

ICSE Board
Class IX Physics
Paper – 5 Solution

SECTION I

Answer 1

(a) Light year (ly) is the distance travelled by light in a year.

$$1 \text{ ly} = 9.46 \times 10^{15} \text{ m}$$

Astronomical unit is the mean distance between the Sun and the earth.

$$1 \text{ AU} = 1.50 \times 10^{11} \text{ m}$$

(b)

- i. -4
- ii. 0
- iii. 1
- iv. 15

(c) Let V be the volume of the liquid displaced,

Mass of the floating body = Mass of the liquid displaced

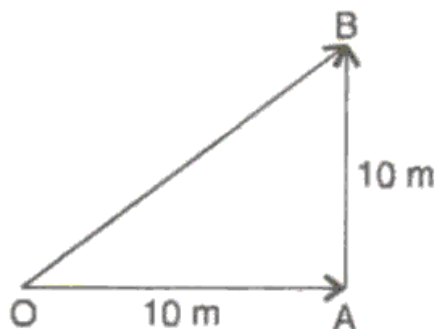
$$7 \text{ kg} = V \times 140 \text{ kg m}^{-3}$$

$$V = 0.05 \text{ m}^3$$

\therefore Volume of the block above the surface of the liquid

$$= 0.07 \text{ m}^3 - 0.05 \text{ m}^3 = 0.02 \text{ m}^3$$

(d)



$$\text{Total displacement OB} = \sqrt{OA^2 + AB^2}$$

$$= \sqrt{(10 \text{ m})^2 + (10 \text{ m})^2}$$

$$= 10\sqrt{2} \text{ m}$$

$$= 10 \times 1.414 \text{ m}$$

$$= 14.14 \text{ m along the direction OB}$$

- (e) Effects of force applied to a non-rigid body:
- The applied force can start or stop the motion of the body.
 - The applied force can change the dimensions of the body.

Answer 2

- (a) In uniform circular motion, the speed of the particle remains uniform but velocity changes.

- (b) The value of one division on the main scale division, $x = \frac{1}{20}$ cm

Given that the number of divisions on the vernier scale, $n = 25$

$$\therefore \text{LC of vernier} = \frac{x}{n} = \frac{(1/20)}{25} = 0.002 \text{ cm}$$

- (c)

- Force of attraction exerted by Earth on the book
 $= 0.6 \text{ kg} \times 9.8 \text{ N/kg}$
 $= 5.88 \text{ N (downward)}$
- Force exerted by book on the Earth = 5.88 N (upward)
- The book is in equilibrium under the action of two forces:
 A Force of 5.88 N exerted by the earth on the book is in the downward direction and a force of 5.88 N exerted by the palm is in the upward direction.

- (d)

- The cork will become tight.
- The cork will become loose.
- The cork will become loose.

- (e) It is because the thermal conductivity of copper is more than that of steel. Thus, it helps to transfer heat faster and more evenly than steel.

Answer 3

- (a) X-Invar Y-Brass

When contact points are close to each other at a lower temperature, due to contraction, the contact takes place and hence, the bell starts ringing.

- (b) Living organisms require numerous elements to regulate their biological activities and for the formation of protoplasm. These elements are called nutritive elements.

- (c) The pyrex glass has a very low coefficient of volume expansion than ordinary glass. It has a good heat resistance. Hence, a pyrex glass dish does not crack when heated strongly while an ordinary glass dish does crack.

- (d) In automobiles, to see the traffic at the back, convex mirror is preferred because it gives a much wider field of view of traffic than a plane mirror of the same size. Besides, the nature of the image formed by a convex mirror is always virtual, erect and smaller than the object.
- (e) When the object is moved away from the convex mirror, the distance of the image from the mirror increases (between pole and focus) and the size of the image gradually decreases. When the object is at infinity, the image is formed at focus.

