

**ICSE Board
Class IX Physics
Paper - 3 Solution**

SECTION I

Answer 1

(a)

- i. Minute
- ii. Hour
- iii. Day
- iv. Month

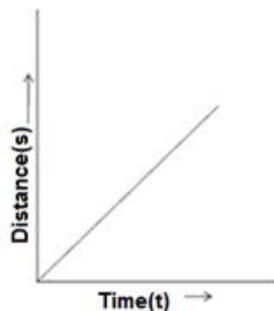
(b) $10^5 \text{ dyne} = 1 \text{ kg m/s}^2$

$$\therefore 100 \text{ dyne} = \frac{1}{10^5} \times 100 \text{ kg m/s}^2 = 10^{-3} \text{ kg m/s}^2 \text{ or } 10^{-3} \text{ N}$$

(c) Two simple aspects that relate atmospheric pressure and weather changes are:

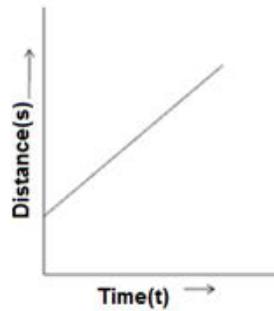
- i. Rise in temperature lowers the density of air and hence, lowers the atmospheric pressure ($P = h \rho g$)
- ii. Rise in humidity or water vapour content in the atmosphere lowers the density of atmospheric air and hence, lowers the atmospheric pressure.

(d)



Body moving with uniform speed
when its initial displacement is zero

(i)



Body moving with uniform speed
when its initial displacement is
not zero

(ii)

(e) Give: $m = 80 \text{ tonnes} = 80 \times 1000 \text{ kg} = 8 \times 10^4 \text{ kg}$

$$a = 2 \text{ m/s}^2$$

$$F = ?$$

$$F = ma = 8 \times 10^4 \text{ kg} \times 2 \text{ m/s}^2 = 160000 \text{ N}$$

Answer 2

- (a) A Stretched spring or a compressed spring exerts force on the objects attached to its ends.
- (b) Carbon dioxide gas is mostly produced by combustion of organic matter (like coal, oil and wood), by fermentation and respiration processes in living organisms.
- (c) Initially, the person and the horse are in the state of rest. When the horse darts off suddenly, the person due to inertia of rest, tends to continue in its state of rest. Hence, the person falls in the backward direction.
- (d) Metal scales/measuring tapes expand or contract due to variation in temperature but they are calibrated by the manufacturer at a particular temperature. This is why, an alloy of iron and nickel called invar is used to make metallic scales/measuring tapes. The coefficient of linear expansion of invar is very low; so, the change in length with the variation in temperature is negligible.

- (e) The Fahrenheit to Celsius conversion formula is:

$$F = \frac{9}{5}C + 32$$

i. $F = \frac{9}{5}C + 32$
 $= \frac{9}{5} \times 0 + 32 = 32^{\circ}\text{F}$

ii. $F = \frac{9}{5}C + 32$
 $= \frac{9}{5} \times 100 + 32 = 212^{\circ}\text{F}$

Answer 3

- (a) One could pound a nail with a hammer and make it hot by doing work on it. Another way is, putting the nail in contact with something at a higher temperature which raises the nail's temperature.
- (b) First law of thermodynamics states that "Energy can be transformed from one form to another, but it can neither be created nor destroyed".
- (c) Dark room acts as the box of a pinhole camera, the keyhole acts as the pinhole and the wall opposite to the keyhole acts as the screen. Thus, the inverted and diminished image of the distant building is formed on the wall.
- (d) Distant images are produced due to multiple reflections. At each reflection, a part of incident light energy is lost due to absorption. So, the images get fainter and fainter.

- (e) Concave mirror gives a magnified image which helps in shaving. For such an image, the face must be placed between the pole and the focus of the mirror. So, the mirror should be of a reasonably long focal length.

Answer 4

- (a) Since the distance of the image from the mirror is equal to the distance of the object (observer) from the mirror at every instant during his motion, the speed of his image with respect to him will be $v + v = 2v$ m/s.

- (b) Velocity of sound is inversely proportional to the square root of density. Moist air has less density than dry air. Due to this, sound travels faster on a cloudy day.

- (c) Given: $T = 2 \times 10^{-3}$ s, $\lambda = 3$ m, $v = ?$

$$v = \frac{\lambda}{T} = \frac{3 \text{ m}}{2 \times 10^{-3}} = 1.5 \times 10^3 \text{ m / s} = 1500 \text{ m / s}$$

The speed of the wave in the medium = 1500 m/s

- (d) We can draw maximum current from a secondary cell as its internal resistance is very small.
- (e) No, on breaking a magnet each piece becomes a complete magnet, i.e. it consists of North Pole and South Pole. Hence, the two poles cannot be separated.

