Exam Review - Problem Set 1

① a) uniform velocity = horizontal line

$\therefore$ $\boxed{\text{B and D}}$

b) uniform acceleration = straight line

$\therefore$ $\boxed{\text{A and C}}$

(note: uniform velocity could be considered a uniform acceleration of zero, making B and D valid also)

c) d = area

i) $d = \frac{1}{2}(5)(30) + (6)(30) = \boxed{255\ m}$

ii) $d = \frac{1}{2}(5)(30) + (6)(30) + (3)(30) + \frac{1}{2}(3)(60)$

$+ (6)(90) + (5)(40) + \frac{1}{2}(5)(50) = \boxed{1300\ m}$

d) d = area from 12 - 13

$= (1)(50) + \frac{1}{2}(1)(20)$

$d = \boxed{60\ m}$

e) a = slope

i) $a = \frac{30}{5} = \boxed{6\ m/s^2}$

ii) $a = \frac{60}{3} = \boxed{20\ m/s^2}$

① f) $a =$ slope of tangent line

i) $a = \frac{60}{3} = \boxed{20\ m/s^2}$

ii) $a = -\frac{50}{5} = \boxed{-10\ m/s^2}$ (approx.)

② a) The ball is moving up the board from 1.5 – 4.5 s.

At $\boxed{4.5\ s}$ it reaches its highest point.

From 4.5 s – 7.5 s it is rolling down the board.

b) $a =$ slope

i) $a = -\frac{0.80}{3} = \boxed{-0.2\bar{6}\ m/s^2}$

ii) $a = -\frac{0.80}{3} = \boxed{-0.2\bar{6}\ m/s^2}$

iii) $a = -\frac{1.60}{6} = \boxed{-0.2\bar{6}\ m/s^2}$

c) $d =$ area (from 1.5 – 4.5)

$= \frac{1}{2}(3)(0.8)$

$d = \boxed{1.2\ m}$

② d) $d = \text{area (total)}$

$= (1.5)(0.8) + \frac{1}{2}(3)(0.8) - \frac{1}{2}(3)(0.8) - (1.5)(0.8)$

$d = \boxed{0}$

③ a) $a = \text{slope}$

i) $a = \boxed{0}$ (horizontal line)

ii) $a = \frac{25}{4} = \boxed{6.25 \text{ m/s}^2}$

iii) $a = \frac{-45}{4} = \boxed{-11.25 \text{ m/s}^2}$

b) $d = \text{area}$

i) $d = (5)(20) = \boxed{100 \text{ m}}$

ii) $d = 100 + 4(20) + \frac{1}{2}(4)(25) = \boxed{230 \text{ m}}$

iii) $d = 230 + \frac{1}{2}(4)(45) = \boxed{320 \text{ m}}$

④ a) speed changes by $\boxed{8 \text{ Km/h}}$

$136 - 128 = 8 \text{ Km/h}$

b) velocity changes by $\boxed{264 \text{ Km/h}}$ [East]

$\Delta v = v_2 - v_1$

$= 136 - (-128)$

$\Delta v = 264 \text{ Km/h}$

(5) a) $v_{avg} = \frac{\text{total distance}}{\text{total time}}$

Distance — note: 24 min = 0.4 h

First 24 min: $d = vt = (40)(0.4) = 16$ Km

Return home: $d = 16$ Km

Back to School: $d = 40$ Km

Total: $d = 72$ Km

Time

First 24 min: $t = 0.4$ h

Return Home: $t = 0.4$ h

Searching: $t = 0.1\overline{6}$ h (10 min)

Back to School: $t = \frac{d}{v} = \frac{40}{40} = 1$ h

Total: $t = 1.9\overline{6}$ h

$v_{avg} = \frac{72 \text{ Km}}{1.9\overline{6} \text{ h}} = \boxed{36.6 \text{ Km/h}}$

