WS-19 for class & Task

(1) Given

$u = 36$ kmph $= 36 \times \frac{5}{18} = 10$ m/s

$v = \sqrt{\mu r g}$

$\Rightarrow v^2 = \mu r g$

$\Rightarrow r = \frac{v^2}{\mu g} = \frac{(10)^2}{(0.5)(10)}$

$r = 20$ m

(2) From given data

$F_c = f$

$\Rightarrow m r \omega^2 = \mu m g$

$\Rightarrow r\omega^2 = \mu g$

$\Rightarrow \omega^2 = \frac{\mu g}{r}$

$\Rightarrow \omega^2 = \frac{0.8 \times 10}{10}$

$\Rightarrow \omega = 9$ rad/sec

$\Rightarrow \omega = 9 \times \frac{60}{2\pi}$

$= 84.5$ rpm

(3) Given $r = 5$m, $\mu = 0.5$

$v = r\omega$ also $v = \sqrt{\mu r g}$

$\Rightarrow r\omega = \sqrt{\mu r g}$

$\Rightarrow r^2\omega^2 = \mu r g$

$\Rightarrow \omega^2 = \frac{\mu g}{r} = \frac{0.6 \times 10}{5}$

$\Rightarrow \omega^2 = 1$

$\Rightarrow \omega = 1$ rad/sec

(4) $r = 18$ m ; $\mu = 0.2$

$v = \sqrt{\mu r g}$

$\Rightarrow v = \sqrt{0.2 \times 18 \times 10}$

$= 6$ m/sec

$= 6 \times \frac{18}{5}$ kmph

$v = 21.6$ kmph

(5) $m = 20$kg; $r = 10$m; $v = 10$m/s

$\tan\theta = \frac{v^2}{rg}$

$\Rightarrow \tan\theta = \frac{(10)^2}{10(10)}$

$\Rightarrow \tan\theta = 1$

$\Rightarrow \theta = 45^\circ$

(6) $m = 40$ kg, $\mu = 0.15$, $u = 0$

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

For box $s = 5$m

$\Rightarrow F_{net} = ma - f$

$\Rightarrow ma' = ma - \mu mg$

$\Rightarrow a' = 2 - 0.15 \times 10$

$\Rightarrow a' = 0.5$

$\therefore 5 = 0 \times t + \frac{1}{2}(0.5)t^2$

$\Rightarrow t^2 = 20$ sec

For lorry $x = ut + \frac{1}{2}at^2$

$x = (0)t + \frac{1}{2}(2)(20)$

$x = 20$m

(7) $l = 2$m ; $\theta = 60^\circ$

$T = 2\pi\sqrt{\frac{l\cos\theta}{g}}$

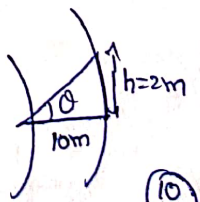
$T = 2\pi\sqrt{\frac{2\cos 60}{10}}$

$T = 2\pi\sqrt{\frac{2 \times \frac{1}{2}}{10}}$

$T = 2(3.14)\frac{1}{\sqrt{10}}$

≈ 2 sec.

(8) $v = \sqrt{rg\tan\theta}$



Given $\omega = 10$m

$r = 50$m

$\tan\theta = \frac{2}{10} = \frac{1}{5}$

$v = \sqrt{\frac{1}{5} \times 50 \times 10}$

$v = 10$ m/s.

(9) $\theta = 2\pi N$

$= 2\pi\frac{1}{6}$

$\theta = \frac{\pi}{2} = 90^\circ$

(10) $v = 36$ kmph $= 36 \times \frac{5}{18} = 10$ m/sec.

$r = 20$m.

$v = \sqrt{\mu r g}$

$\Rightarrow 10 = \sqrt{\mu(20)(10)}$

$\Rightarrow 100 = 200\mu$

$\Rightarrow \mu = \frac{1}{2} = 0.5$

(11) $r = 500m$; $\mu = 0.5$

$v = \sqrt{\mu r g}$

$\Rightarrow v = \sqrt{0.5 \times 10 \times 500}$

$\Rightarrow v = 50 \text{ m/sec.}$

(12) $r_1 = 50m \rightarrow v_1 = v$

$r_2 = ? \rightarrow v_2 = 2v$

$v \propto \sqrt{r}$

$\Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{r_1}{r_2}}$ $\Rightarrow \frac{1}{4} = \frac{50}{r_2}$

$\Rightarrow \frac{v}{2v} = \sqrt{\frac{50}{r_2}}$ $\Rightarrow r_2 = 200m$

(13) $\tan\theta = \frac{v^2}{rg} \Rightarrow \tan 37 = \frac{v^2}{100 \times 10}$

$\Rightarrow \frac{3}{4} = \frac{v^2}{100} \Rightarrow v^2 = 25 \times 3$

$\Rightarrow v = \sqrt{25 \times 3} = 5\sqrt{3} m$

(14) $\theta = 37°$; $\mu = 0.4$.

