ICSE Board
Class IX Physics
Paper – 4 Solution

SECTION I

Answer 1

(a) 1 hour = 60 min = 60 ×60 s = 3600 s

1 day = 24 hours = 24 × 3600 s

1 year = 365 days = 365 × 3600 × 24 s = 31536000 s

(b) A second's pendulum takes 2 seconds to complete one oscillation.

So, time period, T = 2 sec

Frequency, $f = \frac{1}{T}$

$= \frac{1}{2} = 0.5$ Hz

Frequency does not depend upon the amplitude of oscillation.

(c) The balance is in equilibrium when the moment due to the weight of an object on one side of the beam is equal to the moment due to the standard weights on the other side of the beam.

(d) $\frac{u_1}{u_2} = \frac{2}{5}$

$v^2 - u^2 = 2ah$

$v_1 = v_2 = 0$

$a_1 = a_2 = -g = -9.8\,m/s^2$

$\Rightarrow \frac{u_1^2}{u_2^2} = \frac{a_1 h_1}{a_2 h_2}$

$\frac{4}{25} = \frac{h_1}{h_2}$

$\therefore$ Ratio of heights attain is 4 : 25.

(e) Carbon dioxide and methane are two green house gases. They increase the temperature of the earth by not allowing the heat to radiate back into space.

Answer 2

(a) The displacement of the bullet is zero because the bullet has returned to its initial position.

(b) Volume of the room = 4.5 m × 3.5 m × 2.5 m =39.375 m^3

Density of air, $\rho = 1.3\ kg/m^3$

Mass of air, m = ?

$$\rho = \frac{m}{V}$$

$$m = \rho \times V$$

$$1.3 \times 39.375 = 51.19\ kg$$

(c) Yes, the jet of hot gases ejected from the tail is responsible for the propulsion of the rocket. This is because the rocket exerts a force (action) on the gases to expel them through the tail backwards and the outgoing gases exert an equal and opposite force (reaction) on the rocket due to which it moves in the forward direction.

(d) Red hot rivets are pushed into the holes in the plates and hammered tightly. When these rivets cool down, they contract and hold the plates tightly.

(e)

1. Internal diameter of washer increases.
2. Mass of washer remains same.
3. Density of washer decreases.
4. Volume of washer increases.

Answer 3

(a) When placed in water, the focal length of a spherical mirror remains the same.

(b) $F = -362^oF$, $C = ?$

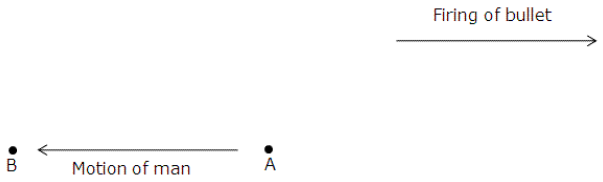
$$\frac{F - 32}{9} = \frac{C}{5}$$

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

$$= \frac{5}{9} \times -362 - 32$$

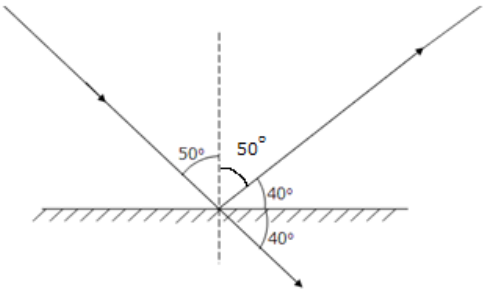
$$= \frac{5}{9} \times -394 = 218.88\ ^oC$$

(c) Newton's third law states that "To every action there is always an equal and opposite reaction". Consider the surface of a frozen pond to be totally frictionless. To move to a point B from a point A, the man should shoot his first bullet in the direction opposite to the direction of B. On reaching point B, to stop himself he should fire his second bullet in the opposite direction.



(d) The observer can differentiate between the two films only if he knows that the barber is left handed or right handed because in a plane mirror, the image is of the same size but laterally inverted. Without this knowledge about the barber, the observer cannot differentiate between the object and the image.

(e)



i. Angle of reflection = Angle of incidence = 50^o
ii. Angle between the incident ray and the mirror = 90^o - Angle of incidence
$= 90^o - 50^o = 40^o$
iii. Angle between the reflected ray and the mirror = 90^o - Angle of reflection
$= 90^o - 50^o = 40^o$
iv. Angle of deviation = 2 (90^o – Angle of incidence)
$=2 \times (90^o - 50^o) = 2 \times 40^o = 80^o$

Answer 4

(a) The speed of sound is more in humid air because the density of air decreases in the presence of moisture.

(b) Here, $\theta = 30^{o}$

The number of images formed = $\frac{360}{\theta} - 1$

$= \frac{360}{30} - 1$

$= 12 - 1 = 11$

(c) From the figure we can see that the wavelength of the wave = 0.8 cm = 8×10^{-3} m.
Frequency = 250 Hz
Velocity = Wavelength x Frequency
$= 8 \times 10^{-3} \times 250 = 2$ m/s

(d) Yes. When the charge on one, say A, is much larger than the charge on the other, say B, on account of induction, the body B, carrying a smaller charge shall acquire some net charge of the opposite sign lying closer to A. Hence, 'B' will experience some net force of attraction.

