1. A: $x = v_0 t + \frac{1}{2} a t^2$ $\quad v = v_0 + at$ $\quad 500 - 250 = 250\,m$

$= 0.5 \times 5 \times 10^2$ $\quad = 5 \times 10$ $\quad \frac{250}{50} = 5\,s$

$= 250\,m$ $\quad = 50\,m/s$ $\quad t = 10 + 5 = 15\,s.$

B: $x = v_0 t + \frac{1}{2} a t^2$ $\quad a = \frac{2x}{t^2} = \frac{2.500}{(15)^2} = 4.44\,m/s^2$

2. 

$F = 50\,N$ $\quad \theta = \omega_0 t + \frac{1}{2}\alpha t^2$

$I = 3\,kg\,m^2$ $\quad \alpha = \frac{2\theta}{t^2} = \frac{2.3\pi}{2^2} = 1.5\pi\,rad/s^2$

$\tau = I\alpha = R.F$ $\quad \therefore\ R = \frac{I.\alpha}{F} = \frac{3.\ 1.5\pi}{50} = 0.28\,m.$

3. $P + \rho g h + \frac{1}{2}\rho v^2 = const.$

$\Delta P = \frac{1}{2}\rho\left(v_T^2 - v_B^2\right) = \frac{1}{2}.\ 1.29.\left(250^2 - 225^2\right) = 7.66 \times 10^3\,N/m^2$

4. $F\Delta t = m\Delta v$ $\quad \Delta v_x = +15\,m/s$ $\quad \Delta v_y = -15\,m/s$

$\Delta v = \sqrt{\Delta v_x^2 + \Delta v_y^2} = 21.2\,m/s$

$F = \frac{0.1 \times 21.2}{0.01} = 212\,N$

5. $x = v_0 t + \frac{1}{2} a t^2$ $\quad a = \frac{2x}{t^2} = \frac{2.20}{5^2} = 1.6\,m/s^2$ $\quad F = ma = 20 \times 1.6 = 32\,N.$

6. $x_B = v_0 t + \frac{1}{2} a t^2$ $\quad \Delta x = \frac{1}{2} a t^2$

$x_w = v_0 t$ $\quad t = \sqrt{\frac{2\Delta x}{a}} = \sqrt{\frac{2.\ -2.5}{-10}} = 0.71\,s$

$y = -\frac{1}{2} g t^2 = -\frac{1}{2} \times 9.8 \times \frac{1}{2} = -2.45\,m$ $\quad h = 2.45\,m$

7. $P + \rho g h + \frac{1}{2}\rho v^2 = const$ $\quad \therefore\ v^2 = 2g\Delta h = 2 \times 9.8 \times 5 = 98\,m^2/s^2$

$v = 9.9\,m/s.$

8. $E = 0 = \frac{1}{2}kd^2 - Mg(h+d)$ $\quad d = \frac{Mg \pm \sqrt{M^2g^2 + 2Mgkh}}{k} = 1.12\text{ m}.$

$M = 6\text{ kg}, \; h = 1.0\text{ m}, \; k = 200\text{ N}.$

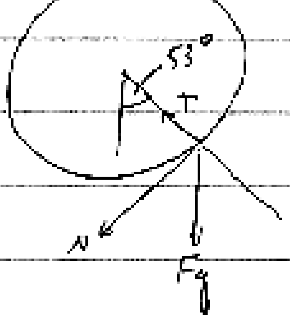
9. Stress does not change. Therefore strain does not change

$\frac{d}{L} = \frac{x}{L/2}$ $\quad x = d/2.$

10. $\omega = \sqrt{k/m}$ $\quad m.a = -kx$ $\quad x = -\frac{m}{k}.a = \frac{-a}{\omega^2} = -0.02\text{ m}.$

11. $F = ma_c = \frac{mv^2}{r} = \frac{1000 \times 12^2}{32} = 4500\text{ N}$

12.

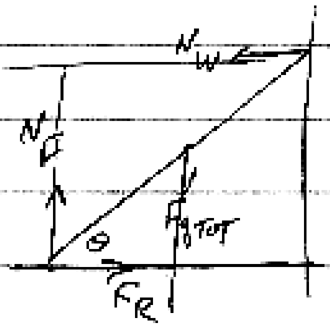


$T - F_g\cos 53^\circ = \frac{mv^2}{r}$ $\quad T = \frac{mv^2}{r} + F_g\cos 53^\circ$

$= \frac{0.5 \times (4)^2}{2} + 0.5 \times 9.8 \times 0.6$

$= 6.95\text{ N}$

13.



$N_F = F_{gTOT}$ $\quad F_R = \mu_s N_F$

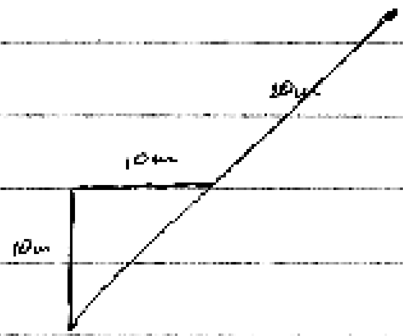
$F_R = N_W$

$N_W . L\sin\theta = F_{gTOT} . \frac{L}{2}\cos\theta$

$\therefore \mu_s \sin\theta = \frac{\cos\theta}{2}$ $\quad \tan\theta = \frac{1}{2\mu_s}$

$\theta = 61.6^\circ$

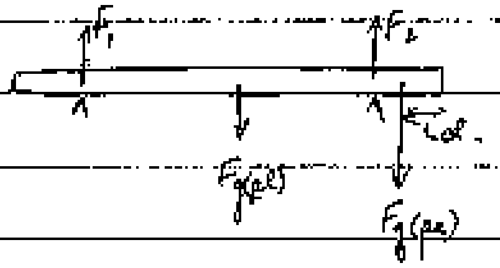
14.



$L = 20 + \sqrt{10^2 + 10^2} = 20 + 14.14 = 34.14\text{ m}.$

15. $\rho_I V_I = \rho_2 V_2$ $\quad \rho_2 = \frac{\rho_I V_I}{V_2} = \frac{\rho_I}{0.6} = 1533\ kg/m^3$.

16. $\bar{v} = \frac{x(2) - x(0)}{2} = 9\ m/s$

17. 

$F_1 + F_2 = F_{g(pl)} + F_{g(pe)}$

$4 \cdot F_{g(pl)} = F_{g(pe)} \cdot (1-d)$

$d = 1 - \frac{4 \cdot F_{g(pe)}}{F_{g(pe)}} = 1 - \frac{4 \cdot 100}{800} = 0.5$

18. $y = v_0 t + \frac{1}{2} a t^2$

$= 0.5 \times 9.8 \times (0.1)^2 = 0.049\ m$.

19. $T = \frac{2\pi}{\omega} = 2\pi \sqrt{\frac{m}{k}}$ $\quad t = T/4 = \frac{\pi}{2} \sqrt{\frac{m}{k}} = 0.157\ s$.

20. $\omega = \sqrt{k/m} = 6\ rad/s$