

ICSE Board
Class IX Physics
Paper - 5 Solution

SECTION I

Answer 1

(a) Yes, the weight of 1 kg iron and 1 kg cotton is same, i.e. $1 \text{ kg} \times 9.8 \text{ m/s}^2 = 9.8 \text{ N}$.

(b) Volume of the body = $100 \text{ cm}^3 = 10^{-4} \text{ m}^3 =$ Volume of the water displaced

Mass of the body = 1 kg

Weight of the body in air = $1 \text{ kg} \times 10 \text{ m/s}^2 = 10 \text{ N}$

Density of the water = 1000 kg/m^3

Mass = Density \times volume

Mass of the water displaced = $10^3 \text{ kg/m}^3 \times 10^{-4} \text{ m}^3 = 10^{-1} \text{ kg}$

Weight of the water displaced = Upthrust = $10^{-1} \times 10 = 1 \text{ N}$

Weight in the water = Weight of the body in air - Upthrust = $10 - 1 = 9 \text{ N}$

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

i. Height of Mount Everest = $9 \times 10^3 \text{ m}$

Order of magnitude = $10^{(3+1)} = 10^4$ because $9 > 3.2$

ii. Mass of a virus = $1 \times 10^{-15} \text{ kg}$

Order of magnitude = 10^{-15} as $1 < 3.2$

iii. Life expectancy of a man = $2 \times 10^9 \text{ s}$

Order of magnitude = 10^9 as $2 < 3.2$

iv. A speck of dust = $7 \times 10^{-10} \text{ kg}$

Order of magnitude = 10^{-9} as $7 > 3.2$

(d) 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:

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

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

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

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

(e) 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.

Answer 2

(a) The upper part of the mirror is made up of a convex mirror and the lower part is made up of a concave mirror.

(b) Normal reaction is the force exerted by a surface on an object in contact with it. The force is perpendicular to the surface and is the only force that the surface exerts on the object. Frictional force depends on this normal reaction.

(c) It demonstrates Newton's third law of motion which states that "To every action, there is an equal and opposite reaction".

(d) 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.

(e) The cement blocks, like any other solid, expand on heating. If no space is left in between the blocks, the force of the expanding block will produce cracks in them. Thus, to avoid such a situation, gaps are left between blocks and then filled with the pitch. The pitch being soft gets squeezed out when blocks expand.

Answer 3

(a) The graph shown in figure (iv) best describes the variation of volume of water with temperature.

(b) Given temperature in Celsius thermometer, $C = 60^{\circ}\text{C}$

Accurate temperature on a Fahrenheit scale is

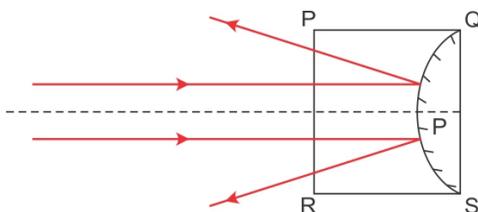
$$\begin{aligned} F &= \frac{9}{5}C + 32 \\ &= \frac{9}{5} \times 60 + 32 \\ &= 140^{\circ}\text{F} \end{aligned}$$

So, the error is $141 - 140 = 1^{\circ}\text{F}$.

(c) Non-renewable sources of energy are those sources which once exhausted are not easily available again. For example coal, petroleum etc.

(d) Rani (the object) is 5 feet from the mirror. Her image will be located 5 feet behind the mirror. Thus, the distance between Rani and the image will be 10 feet.

(e) The object inside PQRS is a convex mirror.



