1. Unit 0.

(1) (C) $11.0\ g\ cm^{-3}$

(2) $v = 60\ km/hr$ $\quad v = s/t$

$s = 600\ km$ $\quad t = s/v = \frac{600\ km}{60\ km/hr} = 10\ hr.$ (C)

$t = ?$

(3) $\frac{25\ m}{s} \cdot \frac{1\ km}{1000\ m} \cdot \frac{3600\ s}{1\ hr} = \frac{25 \times 3600}{1000} = 90\ km/hr$ (D)

(4) $v = 0\ km/hr$ $\quad a = \frac{v-u}{t}$

$u = 10\ km/hr$

$t = 60\ sec$ $\quad = \frac{10-0}{60} = \frac{10}{60} = \frac{1}{6}\ km/hr^2$ (C)

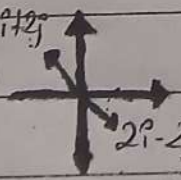
(5) $500\ m^2$ (C)

(6) $2l = 2000\ cm^3$

$\frac{2000\ cm^3}{\frac{1}{2}\ cm^3} = 4 \times 10^3$ (C)

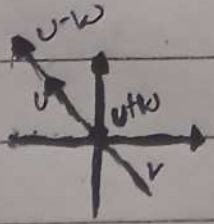
(7) (D) $-7.1\ km/hr$ & $-7.1\ km/hr$.

(8) (A) 225 degrees.

(9) (a) 

(b) $(-2i+2j)+(2i-2j) = 0$

(c) $(-2i+2j)-(2i-2j) = -4i+4j$.

(d) 

(e) $(-2i+2j)(2i-2j) = (-2)(2)+(2)(-2)$

$= -4-4 = -8$

3 Unit 2

① $F_1 = 1000N$

$\theta = 7°$

$T = ??$

$m = 900kg$

$\mu_k = 0.05$

$a = ??$

$F_1 = 2T\sin\theta$

(a) $T = \frac{F_1}{2\sin\theta} = \frac{1000}{2\sin 7} = 4102.8N$

$F_{net} = ma.$

$T - f = ma.$

$4102.8 - 0.05(900)(9.8) = a$

900

(b) $a \approx 4 m/s^2.$

② $m = 20{,}000kg.$

$v = 120km/hr.$

$s = 100m$

$a_{av} = ??$

$F = ??$

(a) $v^2 = u^2 + 2as$ $\quad u = 120km/hr = 33.33m/s$

$2as = -u^2$

$a = \frac{-u^2}{2s} = \frac{-(33.3)^2}{2(100)} = -5.56 m/s^2$

(b) $F = ma$

$= 20{,}000kg \times (-5.56) = -111{,}200N$

$F = 111{,}200N$ opposite to the jet.

③ $m_1 = 50kg.$

$F_1 = 10N, \theta = 45$

$F_2 = 8N, \theta_2 = 30$

$f = 7.5N$

$F_{net} = ma.$

$F_1 - f = ma.$

$a = \frac{F_1 - f}{m}$

$a = \frac{14.3 - 7.5}{50} = 0.136 m/s^2$

$F_x = F_1\cos\theta_1 + F_2\cos\theta_2$

$= 10\frac{\sqrt{2}}{2} + 8\frac{\sqrt{3}}{2}$

$= 14N$

$F_y = F_1\sin\theta_1 - F_2\sin\theta_2$

$= 10\sqrt{2}/2 - 8/2$

$= 3.07N$

$F_T = \sqrt{F_x^2 + F_y^2} = \sqrt{14^2 + 3.07^2} = 14.3N$

2. Unit 1.

① $u = 15 m/s$ at $t=0$ $\quad v = u + at$

$a = 3 m/s^2$ $\quad = 15 + 3(4)$.

$v = ?$ $\quad$ (a) $v = 27 m/s$.

$t = 4s$ $\quad s = ut + \frac{1}{2}at^2$.

$\Rightarrow D = 15(4) + \frac{1}{2}(3)(4)^2$

(b) $s = 84m$

(c) At $t=0$ $v_{av} = v_{inst} = 15 m/s$. Same

At $t=4$ $v_{av} = \frac{15+27}{2} = 21 m/s$ } different.

$v_{inst} = 27 m/s$

② (a) P $\Rightarrow$ slope $= \frac{1100-200}{17.5-2.5}$, $\frac{8000-1300}{32-18} = \frac{1400}{14}$

$= \frac{900}{15} = 60 m/s$ at P $= 121.4 m/s$ at Q

(b) The acceleration is positive.