⑤ b) $V_{avg} = \frac{\text{total displacement}}{\text{total time}}$

$= \frac{40 \text{ Km [E]}}{1.9\overline{6} \text{ h}}$

$V_{avg} = \boxed{20.3 \text{ Km/h [E]}}$

⑥ a) $a = \frac{\Delta v}{\Delta t}$

$= \frac{13.\overline{3} \text{ m/s}}{3.6 \text{ s}}$

$a = \boxed{3.70 \text{ m/s}^2}$

b) $a = \frac{\Delta v}{\Delta t}$

$= \frac{(26.\overline{6} - 13.\overline{3})}{(10.2 - 3.6)}$

$a = \boxed{2.02 \text{ m/s}^2}$

c) $v_f^2 = v_i^2 + 2ad$

$(36.\overline{1})^2 = 0^2 + 2a(400)$

$a = \frac{(36.\overline{1})^2}{2(400)} = \boxed{1.63 \text{ m/s}^2}$

⑦ a) $d = v_i t + \frac{1}{2} a t^2$

$100 = v_i(4.23) + \frac{1}{2}(2)(4.23)^2$

$100 = 4.23 v_i + 17.89$

$v_i = \frac{100 - 17.89}{4.23} = \boxed{19.4 \text{ m/s}}$

b) $v_f = v_i + at$

$= 19.4 + (2)(4.23)$

$v_f = \boxed{27.9 \text{ m/s}}$

⑧ a) $a = \frac{\Delta v}{\Delta t} = \frac{73.7}{27.1} = 2.72 \text{ m/s}^2$

$m = \frac{\Sigma F}{a} = \frac{222\,000}{2.72} = \boxed{81\,630.9 \text{ Kg}}$

b) $d = \left(\frac{v_f + v_i}{2}\right) t$

$= \left(\frac{73.7 + 0}{2}\right) \cdot 27.1$

$d = \boxed{998.6 \text{ m}}$

(9) a) $\vec{v}_{actual} = \vec{v}_{boat} + \vec{v}_{current}$

$= 10 + (-3)$

$= 7 \text{ km/h}$

$t = \frac{d}{v} = \frac{7}{7} = \boxed{1 \text{ h}}$

note: upstream means you are travelling <u>against</u> the current.

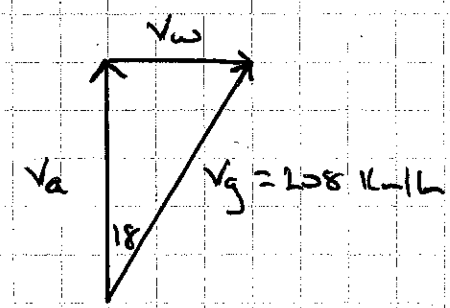
b) $\vec{v}_{actual} = 10 + (+3)$

$= 13 \text{ km/h}$

$t = \frac{d}{v} = \frac{7}{13} = \boxed{0.54 \text{ h}}$

note: downstream means <u>with</u> the current.