SECTION II

Answer 5

(a)

$$\begin{aligned}\text{Least count of vernier callipers} &= \frac{\text{Value of one main scale division (s)}}{\text{Total number of divisions on vernier (n)}} \\ &= \frac{0.1 \text{ cm}}{10} = 0.01 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Measured length} &= \text{MSR} + \text{VSD} \times \text{LC} \\ &= 56 \text{ cm} \times 0.1 \text{ cm} + 8 \times 0.01 \text{ cm} \\ &= 5.6 \text{ cm} + 0.08 \text{ cm} = 5.68 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Corrected length} &= \text{Measured length} - \text{Correction} \\ &= 5.68 - (-0.09) \text{ cm} = 5.77 \text{ cm}\end{aligned}$$

(b)

- i. 1 mm
- ii. 0.1 mm
- iii. 0.001 cm
- iv. 0.1°C
- v. 1 degree
- vi. 5 g

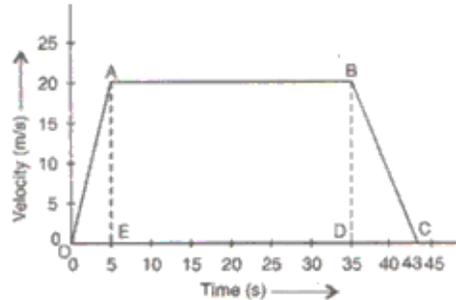
(c)

- i. Graph is a visual presentation of variation of one variable with respect to another. To plot a graph between two variables (independent and dependent variables), the two necessary steps are:
 - 1) Selection and mentioning of the scale used on each axis.
 - 2) Plotting of points with crosses or dots and circles.
- ii. The pressure at the bottom will be equal in both the tanks because the pressure depends on the height of the liquid column which is same in both the tanks ($P = h \rho g$). It does not depend on the width or shape of containers.

Answer 6

(a)

i. v - t graph of the lift:



ii. Acceleration of the lift = $\frac{v - u}{t} = \frac{(20 - 0) \text{ m/s}}{(5 - 0) \text{ s}}$

= 4 m/s²

iii. Retardation of the lift = $\frac{(0 - 20) \text{ m/s}}{(43 - 35) \text{ s}}$

= - $\frac{20}{8}$ m/s²

= -2.5 m/s²

iv. Height of the building = Area of ($\Delta OAE + \square ABDE + \Delta BDC$)

= $\frac{1}{2} \times 20 \text{ m/s} \times 5 \text{ s} + 20 \text{ m/s} \times 30 \text{ s} + \frac{1}{2} \times 20 \text{ m/s} \times 8 \text{ s}$

= 50 m + 600 m + 80 m = 730 m

(b) We know that $v^2 = u^2 + 2as$

Here $u = 0$

$\Rightarrow v^2 = 0^2 + 2as \Rightarrow v = \sqrt{2as}$

As the body is moving with uniform acceleration, $v \propto \sqrt{s}$

i.e. v is directly proportional to the square root of the distance travelled.

(c)

i. A body can travel opposite to its acceleration, e.g. when a body is projected upwards with some initial velocity, it travels in upward direction and its acceleration 'g' will be in the downward direction.

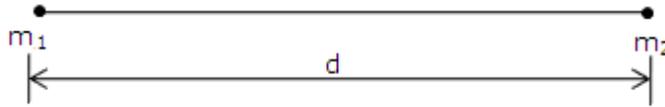
ii. As we know, Acceleration = $\frac{\text{Change in velocity}}{\text{Time taken}}$

= $\frac{\text{Change in displacement/time taken}}{\text{Time taken}} = \frac{\text{Change in velocity}}{(\text{Time taken})^2}$

Hence, square of time occurs in a unit of acceleration.

Answer 7

- (a) Newton's law of gravitation states that “Each particle attracts every other particle in the universe. The force between them is directly proportional to the product of their masses and inversely proportional to the square of the distance between them”.



$$F = \frac{Gm_1m_2}{d^2}$$

Where, G is the universal gravitational constant.

The force of attraction between any two bodies is known as gravitation. On the other hand, the force with which the earth attracts any other body is called gravity.

- (b) Ends of the girders supporting iron bridges are not firmly built into the pillars of concrete on which they rest, but they are supported on rollers to allow them to expand or contract due to variation in temperature without affecting the supporting pillars.

(c)

- i. It is correct to say that Newton's second law of motion is the real law of motion because the first law of motion and the third law of motion are contained in the second law of motion.