Answer 4

- (a) Concave mirror is used by a dentist to examine a cavity because it forms an erect and magnified image of an object placed nearby.
- (b) No, we cannot hear the ringing of a mobile phone placed in a vacuum chamber as sound waves need a medium to travel and in vacuum, there are no such particles.
- (c) Wavelength of the wave = 5m
Velocity of the wave = 300 m/s
Frequency = $\frac{\text{Velocity}}{\text{Wavelength}} = \frac{300 \text{ m/s}}{5 \text{ m}} = 60 \text{ Hz}$
- (d) No, the directions of conventional and electronic current are opposite to each other. Conventional current flows from the positive side of the battery to the negative side while electronic current is actually electron flow from the negative side to the positive side.
- (e) 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.

SECTION II

Answer 5

(a) Mean focal length = $\frac{(38.3 + 37.8 + 38.0 + 37.9 + 38.1 + 37.2)}{6} = 37.9 \text{ cm}$

(b) Distance = Circumference of the semi-circular path = $\pi \times r$
Displacement = Twice of radius = $2 \times r$

Ratio of distance to displacement of the particle = $\frac{\pi \times r}{2 \times r} = \frac{\pi}{2}$

(c) Order of magnitude of a physical quantity is its magnitude in powers of ten when that physical quantity is expressed in powers of ten with one digit to the left of the decimal.

70 years = $70 \times 365 \times 24 \times 60 = 36792000 \text{ min}$

No. of breaths per minute = 15

No. of breaths in 70 years = 36792000×15

$= 551880000 = 5.5 \times 10^8$

Since $5.5 > 3.2$, the order of magnitude is 10^9 .

Answer 6

(a)

- i. Acceleration is shown by time interval OA and DE.
- ii. Retardation is shown by time interval BC and CD.
- iii. Uniform velocity is shown by time interval AB.
- iv. Positive velocity is shown by time interval OC.
- v. Negative velocity is shown by time interval CE.

(b) Acceleration due to gravity is the constant acceleration produced in a body when it falls freely under the effect of gravity alone. Its value in SI unit is 9.8 m/s^2 and in CGS unit is 980 cm/s^2 .

(c) Both the balls will take the same time to hit the ground, because the vertical distance travelled by them is the same. The initial velocity in vertical direction for both of them is same i.e. 0. So, the time taken to reach the ground will be the same as both of them have the same acceleration 'g' in the vertical direction.

Answer 7

- (a) Let a body of mass m , moving with an initial velocity 'u' acquires a velocity 'v' in time 't' seconds.

Initial momentum of body, $p_1 = mu$

Final momentum, $p_2 = mv$

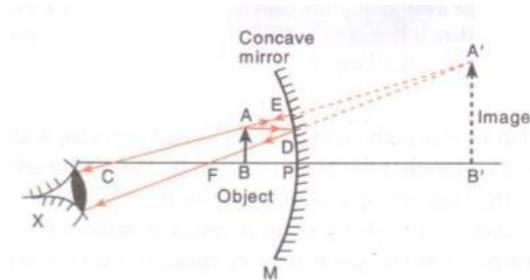
Change in momentum, $\Delta p = p_2 - p_1 = m(v-u)$

Rate of change of momentum = $\frac{\Delta p}{t}$

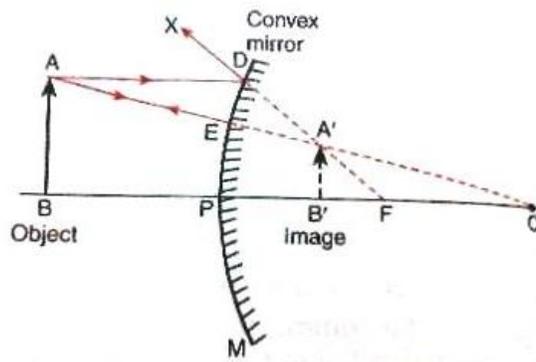
$$= \frac{m(v-u)}{t}$$

$$= m \times a \quad \left[\because \frac{v-u}{t} = a \right]$$

- (b) Concave mirrors are used as shaving mirrors. This is because when the face is placed close to a concave mirror (so that, the face is within its focus); the concave mirror produces a magnified and erect image of the face. Since a large image of the face is seen in the concave mirror, it becomes easier to make a smooth shave.



