ICSE Board
Class IX Physics
Paper – 2 Solution

SECTION I

Answer 1

(a) Unit is a standard quantity of the same kind with which a physical quantity is compared for measuring it. The SI unit of length is meter (m).

(b) The fundamental quantities and their units in SI system are:

Quantity	Unit
Length	meter
Mass	kilogram
Time	second
Temperature	kelvin
Luminous intensity	candela
Electric current	ampere
Amount of substance	mole
Angle	radian
Solid angle	steradian

(c)
   i. $375000 \text{ kg} = 3.75 \times 10^5 \text{ kg}$
      As numerical value is greater than 3.2, the order of magnitude is 10^6 kg.
   ii. $0.0007 \text{ m} = 7.0 \times 10^{-4} \text{ m}$
      As numerical value is greater than 3.2, the order of magnitude is 10^{-3} m.

(d) Parsec refers to the distance at which an arc of length equal to 1 A.U. subtends an angle of one second at a point.

(e) The physical quantities like speed, area, volume, density etc. can be expressed in terms of mass, length and time. These are called derived physical quantities. The corresponding units of derived physical quantities are known as derived units.

Answer 2

(a)
    i.   Objects fall towards the earth due to the force of gravitation of the earth.

   ii.   When a force acts on a body, it is called an action.

(b)
    i.   One Newton is the force which when applied to a body of mass 1 kg produces an acceleration of 1 m/s^2 in it.

   ii.   SI unit of force is Newton and CGS unit of force is dyne.

       1 Newton = 10^5 dyne

$$\therefore \frac{1\,\text{newton}}{1\,\text{dyne}} = \frac{10^5}{1}$$

       The ratio of SI to CGS units of force = 10^5:1

(c) According to Newton's second law of motion, the rate of change of momentum of a body is directly proportional to the force applied on it and the change in momentum takes place in the direction in which the force is applied.

(d)
    i.   When the velocity of a body decreases with time, the rate of change of velocity with time is called retardation.

   ii.
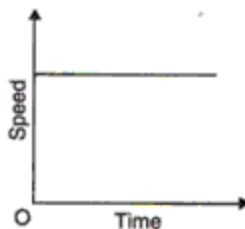
       The given graph represents motion with uniform speed.

(e) Initial velocity of the body, u =0

      Acceleration of body, a = 2 ms^{-2}

      Time of travel, t = 2 s

      Distance covered, s =?

      From Newton's second equation of motion, we have

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

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

$$= 4\,\text{m}$$

      The distance covered by the body in 2 s =4 m

Answer 3

(a) The air conditioner in a room is installed near the ceiling so as to produce quick cooling in the room. The reason is that the cooled air from the air conditioner descends down while the hot air from below rises up and thus, convection current is set up.

(b) Water pipelines often burst during severe frost because water freezes at sub-zero temperature and expands. Since there is no space in the pipes for expansion of freezing water, it therefore exerts large pressure on the pipes; thereby, bursting them.

(c) We can distinguish between a concave mirror and a convex mirror without touching them by bringing each mirror close to our face and observing the nature of the image of our face in the mirror. If the image is magnified, it is a concave mirror and if the image is diminished, it is a convex mirror.

(d) In the process of convection, heat is transferred from one point to another by actual movement of particles of the medium and as particles of solid cannot move, the process of convection is not possible in case of solids.

(e) When an object is brought close to a concave mirror from infinity, the image size increases from point-size to highly-magnified till the object reaches the focus. When the object is brought further close to the mirror, the image formed is magnified but virtual.

Answer 4

(a) A convex mirror is preferred as a rear view mirror in a truck because convex mirror always gives an erect image and it has a wider field of view than a plane mirror.

(b)
 i. Sound is produced when a body vibrates.
 ii. We cannot hear each other on the Moon's surface. This is because sound waves require a material medium to propagate and on the Moon's surface, there is no atmosphere; so, sound waves cannot travel on the Moon.