- ii. Given: $m=5\text{kg}$, $F=1\text{ N}$, $u=0$, $t=20\text{ s}$, $s=?$

$$a = \frac{F}{m} = \frac{1\text{ N}}{5\text{ kg}} = 0.2\text{ ms}^{-2}$$

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

$$= 0 \times 20 + \frac{1}{2} \times 0.2 \times (20)^2$$

$$= 40\text{ m}$$

Answer 8

(a) Given: Original area of plate $A_1 = 3 \text{ m}^2$

Increase in temperature $\Delta T = 40 - 0 = 40^\circ\text{C}$

Increase in area $\Delta A = \beta A \Delta T$

But $\beta = 2\alpha$

$$= 2 \times 0.000016^\circ\text{C}^{-1}$$

$$= 0.000032^\circ\text{C}^{-1}$$

$$\therefore \Delta A = 0.00032^\circ\text{C}^{-1} \times 3 \text{ m}^2 \times 40^\circ\text{C}$$

$$= 3.84 \times 10^{-3} \text{ m}^2$$

The area of plate when it is heated through $40^\circ\text{C} = 3.84 \times 10^{-3} \text{ m}^2$

(b)

- i. The test tube expands first, not the coloured water. Due to an increase in the volume of the test tube, the level of water drops from A to B.
- ii. Liquid after gaining heat expands and hence, level of liquid rises to C.
- iii. Liquid expands on heating. Their expansion is more than solids (glass).
- iv. Initially, the level of liquid rises in the glass tube and then falls down because initially, the glass tube contracts but not coloured water. Thus, the level of water rises up. However, when coloured liquid contracts, the level falls down.

(c)

i. $\gamma = 3\alpha$

where, γ is the coefficient of volume expansion
and α , the coefficient of linear expansion

- ii. Radius will undergo least percentage increase because coefficient of linear expansion is least. Volume will undergo largest percentage increase because coefficient of volume expansion is the largest.

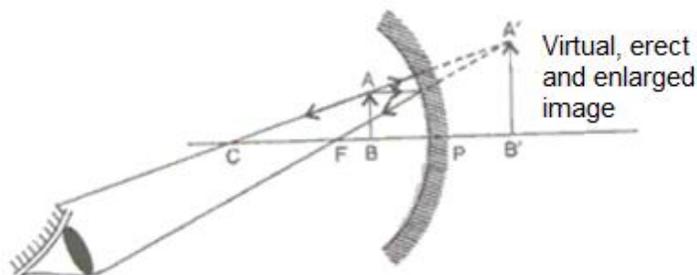
Answer 9

(a) Ultrasonic vibrations are used:

- i. For welding metals having high melting point.
- ii. For scanning various organs of the human body.
- iii. For homogenising milk.
- iv. As insects and rat repellants.

(b)

- i. Correct time is 7:25. Anomaly is due to lateral inversion.
- ii.



(c)

- i. A plane mirror.
- ii. A spherical mirror.
- iii. Focal length of the spherical mirror, $f = \frac{\text{Radius of curvature (R)}}{2}$
- iv. They receive parallel rays and focus them on the receiver.

Answer 10

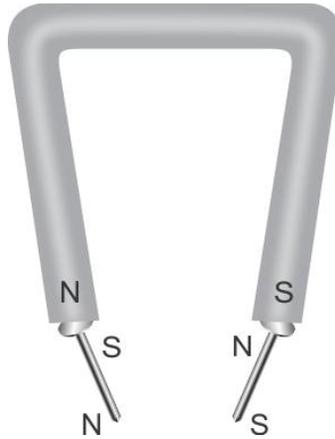
(a) The divergence of leaves increases.

Reason: When a glass rod is rubbed with silk, the glass rod becomes positively charged. On bringing the rod near the conductor, the near surface of the conductor gets negatively charged, while the far surface gets positively charged by induction. When the proof plane is touched at the far surface of the conductor, it gets positively charged. Now, when it is touched to the cap of a positively charged gold-leaf electroscope, positive charge on the plate and the leaves of the electroscope increases due to which the divergence of leaves increases.

(b) Dry cell is not really dry as it contains ammonium chloride jelly. Moreover, as the chemical reaction proceeds within the cell, water is one of the products. Thus, the content of moisture goes on increasing as the cell is being discharged.

(c)

- i. Figure shows the lower ends of the needles near each other (or touching each other). They have opposite polarities developed due to induction. The upper ends are touching the poles of the magnet, having polarities opposite to that of the magnet. This phenomenon is called magnetic induction.



- ii. Magnetism can be lost by heating.