Convex mirrors are used as rear-view mirrors because they always produce an erect image of the object and have a wider field of view.



- (c) Forests are considered as the most important carbon dioxide sinks because the trees in the forests take up carbon dioxide and convert it into oxygen; thus, reducing the amount of carbon dioxide in the atmosphere and bringing them under control. This helps in maintaining the Earth's temperature within a limit and prevents the greenhouse gas from damaging the environment.

Answer 8

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

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

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

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

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

Therefore, volume of copper contained in the alloy,

$$= \frac{m}{8.9 \text{ g / cm}^3} = \frac{7.61 \text{ g}}{8.9 \text{ g / cm}^3} = 0.86 \text{ cm}^3$$

(b) Mud is a bad conductor of heat and so is the air trapped in the thatch of the roof. Thus, in summer, the heat from outside does not flow in and, hence, it keeps the inner side cool. Conversely, in winter, the heat from within does not flow out and it keeps the interior warm.

The concrete houses are somewhat more conducting than mud houses. Thus, the heat in summer flows in and makes it hot inside. Conversely, the heat from within flows out in winter and keeps it cool.

(c)

i. $l_t = l_o (1 + \alpha T)$

Where, T is the temperature and α is the coefficient of linear expansion

ii. $\alpha = \frac{1}{2} \beta$

iii. $\gamma = 3 \alpha$

Answer 9

(a) Interior of a car becomes hot after being parked in the sun because the heat entering the car through the windows, after reflection, cannot escape back due to greenhouse effect.

(b)

- i. Mechanical wave is a wave that needs a medium to travel. The oscillating material does not move from its initial equilibrium position, as only the energy is transferred by connected particles.
- ii. Electromagnetic wave is a wave of energy having a frequency within the electromagnetic spectrum and propagates as periodic oscillation of electric and magnetic fields perpendicular to each other.
- iii. Sound is a mechanical wave that is an oscillation of pressure transmitted through solid, liquid, or gas.

(c)

- i. Distance of image from the mirror = Distance of object from the mirror = 3.5 m
The patient is sitting 2 m away from the mirror; so, the distance of the image from the patient = $2 + 3.5 = 5.5$ m
- ii.
 1. Principal axis - It is an imaginary straight line passing through the centre of curvatures of a spherical mirror.
 2. Focus is the point on the principal axis where all the rays travelling parallel to the principal axis, after reflection from the mirror, converge or appear to converge.

Answer 10

(a)

- i. Negative charge is induced in the near end of A; so, there will be attraction. A will be attracted towards the rod.
- ii. Negative on A and positive on B.
- iii. Due to attraction of the positive charge of the rod, electrons move towards A. So, there will be positive charge on B owing to the deficiency of electrons and negative charge on A owing to excess of electrons.

(b)

- i. Voltage of a battery cell tells us about the difference of static charge available on the two terminals of a battery cell.
- ii. Electrons leave from the negative terminal of the battery.
- iii. The conventional current flows from the positive terminal to the negative terminal of the battery.

(c) The cause of Earth's magnetism is not very clear. However, for the sake of simplicity, the following assumptions are made regarding Earth's magnetism.

1. It is assumed that at the centre of the Earth, a huge bar magnet is buried.
2. The south end of the Earth's bar magnet points towards the geographic North Pole and vice versa.
3. The axis of the Earth's magnet is not in line with geographical axis, but makes a small angle with it.
4. The magnetic lines of force of the Earth's magnet originate from its north pole (which is towards its geographic South Pole) and end up at its south pole.
5. The magnetic lines of force at any place on the surface of earth, travel parallel to each other and hence, Earth's magnetic field at a given place is uniform.
6. The intensity of the magnetic field of the Earth is maximum at magnetic poles and minimum at magnetic equator.