$a = \frac{v-u}{\Delta t} = \frac{121.4-60}{25-10} = \frac{61.4}{15} \approx 4 m/s^2$

③ $v = 6 m/s$ $\quad v^2 = u^2 + 2as$

$a = 0.8 m/s^2$. $\quad s = \frac{v^2}{2a} = \frac{36}{1.6} = 22.5m$.

$s = 32$. $\quad v = u + at$

$t = 3?$ $\quad t = v/a = \frac{6}{0.8} = 7.5s$

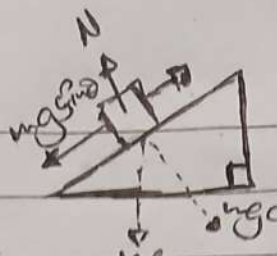
④ $l = 60m$

$\theta = 43°$

$v = ?$

60 m

4. Unit 3



(1) (a) $F_{net} = ma$

$mg\sin\theta - f = ma$

$mg\sin\theta - \mu mg\cos\theta = ma$ $\quad f = \mu N,\ N = mg\cos\theta$

$a = g(\sin\theta - \mu\cos\theta)$ $\quad f = \mu mg\cos\theta$

(b) $\lim_{\mu \to 0} g(\sin\theta - \mu\cos\theta) \Rightarrow \lim_{\mu \to 0} a = g\sin\theta$

(2) (a) $\theta = 10°$ $\quad a = 9.8(\sin 10° - 0.05\cos 10°)$

$g = 9.8\ m/s^2$ $\quad a = 1.219\ m/s^2$

$\mu = 0.05$

(b) $s = vt + \frac{1}{2}at^2$

$s = \frac{1}{2}at^2 = \frac{1}{2}(1.219)(30)^2 = 548.55m.$

$v = v_0 + at$ $\quad v = at = (1.219)(30) = 36.57 m/s$

(3) (a) $f_c = f_{horizontal} = F\sin\theta$ $\quad 600 km/hr. \downarrow 166.67$

$= 80{,}000\sin 30°$

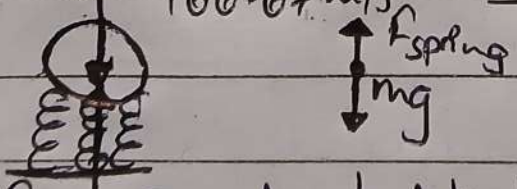
$f_c = 40{,}000N$

(b) $F_c = \frac{mv^2}{r} \Rightarrow r = \frac{mv^2}{F_c} = \frac{6000(166.67)^2}{40{,}000} = 4166.67m$

(c) half way $\Rightarrow d = \pi r \Rightarrow 3.14 \times 4166.67 = 13080.76m$

$t = \frac{d}{v} = \frac{13080.76m}{166.67 m/s} = 78.48s$

(4) (a)



(b) $F_{net} = 0$, $k_T = k_1 + k_2 + k_3$, $k_1 = k_2 = k_3$, $k_T = 3k$

$3kx - mg = 0$

$3kx = mg$ $\quad x = \frac{mg}{3k}$

(c) $\lim_{k \to \infty} x = \lim_{k \to \infty} \frac{mg}{3k} = 0.$

(5) (a) $V_T = ??$ $\quad F_D = \frac{1}{2}\rho A C v^2$

$m = 60kg$ $\quad 2mg = \rho A C v^2$

$A = 0.25m^2$ $\quad v = \sqrt{\frac{2mg}{\rho AC}}$

$C = 0.5$

$\rho = 1.2kg/m^3$ $\quad = \sqrt{\frac{2(60)(9.8)}{1.2(0.25)0.5}}$

(b) $A_2 = 100A_1$ $\quad V_T = 88.5 m/s$

$V_T = ??$

$V_{2T} = V_T \times \frac{1}{\sqrt{100}} = \frac{V_T}{10} = 8.85 m/s$

(6) (a) $Y = 45 \times 10^9 N/m^2$ $\quad Y = \frac{Fh}{A\Delta x}$

$\Delta x = ??$ $\quad \Delta x = \frac{Fh}{AY} = \frac{10,000 \times 10}{0.0314 \times 45 \times 10^9}$

$W = 10,000N$

$d = 20cm$ $\quad A = \pi\left(\frac{0.2}{2}\right)^2$ $\quad \Delta x = 7.07 \times 10^{-5} m$

$h = 10m$ $\quad = 0.0314m^2$

(b) $Y_2 = \frac{Y_1}{2}$, $\Delta x = \frac{Fh}{\frac{AY}{2}} = \frac{2Fh}{AY} = 2(7.07 \times 10^{-5} m)$

$= 1.416 \times 10^{-4} m$