Practice paper 2 Solution

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Section -A

Ans. 1. (*i*) (d) (*ii*) (d) (*iii*) (b) (*iv*) (c) (*v*) (d) (*vi*) (c) (*vii*) (b) (*viii*) (a)
(*ix*) (b) (*x*) (b) (*xi*) (c) (*xii*) (b) (*xiii*) (c) (*xiv*) (a) (*xv*) (b)

Ans. 2. (*i*) (*a*) Two

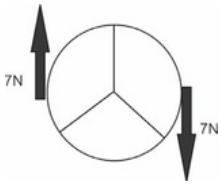
(*b*) Yes

(*c*) Negative

(*ii*) (*a*) Force C (*b*) 10× 0.04 – 0.40 Nm

(*iii*) Centripetal force. It acts towards the centre of the circular path.

(*iv*) The free body diagram is as shown:



The moment of the couple is

M = Force × Perpendicular distance

M = 7 × 0.5 = 3.5 N m

(*v*) Kinetic energy will become one-fourth *i.e.*, 10 J

(*vi*) (*a*) Natural vibration (*b*) Increase the length of the pendulum.

(*vii*) (*a*) Wire A (*b*) Both have the same resistivity.

Ans. 3. (*i*) (*a*) Concave lens (*b*) No

(*ii*) (*a*) Earthing is a process of connecting the metallic body of an appliance to the earth through a conductor.

(*b*) Protection: When an appliance is properly earthed, then any accidental contact of live wire with its metallic body results in a flow of heavy current through the appliance. Earthing results in a safe and easy flow of electric current to the earth. Thus, a user is protected from any fatal electric shock.

(*iii*) Electric current, number of turns

(*iv*) Heat absorbed = mL + m × c × (T− 0)

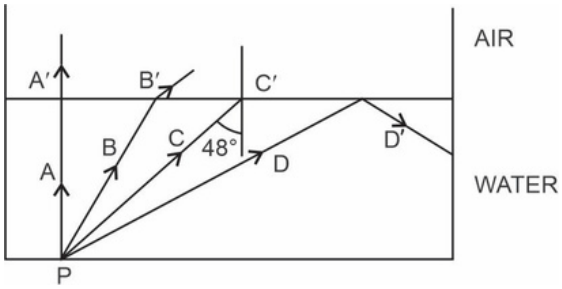
5460 = 10 × L + 10 × 4200 × 50

L = 336000 J kg^{-1}

(*v*) (*a*) Gamma (*b*) Alpha

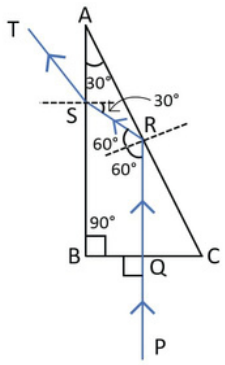
Section -B

Ans. 4. (*i*) (*a*) The diagram is as shown:

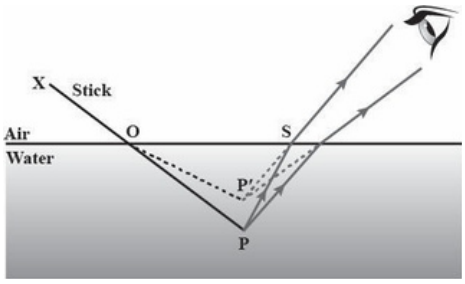


(*b*) Ray B - Refraction, Ray D - Total internal reflection.

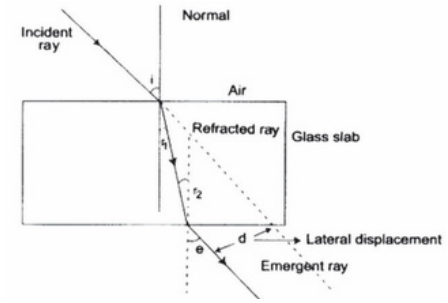
(*ii*) The diagram is as shown:



(*iii*) (*a*) The diagram is as shown:



(*b*) (*i*) The ray diagram is as shown:

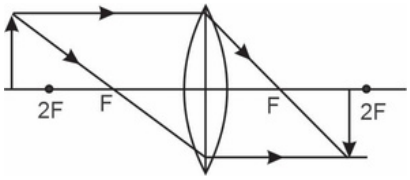


(*ii*) Incident ray and emergent rays are parallel to each other.