$f = \mu mg = 0.4 \times 50 \times 10$

$= 200 N.$

L Taste

(1) $R = 20m$. $v = \sqrt{\mu r g}$. $v \propto \sqrt{r}$

$v' = v + \frac{10}{100} v$

$\Rightarrow v' = 1.1 v$ $\Rightarrow \left(\frac{v}{v'}\right)^2 = \left(\frac{r}{r'}\right)$

$\Rightarrow \left[\frac{v}{1.1v}\right]^2 = \frac{20}{r'}$

$\Rightarrow \frac{1}{1.21} = \frac{20}{r'} \Rightarrow r' = 20 \times 1.21$

$= 24.2m.$

(2) $\mu = 0.25$; $r = 20m$

$v_{max} = \sqrt{\mu r g}$

$= \sqrt{0.25 \times 20 \times 10}$

$\simeq 7 m/sec$

(3) $r = 300 m$

$v = 54 \text{ kmph}$

$v = 54 \times \frac{5}{18}$

$v = 15 m/sec$

$v = \sqrt{\mu r g} \Rightarrow v^2 = \mu r g$

$\Rightarrow v^2 = \tan\theta \, rg$

$\Rightarrow (15)^2 = h \times 300 \times 10$

$h = \frac{15^2}{3000} = 0.075m$

(4) $r = 7.5m$; $v = 10 m/sec$

$\tan\theta = \frac{v^2}{rg} = \frac{(10)^2}{7.5 \times 10}$

$\tan\theta = \frac{10}{7.5} = \frac{100}{75} = \frac{4}{3}$

$\theta = 57°$

(5) $v_{max} = 3.5 m/sec.$

$R = 250m. = 2.5cm$

$v_{max} = \sqrt{\mu r g}$

$\Rightarrow v^2 = \mu r g$

$\Rightarrow (3.5)^2 = h \times 2.5 \times 10$

$\Rightarrow h = \frac{(3.5)^2}{25} = 0.5m$

(6) $h = 2m$ $r = 120m$

$\tan\theta = \frac{h}{d} = \frac{2}{1.5}$

$\tan\theta = \frac{4}{3}$

$v_{max} = \sqrt{\tan\theta \, rg}$

$= \sqrt{\frac{4}{3} \times 120 \times 10}$

$= \sqrt{1600}$

$= 40 m/sec.$

(7) $h = 0.08m$

$\tan\theta = \frac{h}{d}$ $R = 200m$

$d_1 = 1.6m$

$v = \sqrt{\mu r g} = \sqrt{\tan\theta \, rg}$

$v = \sqrt{\frac{0.08}{1.6} \times 200 \times 10} = \sqrt{\frac{1}{20} \times 200 \times 10}$

$v = 0 m/sec.$

(11) $\mu \rightarrow v_1 = 10 m/s$

$\mu' = \frac{\mu}{2} \rightarrow v_2 = ?$

$v \propto \sqrt{\mu}$

$\Rightarrow \frac{v_1}{v_2} = \sqrt{\frac{\mu}{\mu/2}}$

$\Rightarrow \frac{10}{v_2} = \sqrt{2}$

$\Rightarrow v_2 = \frac{10}{\sqrt{2}} = 7.07 m/sec$

(12) $r = 30m$; $\theta = 30°$

$v_{max} = \sqrt{\tan\theta \cdot rg}$

$v_{max} = \sqrt{\tan 30 \times 30 \times 10}$

$v_{max} = \sqrt{0.732 \times 100} = 13.16 m/sec$

(13) $r = 150m$; $v = 20 m/sec$

$\tan\theta = \frac{v^2}{rg} = \frac{(20)^2}{150 \times 10}$

$\tan\theta = \frac{4}{15}$

$\theta = 15.54°$

(14) $\tan\theta = \frac{h}{d}$

$\Rightarrow \tan\theta = \frac{h}{1}$

$\Rightarrow \frac{4}{15} = h$

$\Rightarrow h = 0.27m$