(c) When a positively charged rod is brought near the disc of a positively charged gold leaf electroscope, the divergence of the leaves increases. This is because the electrons move from the leaves to the disc with the result that positive charge on the leaves increases.

(d) The resistance of a wire depends on:
 i. The length of the wire
 ii. The area of the cross section of the wire
 iii. The temperature of the wire
 iv. The material of the wire

3

(e)
    i. The magnetic force appears to be concentrated near the ends of a bar magnet. These ends are called the poles of the bar magnet.

    ii. Neutral points are the points where the magnetic field of a magnet is equal in magnitude to the earth's horizontal magnetic field but in the opposite direction.

SECTION II

Answer 5

(a) A body in a state of motion continues to move with the same speed in the same direction in a straight line unless an external force is applied on it to change its state. This property of the body is called inertia of motion. Or simply, the tendency of a moving body to continue its state of motion unless acted upon by an external force.

A book lying on a table will remain there unless it is displaced by some external force. This is an example of inertia of rest.

A ball rolling on the ground will continue to roll unless the external force i.e. the force of friction between the ball and the ground stops it. This is an example of inertia of motion.

(b) Mass of a body is the quantity of matter contained in it. The SI unit of mass is kg.

(c) The laws of liquid pressure are:
    i. Pressure inside the liquid increases with the depth from the free surface of the liquid.
    ii. Pressure is same at all points on a horizontal plane, in case of a stationary liquid.
    iii. Pressure is same in all directions about a point inside the liquid.
    iv. Pressure at same depth is different in different liquids. It increases with the increase in the density of the liquid.
    v. A liquid will always seek its own level.

Answer 6

(a) Consider a vessel containing a stationary liquid of density ρ. Consider a horizontal surface PQ within the liquid at a depth h below the free surface XY. Let the surface area of PQ be A.
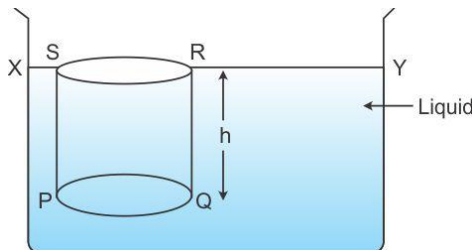
The total force acting on the surface PQ will be equal to the weight of the liquid column PQRS, i.e. product of mass 'm' of the liquid column of height 'h' and acceleration due to gravity 'g'.

Therefore,

$$\text{Pressure}(P) = \frac{\text{Thrust on the surface}(F)}{\text{Area of the surface}(A)}$$

$$= \frac{mg}{A}$$

$$= \frac{V\rho g}{A} \quad \left\{ \because \text{Mass}(m) \text{ of the liquid column} = \text{Volume of liquid in the column} \atop \times \text{Density of the liquid} \right\}$$

$$= \frac{Ah\rho g}{A} \quad \{\because \text{Volume}(V) = \text{Area}(A) \times \text{Height}(h)\}$$

$$\Rightarrow P = h\rho g$$

(b) Periscope is a device used to see an object which is not directly seen due to certain obstacles. The principle employed in a periscope is successive reflections from two parallel plane mirrors.

(c) Correct time is 7:25. This anomaly occurs due to lateral inversion.

(d) During uniform circular motion, though the speed of the body remains constant, its direction of motion and hence, its velocity changes continuously at each point. So, uniform circular motion is an accelerated motion.