Answer 4

- (a) The medium required for sound waves to travel in a medium should be elastic and particles of the medium must have inertia. Also, the medium should be frictionless.
- (b) Explosions produce sound waves which require material medium for their propagation. Since there is no medium between other planets, sound cannot travel through a vacuum medium. Thus, the sound of explosions that take place on the surface of other planets cannot reach the Earth and we cannot hear the explosions.
- (c) The distance travelled by the wave in one timeperiod of vibration is,
Wavelength $\lambda = \frac{0.4 \text{ m}}{20} = 0.02 \text{ m}$
Frequency $\nu = \frac{120 \text{ waves}}{60 \text{ s}} = 2 \text{ waves/s} = 2 \text{ Hz}$
Speed $V = \nu\lambda = 2 \text{ Hz} \times 0.02 \text{ m} = 0.04 \text{ m/s}$
- (d) A voltmeter is used to measure the potential difference between two points. A voltameter is a vessel used to carry out the process of electrolysis.
- (e) Three magnetic elements are:
i. Magnetic declination.
ii. Magnetic dip or inclination.
iii. Horizontal component of earth's magnetic field.

SECTION II

Answer 5

(a) The following are the properties of gravitational force:

- i. Gravitational force between two bodies forms an action-reaction pair i.e. the forces are equal in magnitude but opposite in direction.
- ii. Gravitational force acts along the line joining the centers of the two interacting bodies.
- iii. Gravitational force between the two bodies is independent of the nature of the intervening medium.
- iv. Gravitational force is negligible in case of light bodies but becomes appreciable in case of massive bodies like planets and stars.

(b) Given, $l_1 = 1 \text{ m}$, $T_1 = 2 \text{ s}$, $l_2 = 0.5 \text{ m}$, $T_2 = ?$

$$\frac{T_1}{T_2} = \sqrt{\frac{l_1}{l_2}}$$

$$\frac{2}{T_2} = \sqrt{\frac{1 \text{ m}}{0.5 \text{ m}}}$$

$$\frac{2}{T_2} = \sqrt{2}$$

$$\therefore T_2 = \frac{2}{\sqrt{2}}$$

$$= \sqrt{2}$$

$$\therefore T_2 = 1.414 \text{ s.}$$

(c) Mean focal length of the convex lens $\bar{f} = \frac{10.2 \text{ cm} + 10.1 \text{ cm} + 10.0 \text{ cm}}{3}$

$$= \frac{30.3 \text{ cm}}{3} = 10.1 \text{ cm}$$

Answer 6

(a)

i. Given $v = 0$, $u = u$, $h = ?$ $a = -g$ Using $v^2 = u^2 + 2as$

$$0 = u^2 + 2(-g) \times h$$

$$h = \frac{u^2}{2g} \dots\dots\dots(1)$$

ii. $v = 0$, $u = u$, $a = -g$, $t = ?$

$$v = u + at$$

$$0 = u + (-g) t$$

$$t = \frac{u}{g} \dots\dots\dots(2)$$

iii. Time of descent = Time of ascent = $\frac{u}{g}$ -----(From 2)iv. $u = 0$, $a = g$, $s = h$, $v = ?$ Using, $v^2 = u^2 + 2as$

$$v^2 = 0 + 2(g)(h)$$

$$v^2 = 2gh$$

$$v = \sqrt{2gh}.$$

(b) Uses of velocity-time graph:

- i. It is used to study the nature of motion of a body.
- ii. Slope of v-t graph at any instant gives the acceleration at that instant.
- iii. Area under the velocity-time curve gives the displacement of the body.

(c) Height attained by the rocket = Area of ΔOAB

$$= \frac{1}{2} \times 600 \text{ m/s} \times 40 \text{ s}$$

$$= 12000 \text{ m} = 12 \text{ km}$$

Answer 7

(a) Body Y has greater acceleration because its slope is more than the slope of X.

