted	Repelled