(10) $\vec{v}_{ground} = \vec{v}_{air} + \vec{v}_{wind}$

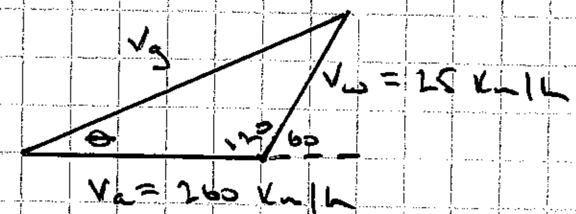


$\sin 18 = \frac{V_w}{208}$

$V_w = 208 \sin 18$

$V_w = \boxed{64.3 \text{ km/h}}$

(11) $\vec{V}_g = \vec{V}_a + \vec{V}_w$



$V_g^2 = 25^2 + 260^2 - 2(25)(260)\cos 120$

$V_g = 273.4$ km/h

$\frac{\sin\theta}{25} = \frac{\sin 120}{273.4}$

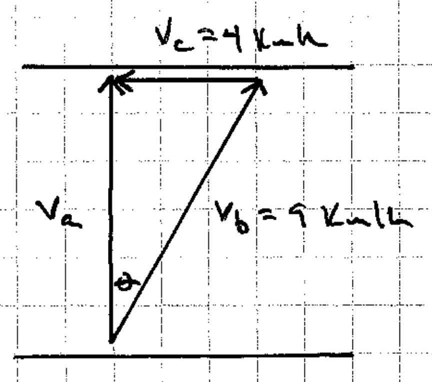
$\theta = \sin^{-1}\left(\frac{25\sin 120}{273.4}\right)$

$\theta = 4.5°$

$\therefore V_g = \boxed{273.4 \text{ km/h } [4.5° \text{ N of E}]}$

(12) a)

$\vec{V}_{actual} = \vec{V}_{boat} + \vec{V}_{current}$



$$\sin\theta = \frac{4}{9}$$

$$\theta = \sin^{-1}\left(\frac{4}{9}\right) = 26.4°$$

$$\boxed{26.4° \text{ E of N}}$$

b) $V_b^2 = V_a^2 + V_c^2$

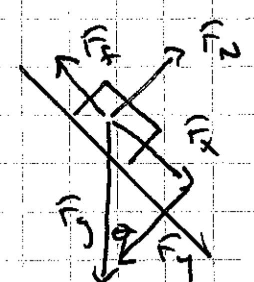
$$V_a^2 = V_b^2 - V_c^2$$

$$V_a = \sqrt{9^2 - 4^2}$$

$$V_a = \boxed{8.1 \text{ km/h}}$$

(13) $\mu = \tan\theta$

why? →



$$\theta = \tan^{-1}\mu$$

$$= \tan^{-1}(0.92)$$

$$\theta = \boxed{42.6°}$$

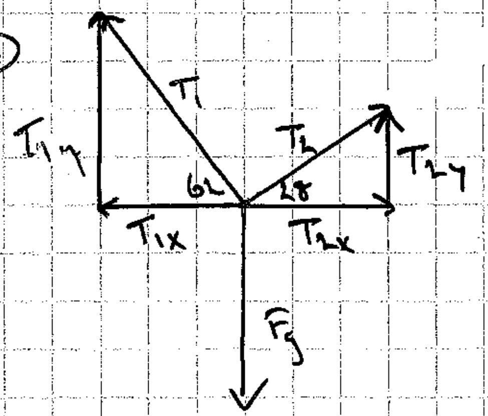
$$F_x = F_f$$

$$\cancel{m}\cancel{g}\sin\theta = \mu \cdot \cancel{m}\cancel{g}\cos\theta$$

$$\mu = \frac{\sin\theta}{\cos\theta}$$

$$\mu = \tan\theta$$

(14)



Horizontal

$$T_{1x} = T_{2x}$$

$$T_1 \cos 62 = T_2 \cos 28$$

Vertical

$$T_{1y} + T_{2y} = F_g$$

$$T_1 \sin 62 + T_2 \sin 28 = (250)(9.8)$$

Solve the first equation for T_1 and substitute into the second equation.