(b) Given $l_1 = 50 \text{ cm}$, $l_2 = 50.048 \text{ cm}$

$$\Delta l = l_2 - l_1 = 0.048 \text{ cm}$$

$$t_1 = 0^\circ\text{C}; t_2 = 353\text{K} = (353 - 273)^\circ\text{C} = 80^\circ\text{C}$$

$$\Delta t = t_2 - t_1 = 80^\circ\text{C} - 0^\circ\text{C} = 80^\circ\text{C}$$

$$\therefore \alpha = \frac{\Delta l}{l_1 \times \Delta t} = \frac{0.048 \text{ cm}}{50 \text{ cm} \times 80^\circ\text{C}} = 1.2 \times 10^{-5} \text{ }^\circ\text{C}^{-1}.$$

(c) Inertia is the property of a body or its inability to change its state of rest or of uniform motion by itself.

Inertia is of three types, viz.

- i. Inertia of rest: It is the inherent property of a body by virtue of which a body at rest will remain at rest unless an external force is applied on it.
- ii. Inertia of motion: It is the inherent property of a body by virtue of which a body in motion continues to remain in motion unless an external force is applied on it.
- iii. Inertia of direction: It is the inherent property of a body by virtue of which it is unable to change its direction of motion by itself.

Answer 8

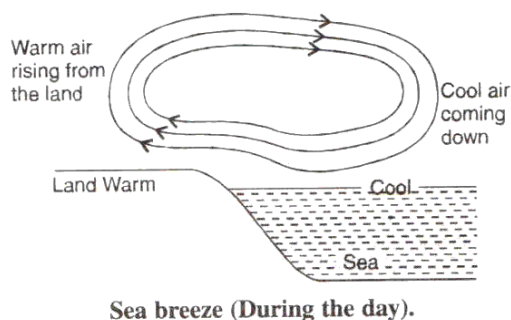
(a)

- i. Heat flows from a body at a higher temperature to a body at a lower temperature.
- ii. In heat exchange, the heat lost by the hot body is equal to the heat gained by the cold body.
- iii. Substances generally expand on heating.
- iv. A certain amount of heat known as latent heat is required to change the state of a body from solid to liquid or from liquid to gas without any change in temperature.
- v. On heating or cooling, the weight of the body remains the same.

(b) In cold regions, when atmospheric temperature falls below 0°C , the surfaces of rivers and lakes freeze. Water at 4°C being heavier sinks to the bottom, while at the surface, it turns into ice. Water remains in the state of liquid in the lower region. Thus, the aquatic animals move to the lower region in water and survive.

(c) The cold air blowing from the sea towards the land during the day is called sea breeze.

During day time, the land becomes hotter than the sea due to its large absorbing power and low specific heat capacity. In the evening, therefore, the air above the land, being more heated, expands and rises up. The colder air above the sea surface blows towards the land to take its place. This sets up the convection currents which form the sea breeze as shown in the figure.



Answer 9

(a) We know that, acceleration due to gravity , $g = \frac{GM}{R^2}$

On the earth,

$$g_E = \frac{GM_E}{R_E^2}$$

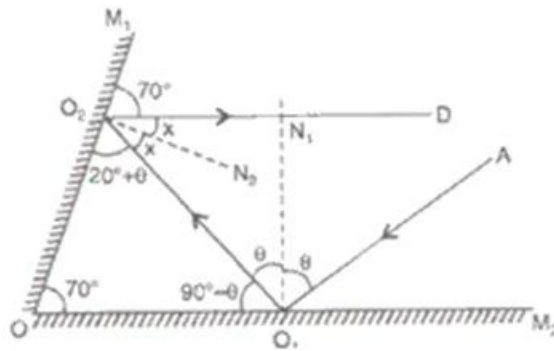
On the planet,

$$g_P = \frac{GM_P}{R_P^2}$$

According to the question, $M_P = \frac{M_E}{2}, R_P = \frac{R_E}{2}$

$$\begin{aligned} \therefore g_P &= \frac{GM_E}{2\left(\frac{R_E}{2}\right)^2} \\ &= \frac{2GM_E}{R_E^2} \\ &= 2(g_E) \\ &= 2 \times 9.8 \text{ m/s}^2 \\ &= 19.6 \text{ m/s}^2 \\ \therefore g_P &= 19.6 \text{ m/s}^2 \end{aligned}$$