(*iii*) Lateral displacement is marked by d in the diagram.

Ans. 5. (*i*) Given: h = 5 cm, u = – 25 cm, f = + 10 cm, v = ?, nature = ?

Since the object is placed at 25 cm and the focal length is 10 cm, therefore, the object is placed beyond 2f of the converging lens. The ray diagram is as shown below:



By lens formula, we have $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$

$$\frac{1}{v}=\frac{1}{f}+\frac{1}{u}=\frac{1}{10}+\frac{1}{-25}=\frac{3}{50}$$

Therefore, $v=\frac{50}{3}=16.67$ cm

Also, Magnification $m=\frac{h'}{h}=\frac{v}{u}$

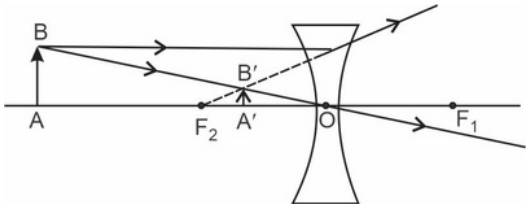
Therefore, $h' = h \times \frac{v}{u} = 5 \times \frac{16.67}{-25} = -3.33$ cm

Thus, the image is real and inverted and is formed at a distance of 16.67 cm on the other side of the lens.

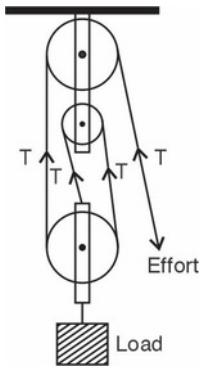
(*ii*) (*a*) X – Violet, Y - Red

(*b*) All colours have the same speed in vacuum.

(*iii*) The ray diagram is a shown below. The lens used is a concave lens.



Ans. 6. (*i*) (*a*) Correct winding of rope around pulleys, load and effort is as shown above.



(*b*) Since there are five strings in the block and tackle system, therefore, the velocity ratio of the system is VR = n = 5.

Now, VR = —— or $d_E = 5 \times d_L = 5 \times 1 = 5$

(*ii*) (*a*) C, because force C is nearest to O.

(*b*) A, because force, A is farthest from O.

(*c*) 1. A and B are producing clockwise moments.

2. C force is producing anticlockwise moment.

(*d*) The clockwise moment of force about O = Force × OA = 4 × 0.9 = 3.6 N m

The clockwise moment of force about O = Force × OB = 4 × 0.8 = 3.2 N m

Total clockwise moment of the two forces about O = (3.6 + 3.2) = 6.8 N m

The anticlockwise moment of force about O = Force × OB = 4 × 0.6 = 2.4 N m

The resultant torque about O = anticlockwise moments + clockwise moments

= +2.4 + (–6.8)

= 2.4 – 6.8 = – 4.4 N m

= 4.4 (clockwise)

(*iii*) Given: m = 30 kg, F = 200 N, AB = 3 m,CB = 1.5 m

(*a*) Work done is given by the product of force and displacement, therefore

W = F × S = F × AB = 200 × 3 = 600 J

(*b*) Potential energy gained by the block U = mgh = 30 × 10 × 1.5 = 450

Ans. 7. (*i*) (*a*) The first echo is heard when the sound is reflected by the nearest cliff.

Let x_1 be the distance of the nearest cliff from the person.

Now, total distance travelled by sound between the person and the cliff is = $2x_1$

= 2 × 640 = 1280 m

Time taken for echo to return t = 4 s

Therefore, speed of sound = $2x_1/t = 1280/4 = 320$ m s^{-1}

(*b*) The second echo is heard when the sound is reflected by the second cliff.