$$T_1 = T_2 \frac{\cos 28}{\cos 62}$$

$$\left(T_2 \frac{\cos 28}{\cos 62}\right) \sin 62 + T_2 \sin 28 = 2450$$

$$1.661\, T_2 + 0.469\, T_2 = 2450$$

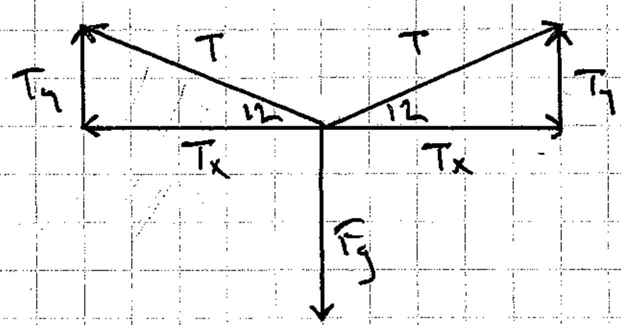
$$2.13\, T_2 = 2450$$

$$T_2 = \boxed{1150.2 \text{ N}}$$

$$T_1 = T_2 \frac{\cos 28}{\cos 62}$$

$$= 1150.2 \frac{\cos 28}{\cos 62} = \boxed{2163.2 \text{ N}}$$

15



Vertical

$$T_y + T_y = F_g$$

$$2T_y = F_g$$

$$2T_y = (50)(9.8)$$

$$T_y = 245\text{ N}$$

$$\sin 12 = \frac{T_y}{T}$$

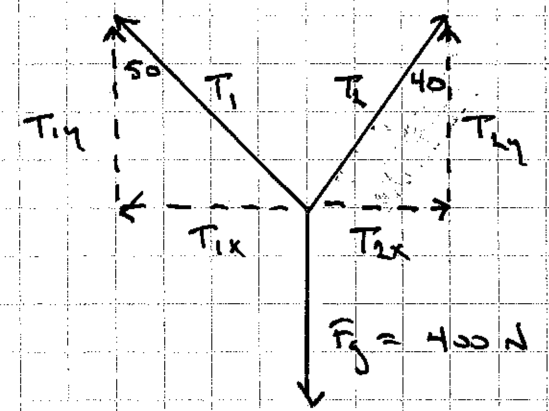
$$T = \frac{T_y}{\sin 12}$$

$$= \frac{245}{\sin 12}$$

$$T = \boxed{1178.4\text{ N}}$$

note: the tension forces are equal because the angles are the same.

(16)



Note: $T_1 = \omega_1$

$T_2 = \omega_3$

Vertical

$T_{1y} + T_{2y} = 400$

$T_1 \cos 50 + T_2 \cos 40 = 400$

$\left(\frac{T_2 \sin 40}{\sin 50}\right)\cos 50 + T_2 \cos 40 = 400$

$0.539\ T_2 + 0.766\ T_2 = 400$

$1.305\ T_2 = 400$

$\omega_3 = T_2 = \boxed{306.4\ N}$

Horizontal

$T_{1x} = T_{2x}$

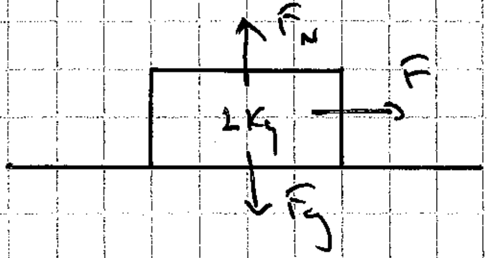
$T_1 \sin 50 = T_2 \sin 40$

$T_1 = \frac{T_2 \sin 40}{\sin 50}$

$T_1 = \frac{306.4 \sin 40}{\sin 50}$

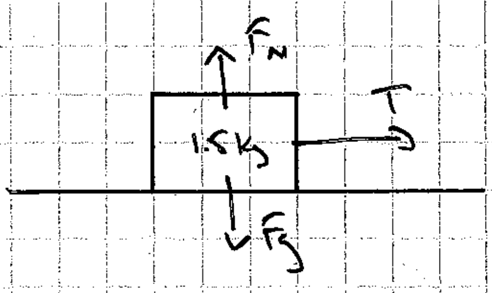
$\omega_1 = T_1 = \boxed{257.1\ N}$

(17) a) To find a, treat them as one object with a mass of 2 Kg.



$$a = \frac{F}{m} = \frac{4}{2} = \boxed{2 \text{ m/s}^2}$$

b) To find T, isolate one mass.