(b)



Ray diagram is drawn as shown in the above figure

$$\angle M_1O_2D = \angle M_1O_2N_2 = 70^\circ$$

From the figure,

$$\begin{aligned} \angle O_2O_1O &= 90^\circ - \theta \text{ and } \angle OO_2O_1 = 180^\circ - (70^\circ + 90^\circ - \theta) \\ &= 20^\circ + \theta \end{aligned}$$

$$\angle N_2O_2O_1 = 90^\circ - (20^\circ + \theta) = 70^\circ - \theta$$

$$\text{But } \angle M_1O_2N_2 = 90^\circ$$

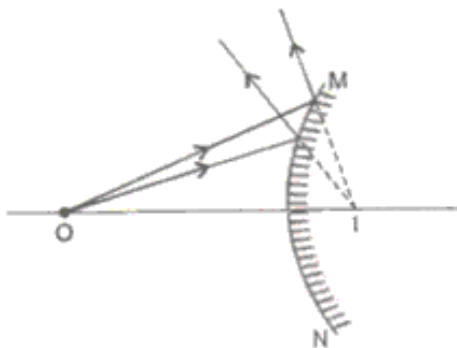
$$x = 90^\circ - (20^\circ + \theta) = 70^\circ - \theta$$

$$\text{As we know that } \angle M_1O_2D + \angle N_2O_2D = 90^\circ$$

$$70^\circ + 70^\circ - \theta = 90^\circ \rightarrow \theta = 50^\circ$$

(c)

i.



ii. Given: $\lambda_1 : \lambda_2 = 3 : 5$, $v_1 : v_2 = ?$

Applying $v = v\lambda$,

$$\frac{v_1}{v_2} = \frac{\lambda_2}{\lambda_1} = \frac{5}{3}$$

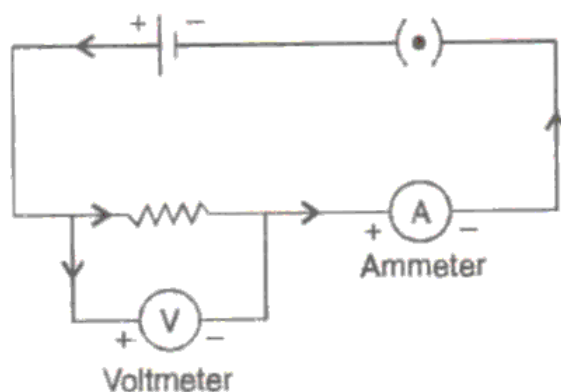
$$\Rightarrow v_1 : v_2 = 5 : 3$$

Answer 10

(a) Divergence of leaves increases.

Reason: When an ebonite rod is rubbed with fur, the ebonite rod is charged negatively and the fur is charged positively. When the positively charged fur is brought near the cap of a positively charged electroscope, it attracts electrons from the plate of the cap to the leaves. Thus, the positive charge on the plate and the leaves of the electroscope increases due to which, the leaves show greater divergence.

(b)



(c)

- i. The metal piece 'A' is called the magnetic keeper.
- ii. A is made of soft iron.
- iii. Piece 'A' preserves the magnetism in the magnet.
- iv. According to molecular (or domain) theory of magnetism, the magnet consists of a large number of tiny molecular magnets arranged in a particular direction. When a metal piece A is held between the north and the south poles of the magnet 'A' becomes a strong induced magnet. The magnetic dipoles in the horseshoe magnet and the metal piece 'A' form a closed loop with no free poles left. Thus, the metal piece 'A' serves the purpose of preventing demagnetization.