Date : 07.10.2019 Class : XI

PHYSICS (Marks - 25)
Hints and Solutions

1. (b) Work done by centripetal force is always zero, because force and instantaneous displacement are always perpendicular.

$W = \vec{F}.\vec{s} = Fs\cos\theta = Fs\cos(90°) = 0$

2. (a) Work = Force × Displacement (length)

If unit of force and length be increased by four times then the unit of energy will increase by 16 times.

3. (c) $W = Fs\cos\theta \Rightarrow \cos\theta = \frac{W}{Fs} = \frac{25}{50} = \frac{1}{2} \Rightarrow \theta = 60°$

4. (c) $W = \vec{F}.\vec{s} = (5\hat{i} + 3\hat{j}).(2\hat{i} - \hat{j})$ = 10 – 3 = 7 J

5. (d) As the body moves in the direction of force therefore work done by gravitational force will be positive.

$W = Fs = mgh = 10 \times 9.8 \times 10 = 980\ J$

6. (d)

7. (b) $W = Fs = F \times \frac{1}{2}at^2 \quad \left[\text{from } s = ut + \frac{1}{2}at^2\right]$

$\Rightarrow W = F\left[\frac{1}{2}\left(\frac{F}{m}\right)t^2\right] = \frac{F^2t^2}{2m} = \frac{25\times(1)^2}{2\times 15} = \frac{25}{30} = \frac{5}{6}\ J$

8. (b) Work done on the body = K.E. gained by the body

$Fs\cos\theta = 1 \Rightarrow F\cos\theta = \frac{1}{s} = \frac{1}{0.4} = 2.5N$

9. (d) $s = \frac{t^2}{4} \quad \therefore ds = \frac{t}{2}dt$

$F = ma = \frac{md^2s}{dt^2} = \frac{6d^2}{dt^2}\left[\frac{t^2}{4}\right] = 3N$

Now $W = \int_0^2 F\,ds = \int_0^2 3\frac{t}{2}dt = \frac{3}{2}\left[\frac{t^2}{2}\right]_0^2 = \frac{3}{4}\left[(2)^2 - (0)^2\right] = 3J$

10. (d) Net force on body $= \sqrt{4^2 + 3^2} = 5N$

$\therefore a = F/m = 5/10 = 1/2\, m/s^2$

Kinetic energy = $\frac{1}{2}mv^2 = \frac{1}{2}m(at)^2 = 125\ J$

11. (b) $W\int_0^{x_1} F.dx = \int_0^{x_1} Cx\ dx = C\left[\frac{x^2}{2}\right]_0^{x_1} = \frac{1}{2}Cx_1^2$

12. (c) $U = \frac{F^2}{2k} \Rightarrow \frac{U_1}{U_2} = \frac{k_2}{k_1}$ (if force are same)

$\therefore \frac{U_1}{U_2} = \frac{3000}{1500} = \frac{2}{1}$

13. (c) $P = \sqrt{2mE}$ $\therefore P \propto \sqrt{m}$ (if E = const.) $\therefore \frac{P_1}{P_2} = \sqrt{\frac{m_1}{m_2}}$

14. (c) Work in raising a box

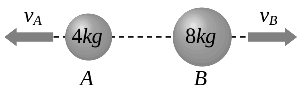
= (weight of the box) × (height by which it is raised)

15. (a) $E = \frac{P^2}{2m}$ if P = constant then $E \propto \frac{1}{m}$

16. (d) $E = \frac{P^2}{2m}$ $\therefore E \propto P^2$

i.e. if P is increased n times then E will increase n^2 times.

17. (d) As the initial momentum of bomb was zero, therefore after explosion two parts should possess numerically equal momentum



i.e. $m_A v_A = m_B v_B \Rightarrow 4 \times v_A = 8 \times 6 \Rightarrow v_A = 12\ m/s$

$\therefore$ Kinetic energy of other mass A, = $\frac{1}{2} m_A v_A^2$

= $\frac{1}{2} \times 4 \times (12)^2$ = 288 J.

18. (a)

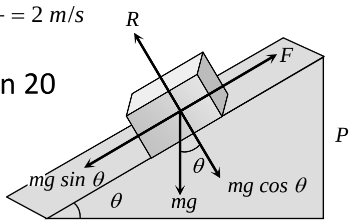
19. (d) $P = \vec{F}.\vec{v} = ma \times at = ma^2 t$ [as u = 0]

$= m\left(\frac{v_1}{t_1}\right)^2 t = \frac{m v_1^2 t}{t_1^2}$ $[\text{As } a = v_1 / t_1]$

20. (d) $v = 7.2 \frac{km}{h} = 7.2 \times \frac{5}{18} = 2\ m/s$

Slope is given 1 in 20

$\therefore \sin\theta = \frac{1}{20}$



When man and cycle moves up then component of weight opposes it motion *i.e.* $F = mg\sin\theta$

So power of the man $P = F \times v = mg\sin\theta \times v$

$= 100 \times 9.8 \times \left(\frac{1}{20}\right) \times 2 = 98\ Watt$

21. (b) If a motor of 12 *HP* works for 10 days at the rate of 8 *hr/day* then energy consumption = power × time

$= 12 \times 746\ \frac{J}{\sec} \times (80 \times 60 \times 60)\sec$

$= 12 \times 746 \times 80 \times 60 \times 60\ J = 2.5 \times 10^9\ J$

Rate of energy = $50\ \frac{paisa}{kWh}$

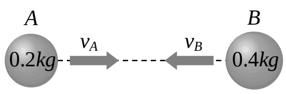
i.e. $3.6 \times 10^6\ J$ energy cost 0.5 *Rs*

So $2.5 \times 10^9\ J$ energy cost = $\frac{2.5 \times 10^9}{2 \times 3.6 \times 10^6} = 358\ Rs$

22. (c) $P = Fv = 500 \times 3 = 1500\ W = 1.5\ kW$

23. (a)

24. (c)



Initial linear momentum of system = $m_A\vec{v}_A + m_B\vec{v}_B$

$= 0.2 \times 0.3 + 0.4 \times v_B$

Finally both balls come to rest

∴ final linear momentum = 0

By the law of conservation of linear momenum

$0.2 \times 0.3 + 0.4 \times v_B = 0$

∴ $v_B = -\frac{0.2 \times 0.3}{0.4} = -0.15\ m/s$

25. (c) For a collision between two identical perfectly elastic particles of equal mass, velocities after collision get interchanged.