Practice paper 1 Solution

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Section -A

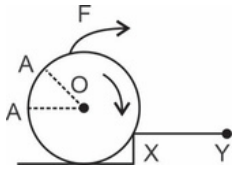
Ans. 1. (*i*) (c) (*ii*) (c) (*iii*) (d) (*iv*) (c) (*v*) (a) (*vi*) (a) (*vii*) (d) (*viii*) (b)
(*ix*) (d) (*x*) (d) (*xi*) (b) (*xii*) (*d*) (*xiii*) (c) (*xiv*) (a) (*xv*) (c)

Ans. 2. (*i*) (*a*) $\eta = \frac{MA}{VR} \times 100$

(*b*) When the nucleus is unstable *i.e.,* the neutron-proton ratio is out of the safety belt region. n/p ratio is less than 1 or more than 1.5.

(*c*) No change. This is because radioactivity is a nuclear phenomenon.

(*ii*) Force should be applied at A near the rim to increase the moment of force by increasing perpendicular distance OA (between force and point of rotation).



(*iii*) So that there is maximum distance between force and turning point and minimum force is needed.

(*iv*) For moment about O, $6 = 20 \times r$ or $r = 6/20$ m

Distance of F from A = $2 \times 6/20 = 6/10$ m

Moment of F about A = $20 \times 6/10 = 12$ N m

(*v*) The man who walks on a level road does no work as he is walking at right angle to the direction of gravitational force. Hence, the man climbing a slope is doing more work.

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

(*vii*) Parallel combination is represented by A. As slope gives resistance and slope of A is less.

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

(*ii*) (*a*) The earth pin is thicker and longer than the other two pins.

(*b*) The electric switch should be connected in the 'Live' wire.

(*iii*) (*a*) The polarity at end A is north polarity.

(*b*) An advantage of an electromagnet over a permanent magnet is that an electromagnet can produce a strong magnetic field.

(*iv*) Mass of ice = 2 g

Initial temperature = 0°C

Final temperature = 100°C

Heat required to change 2 g of ice at 0°C to water at 0°C

= (2 × 336) J = 672 J.

Heat required to change 2 g of water from 0°C to 100°C

= [2 × 4.2 × (100 – 0)] J = (200 × 4.2) J

= 840 J.

Heat required to change 2 g of water at 100°C to 100°C steam

= (2 × 2268) J = 4536 J

Total heat required

= (672 + 840 + 4536) J = 6048 J.

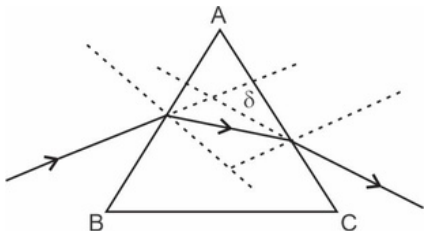
(*v*) Gamma radiation.

Section -B

Ans. 4. (*i*) (*a*) The image of all the letters of the word VIBGYOR in their corresponding colours will not be at the same place.

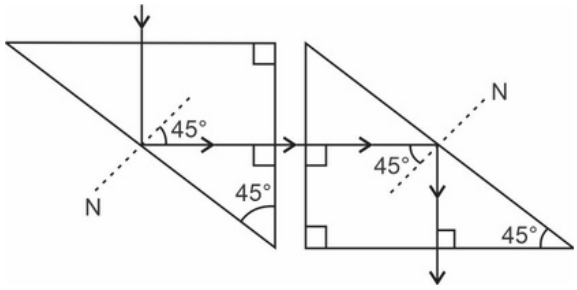
(*b*) In glass, red colour has the higher speed than violet colour, so red will be raised to the maximum while violet will be at the bottom and the other colours will be raised in the order indigo, blue, green, yellow and orange.

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



(*b*) Angle of incidence and nature of material of the prism.

(*iii*) The diagram is as shown:



Ans. 5. (*i*) (*a*) 1. Convex lens of focal length f = 1/P = + ½ = + 0.5 m = + 50 cm

2. Concave lens of focal length f = 1/P = – ¼ = – 0.25 m = – 25 cm

(*b*) Given u = – 100 cm, f = – 25 cm , v = ?

Using the formula $\frac{1}{f}=\frac{1}{v}-\frac{1}{u} \Rightarrow \frac{1}{v}=\frac{1}{f}+\frac{1}{u}=\frac{1}{-25}+\frac{1}{-100}=\frac{-4-1}{100}=\frac{-1}{20}$

Therefore, v = –20 cm

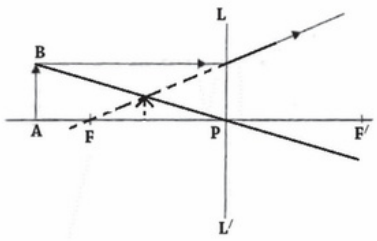
(*ii*) (*a*) X – Violet, Y – Red

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

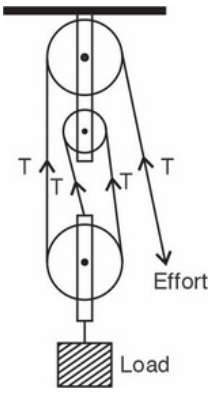
(*iii*) (*a*) Concave lens

(*b*) Focus

(*c*) The diagram is as shown:

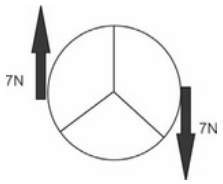


Ans. 6. (*i*) (*a*) The diagram is as shown:



(*b*) Lower block of this pulley system should be of negligible weight in order to increas the mechanical advantage of the system. Moreover if the lower block has weight i adds up to the load.