(e) If a bar magnet is cut into two equal pieces (either transverse to length or along the length), the magnetic strength of each part becomes half of the magnetic strength of the original magnet.

SECTION II

Answer 5

(a) The pitch of a screw gauge is the linear distance moved by its screw on the main scale when the circular scale is given one complete rotation.

$$\text{Pitch} = \frac{1\,\text{mm}}{2} = 0.5\,\text{mm}$$

$$\text{LC} = \frac{\text{Pitch}}{\text{No. of divisions on circular scale}} = \frac{0.5\,\text{mm}}{50} = 0.01\,\text{mm}$$

$\text{MSR} = 0.05\,\text{cm} = 0.5\,\text{mm}$

$\text{CSR} = 27 \times 0.01\,\text{mm} = 0.27\,\text{mm}$

$\text{Diameter of wire} = \text{MSR} + \text{CSR}$

$= 0.5\,\text{mm} + 0.27\,\text{mm}$

$= 0.77\,\text{mm} = 0.077\,\text{cm}$

(b) Mass of water displaced by the stone, m = 1.5 kg

We know that,

Weight = Mass × Acceleration due to gravity

= m × g

Weight of the water displaced = 1.5 × 9.8 N = 14.7 N

In accordance with Archimedes' Principle, when an object is wholly or partially immersed in a liquid, it experiences a buoyant force or upthrust which is equal to the weight of the liquid displaced by the object.

The buoyant force acting on the stone is 14.7 N.

(c) Force on the table = 8 N

Area of the side of the glass slab in contact with table = 10 x 10 = 100 cm^2 = 0.01 m^2

$$\text{Pressure on the table} = \frac{\text{Force}}{\text{Area}} = \frac{8}{0.01} = 800\,\text{Pa}$$

When the slab is tilted, the area of the side of the glass slab in contact with the table

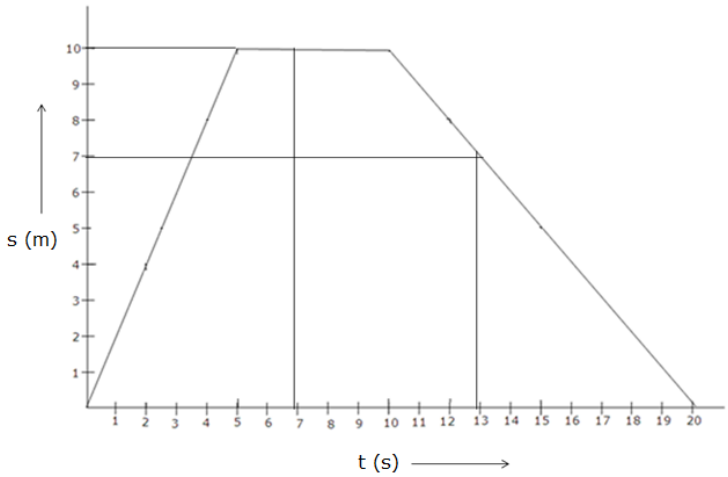
= 10 × 4 = 40 cm^2 = 0.004 m^2

$$\text{Pressure on the table} = \frac{\text{Force}}{\text{Area}} = \frac{8}{0.004} = 2000\,\text{Pa}$$

The pressure will increase as the area of contact of the slab with the table decreases.

Answer 6

(a)

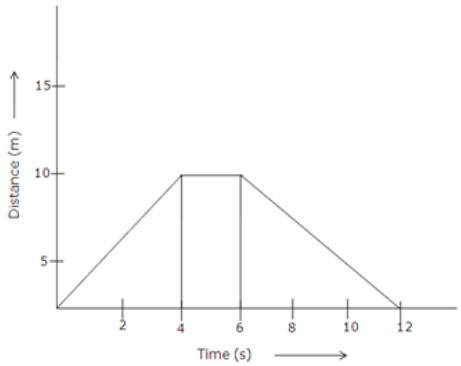


From the graph, we find that
Displacement of the body at 7 s = 10 m
Displacement of the body at 13 s = 7 m

(b) Initial velocity u = 0
Final velocity v = 20 m /s
Distance s = 40 m

Using third equation of motion to obtain acceleration
$v^2 - u^2 = 2as$
$20^2 - 0 = 2 \times a \times 40$
$a = 400/80 = 5\ m/s^2$
To obtain time, we use first equation of motion
$v = u + at$
$t = (v - u)/a$
$t = 20/ 5 = 4\ s$

(c)



Total displacement is zero because the person has returned to his initial position.

Answer 7

(a) The masses of P and Q are equal.

Velocity of P = v

Velocity of Q = 5v

Momentum of P, $M_p = mv$

Momentum of Q, $M_q = 5\ mv$

The ratio of momentum $M_p/M_Q = 1/5$

The inertia is only dependent on the mass of the body; so, the ratio of inertia is 1:1.