If x_2 is the distance of the second cliff from the person, then the total distance travelled by the sound between the person and the cliff is = $2x_2$

Time taken t = 4 + 3 = 7s

Now, $V = 2x_2/t$ or $x_2 = V \times t/2 = 320 \times 7/2x_2 = 2120$ m

Hence, the distance between the two cliffs = 640 + 1120 = 1760 m

(*ii*) The decay of U - 238, to form Pb - 206, follows the following scheme.

$U_{92}^{238} \xrightarrow{\alpha} Th_{90}^{234} \xrightarrow{\beta} Pa_{91}^{234} \xrightarrow{\beta} U_{92}^{234}$

$U_{92}^{234} \xrightarrow{\alpha} Th_{90}^{230} \xrightarrow{\alpha} Ra_{88}^{226} \xrightarrow{\alpha} Rn_{86}^{222}$

$Rn_{86}^{222} \xrightarrow{\alpha} Po_{84}^{218} \xrightarrow{\alpha} Pb_{82}^{214} \xrightarrow{\beta} Bi_{83}^{214}$

$Bi_{83}^{214} \xrightarrow{\alpha} Ti_{81}^{210} \xrightarrow{\beta} Pb_{82}^{210} \xrightarrow{\beta} Bi_{83}^{210}s$

$Bi_{83}^{210} \xrightarrow{\beta} Po_{84}^{210} \xrightarrow{\alpha} Pb_{82}^{206}$

Number of α-particles emitted = 8

Number of β-particles emitted = 6.

(*iii*) (*a*) The person is trying to change the values of the electronic components to produce vibrations of frequency equal to that of the incoming radio waves which he wants to receive.

(*b*) The phenomenon involved in tuning the radio set is resonance

(*c*) **Resonance :** When the frequency of the externally applied periodic force is equal to the natural frequency of the body, the body starts vibrating large amplitude, producing a loud sound.

3. (*i*) (*a*) A three pin plug is used to supply electricity to any electrical appliance whose body is earthed. The third pin big pin of the plug helps us to do this earthing. The user of the electrical appliance is then protected against accidental electrical shocks.

(*b*) The main switch is connected right at the starting point of the household wiring. This enables us to switch off (or 'on') the supply of electricity, to the household, as per our need.

(*ii*) (*a*) The completed reaction is as follows $^{222}_{86}Rn \rightarrow ^{218}_{84}Po + ^{4}_{2}\alpha$

(*b*) It will deflect towards the negative plate of the electric field.

(*iii*) (*a*) The two resistors, of 4 Ω and 6 Ω are connected in parallel between points P and Q. If R is the equivalent resistance between these two points, then we have

$\frac{1}{R} = \frac{1}{4} + \frac{1}{6} = \frac{5}{12}$ or R = 2.4 ohm.

(*b*) The total emf of the two cells is (2 + 2) V = 4 V. The equivalent resistance of the circuit is 2.4 Ω. Hence, the ammeter reading, say I, would be given by $I = \frac{V}{R} = \frac{4}{2.4} = 1.67$ A

9. (*i*) Given: m = 250 g, T_1 = 65°C, m_W = 50 g, T_2 = 20°C, T = 25°C, s = ?

Let be the required specific heat capacity. Then

Heat lost by the metal = 250 × s × (65 – 25) = 10000 s units

Heat gained by the water = 50 × 4.2 × (25 – 20) = 1050 units

(Specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$)

Hence, 10000s = 1050, solving, we have

s = 0.105 J $g^{-1}°C^{-1}$

(*ii*) (*a*) The boiling point of the substance is 150°C.

(*b*) In the region DE, the substance undergoes a change of state from liquid to solid phase.

(*c*) The region DE is shorter than the region BC because the latent heat of fusion is generally much less than the latent heat of evaporation.

(*iii*) (*a*) This is due to the change in magnetic flux in the coil. Due to change in magnetic flux an induced emf is produced in the coil. Hence, a current flows through the galvanometer.

(*b*) The current appears clockwise when viewed form end A.

(*c*) The galvanometer now deflects towards left.

(*d*) No deflection is observed as there is no relative motion between the magnet and the coil.