Answer 7

  (a) Archimedes' principle states that when a body is totally or partially immersed in a fluid, it experiences an upthrust equal to the weight of the fluid displaced.
Experimental verification of Archimedes' principle:
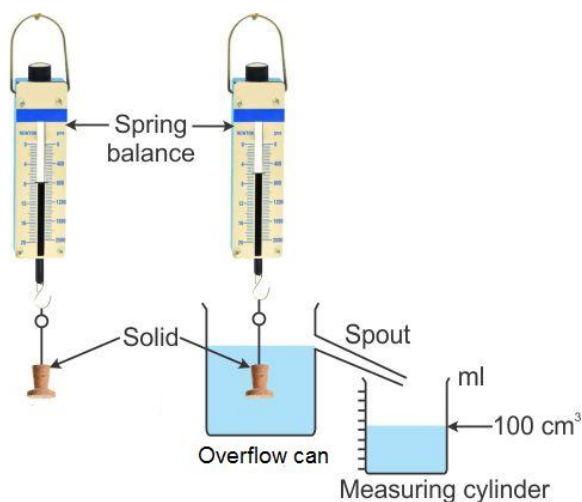
Place an overflow can on a table and place a beaker under its spout as shown in the figure. Pour water into the can till the water starts overflowing through the spout. When the water stops dripping, replace the beaker by another one of known weight. Suspend a solid with the help of a string from the hook of a spring balance and record the weight of the solid.

Now, gradually lower the solid into the overflow can containing water and record its new weight in water when it is fully submerged in water.

When no more water drips from the spout, weigh the beaker containing water.

We will notice that the difference of weights of the solid in air and in water is equal to the difference of weight of beaker with displaced water and that of the empty beaker. That is, the apparent loss of weight of the solid or upthrust on the solid equals the weight of water displaced.

 (b) Weight of the body in air = 450 gf
Weight of the body in water = 310 gf
   i. Loss in weight of the body = 450 gf - 310 gf = 140 gf
  ii. Upthrust on the body = Loss in weight = 140 gf

  (c) Thrust on a surface is the force acting normally on the surface while pressure on a surface is thrust acting on a unit area of the surface.
SI unit of thrust is Newton (N) and that of pressure is Pascal (Pa).

Answer 8

(a) Thermal expansion of gases:
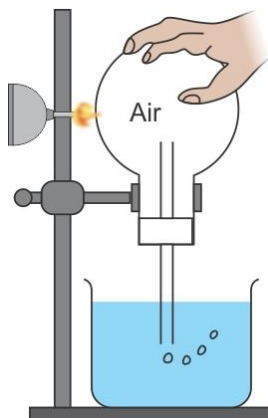
Take a round bottom flask which is filled with air and closed with a one holed rubber cork. A narrow capillary tube is passed through the rubber stopper and the flask is supported on a tripod in an inverted position as shown in the figure; so that, the end of the capillary tube is under water. Now, heat the flask gently with a spirit lamp. You will observe bubbles coming out from the capillary tube. This shows that air has expanded on heating and it escapes from the flask. Like air, all other gases also behave in the same way.

(b) Coefficient of cubical expansion, γ =5.1×10^{-5} per ^{o}C

We know, $\dfrac{\alpha}{\gamma} = \dfrac{1}{3}$

$$\alpha = \dfrac{\gamma}{3}$$
$$= \dfrac{5.1 \times 10^{-5}}{3}$$
$$= 1.7 \times 10^{-5} \text{ per } ^o\text{C}$$

(c)

i. On a cloudy night, when earth radiates heat, the clouds being a good reflector reflect the heat radiations of the long wavelength back to the earth. On the other hand, on a clear night, heat radiations escape into the atmosphere and thus, lower the temperature of earth. That is why, cloudy nights are warmer than clear nights.

ii. Cooking utensils are blackened from the base so that they can absorb more heat to cook the food faster. On the other hand, the sides are kept shining so as to keep the contents warm for a long time because shining surfaces reflect heat better.