(b) Hydrostatic pressure = $\rho\ gh$

where h = 1.5 m

g = 10 m/s^2

ρ = 1030 kg/m^3

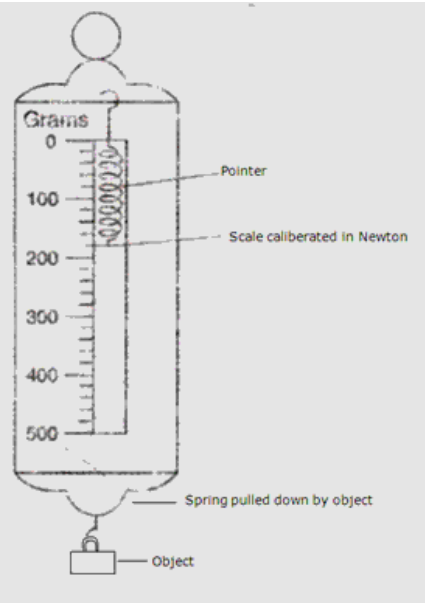
Hydrostatic pressure = 1030 × 10 × 1.5 = 15450 Pa

1 Pa = 10^{-5} bar

15450 Pa = 15450 × 10^{-5} bar

(c) Spring balance utilizes the relationship between the applied load and the deformation of a spring. This relationship is usually linear; the more the applied load the more is the deformation of the spring. The body to be weighed is suspended to one end of a hook which is attached to a spring whose pointer is free to move over a scale that is calibrated with standard weights. The body pulls the spring due to gravitational force and its weight is shown on the calibrated scale.

Diagram of a spring balance is as shown in the figure.



Answer 8

(a) A freezing mixture is a mixture of two substances, usually ice and salt. The mixture has a low melting point. It is used as cooling bath in laboratories and in ice cream parlors to freeze ice creams. Usually, ice has a melting point of $0^{o}C$ and salt is added to lower this melting point of ice.

(b)

Renewable resources	Non-renewable resources
1. These are the resources which can be utilized continuously over a very long period of time.	1. These are the resources which cannot be continuously utilized over a very long period of time.
2. These resources can be regenerated.	2. These resources cannot be regenerated.
3. Examples: Air, water	3. Examples: Fossil fuels, wood

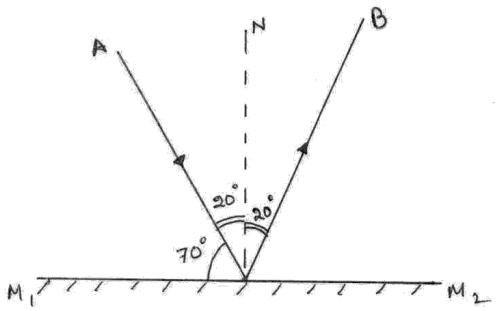
(c)

i. Adverse consequences of anomalous expansion of water:
   1. In cold countries, water pipes burst in winters.
   2. Ice cream moulds break while freezing the ice-cream.

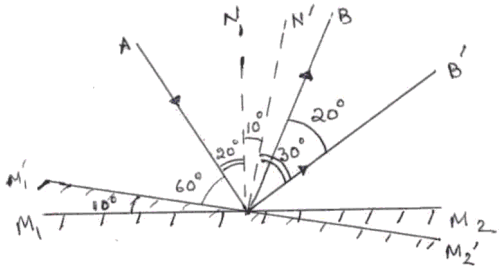
ii. This is because floor tiles absorb heat rapidly. This means that if you stand bare foot on the tiles, a lot of heat is drawn out of your foot. A carpet, in comparison absorbs heat slowly. This makes the tiles-floor feel colder than a carpet when they are actually the same temperature.

Answer 9

(a) Initially, the ray diagram is



After titling the mirrors by 10^o, the incident angle becomes 60^o. The ray diagram is



Angle between incident ray and final reflected ray = $30^o + 30^o = 60^o$

(b)

i. We will observe that the paper starts burning.
ii. No, because a convex mirror diverges the light rays incident on it.
iii. Radius of curvature is twice the focal length of the mirror, R = 2f

(c)

i. Two uses of convex mirrors are as follows:
    1. It is used as a rear view mirror in vehicles.
    2. It is used as a reflector in street lamps

ii. Wave motion is the means of transferring energy and momentum from one point to another without any actual transportation of matter between them. Characteristics of wave motion are:
    1. It is a sort of disturbance travelling through a medium.
    2. When a wave motion passes through a medium, the particles of the medium vibrate.

Answer 10

(a)

i. End A will have a positive charge.
ii. End B will have a negative charge.
iii. The cap of the electrosope will have a negative charge.
iv. The charge on the gold leaves will be negative.
v. Leaves will diverge by repelling each other.
vi. If the electroscope is now earthed then the charge on metal rod will be positive.

(b) A is the switch; B is the battery cell; C is the ammeter; D is the resistance; E is the voltmeter; F is the variable resistance.

(c)

i. The magnetic strength reduces to half.
ii. The magnetic strength reduces to half.
iii. Not all iron bars are magnets because the molecular magnets present in the iron bars are randomly aligned. For an iron bar to be a magnet, the molecular magnets should be aligned in one direction.