(*ii*) (*a*) The free body diagram is as shown:



(*b*) The moment of the couple is
M = Force × Perpendicular distance
M = 7 × 0.5 = 3.5 N m

(*iii*) (*a*) **Given :** Force acting on the horse-cart system = 300 N,

Initial velocity = 18 km h^{-1} = $\frac{5}{18} \times 18 = 5$ ms^{-1}

Therefore, Power developed by the horse
= Force × Velocity = 300 × 5 = 1500 W

(*b*) Equivalent horse power = $\frac{1500}{746}$ = 2.01 H.P.

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
$= 2x_1 = 2 \times 640 = 1280$ 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 $t = 4 + 3 = 7$ s
Now, $V = 2x_2/t$ or $x_2 = V \times t/2 = 320 \times 7/2$
$x_2 = 2120$ m
Hence, the distance between the two cliffs = 640 + 1120 = 1760 m

(*ii*) (*a*) Atomic number and mass number of radium are 88 and 229, respectively.

(*b*) ${}^{229}_{88}\text{Ra} \rightarrow {}^{0}_{-1}\text{e} + {}^{229}_{89}\text{X}$

(*c*) Mass defect, decrease in mass gets converted into energy.

(*iii*) (*a*) When the sound becomes loudest, the name of the phenomenon taking place is resonance. This is called the fundamental mode of vibration.

(*b*) The sound becomes loudest for a particular length of air column because the natural frequency, of this length of air column, becomes equal to the frequency of the vibrating tuning fork.

Ans. 8. (*i*) (*a*) The resistance of an appliance is given by the expression $R = \frac{V^2}{P}$

For the bulb marked 100 W , 220 V we have

$$R_B = \frac{(220)^2}{100} = 484\ \Omega$$

For the heater marked 2000 W, 220 V we have

$$R_H = \frac{(220)^2}{2000} = 24.2\ \Omega$$

$$\frac{R_B}{R_H} = \frac{484}{24.2} = 20$$

(*b*) The currents, flowing through the bulb and the heater, are (100/220) ampere and (2000/220) ampere respectively. Thus, the current, through the heater, is as much as 20 times than that through the bulb. Therefore, a thicker connecting wire, or lead, will be required for the electric heater.

(*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*) 1 ampere of current will be shared by the two resistors of 10 ohm and 15 ohm which are connected in parallel.

Let the current through the 10 ohm resistor be I_1 and that through 15 ohm resistor be I_2. Let total current in the circuit be I ampere

Now, current through resistor 10 ohm is given by the expression

$$I_1 = \frac{IR_2}{R_1 + R_2} = \frac{1 \times 15}{10 + 15} = \frac{15}{25} = 0.6 \text{ A and}$$

The current through the 15 ohm resistor is

$I_2 = I - I_1 = 1 - 0.6 = 0.4$ A

(*b*) Resistors of 10 ohm and 15 ohm are connected in parallel, therefore, equivalent resistance of their combination is

$$R = \frac{R_1 R_2}{R_1 + R_2} = \frac{10 \times 15}{10 + 15} = \frac{150}{25} = 6 \text{ ohm}$$

Now, 5 ohm and 6 ohm resistors are connected in series, hence total resistance of the combination is $R_T = 6 + 5 = 11\ \Omega$

Ans. 9. (*i*) Let mass of the liquid required be m.

Given:

Fall in temperature of liquid A

$= (40 - 32)\ °C$

Rise in temperature of liquid B

$= (32 - 20)\ °C$

Heat given by mass m of liquid A

$= m \times 0.84 \times (40 - 32)$ J

Heat taken by 100 g of liquid B

$= 100 \times 2.1 \times (32 - 20)$ J

Assuming that there is no heat loss,

By the principle of calorimetry, we have

Heat given by A = Heat taken by B

$m \times 0.84 \times 8 = 100 \times 2.1 \times 12$

which gives $\frac{100 \times 2.1 \times 12}{0.84 \times 8} = 375$ g

(*ii*) (*a*) AB part of the graph represents time in t seconds taken by ice at 0°C to convert into water at 0°C. CD part of the graph represents time in seconds taken by water at 100°C to convert into steam at 100°C.

(*b*) From the graph, we conclude that ice takes less time in heating from –10°C to 0°C. But in the process of melting, it takes comparatively longer time. It shows that ice has a high specific latent heat of fusion.

(*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 from 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.