Answer 9

(a)
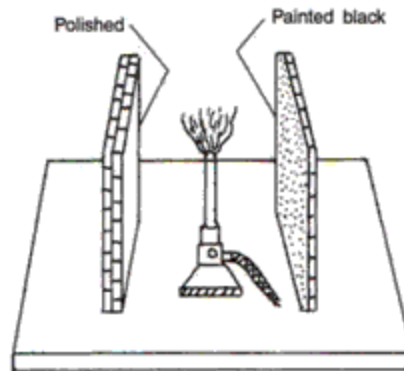
Take two sheets of tin plates, one blackened and the other polished brightly. Fix some drawing pins on the outer side of both the sheets using wax. Fix these plates vertically at a short distance apart. Place a Bunsen burner midway between them. When you light the burner, you will observe that the pins from the black painted sheet start dropping while the pins on the polished surface remain in the same position for a much longer time.
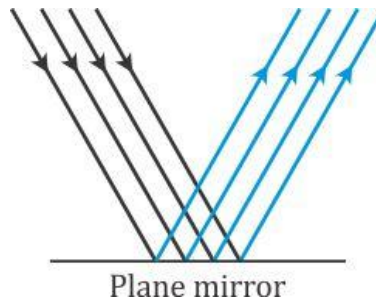
Thus, we can conclude that blackened surface is a better absorber of heat than the polished one.

(b)
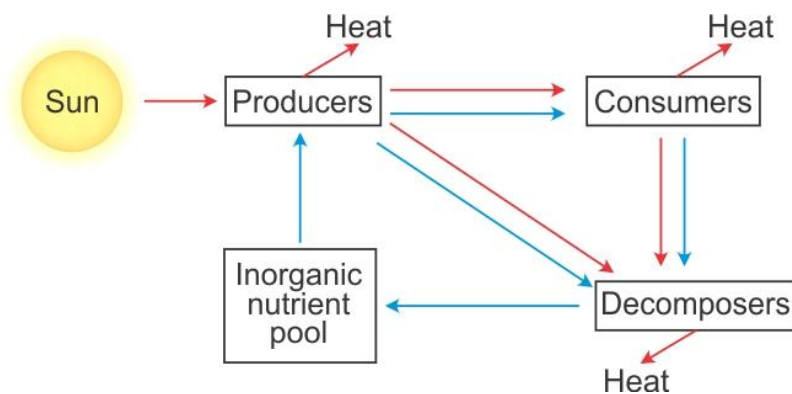
All energy comes from the sun but heat given out at each of the conversion processes like production, consumption does not go back to the sun. So, energy flow is not a cyclic process.

(c) **Regular reflection**:

Plane mirror

In regular reflection, a parallel beam of incident light is reflected as a parallel beam in one direction. Regular reflection occurs from smooth surfaces like that of a plane mirror.

Irregular reflection:
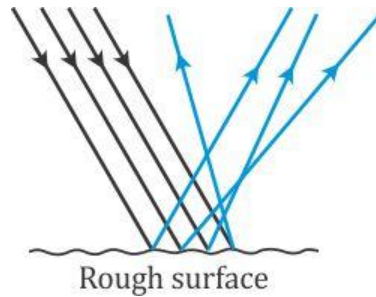
Rough surface

In irregular reflection, a parallel beam of incident light is reflected in different directions. Irregular reflection occurs from rough surfaces like that of a paper, cardboard, walls etc.

Answer 10

(a) The mirror which always produces an erect and virtual image is a convex mirror. The size of the image is always smaller than the size of the object.

(b) When an object is placed between the focus and the pole of a concave mirror, the image formed is erect and magnified.

(c)

MEDIUM	SPEED OF SOUND (ms^{-1})
Air	330
Water	1450
Steel	5100

Speed of sound is more in solid (steel), less in liquid (water) and least in gas (air).

(d) In case of electrostatic conduction, the transfer of electrons takes place between the conductor and the charged body whereas in case of induction, no such transfer takes place, only the realignment of electrons in the induced body occurs.

(e) No, the resistance of a wire doesn't depend on the circuit in which it is connected. Resistance of a wire depends only on the length of wire, type of material of the wire, area of cross section of wire and temperature of the wire.