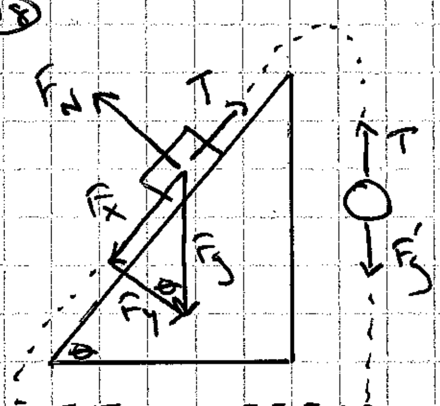
$$\Sigma F = T$$

$$T = ma$$

$$= (1.5)(2)$$

$$T = \boxed{3 \text{ N}}$$

(18)



a) $\Sigma F = F_g' - F_x$

$(m' + m)a = m'g - mg\sin\theta$

$11.6\, a = (3.6)(9.8) - (8)(9.8)\sin 53$

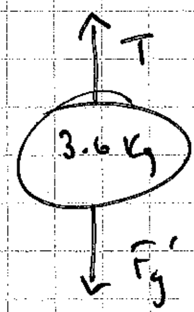
$11.6\, a = -24.778$

$a = -2.14$

or

$$\boxed{2.14 \text{ m/s}^2 \text{ [ccw]}}$$

(18) b)



$\Sigma F = F_g' - T$

$m'a = m'g - T$

$(3.6)(-2.14) = (3.6)(9.8) - T$

$T = \boxed{43\ N}$

(19) Since speed is constant, $F_A = F_f$.

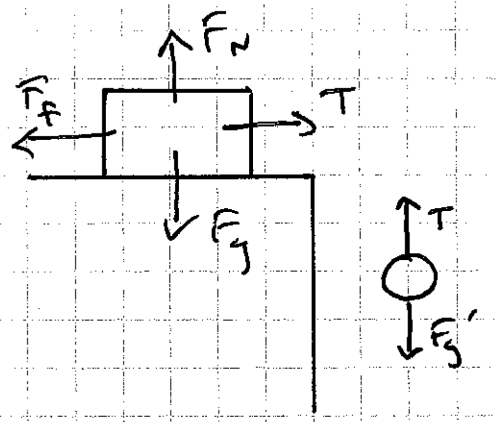
$\therefore \quad F_f = \mu \cdot F_N$

$F_A = \mu \cdot F_g$

$46.4 = \mu\,(9.75)(9.8)$

$\mu = \boxed{0.486}$

(20)



$\Sigma F = F_g' - F_f$

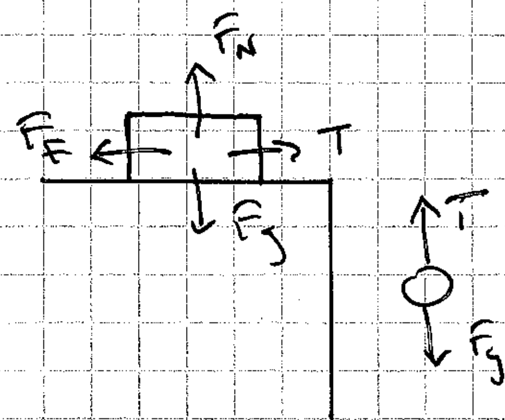
$(m + m')a = m'g - \mu mg$

$9a = (4)(9.8) - (0.55)(5)(9.8)$

$9a = 12.25$

$a = \boxed{1.36\ m/s^2\ [cw]}$

(21)



$$\Sigma F = F_g' - F_f$$

$$(m + m')a = m'g - \mu mg$$

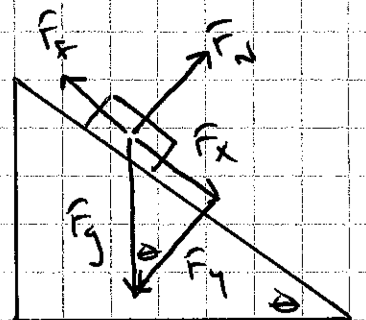
$$9(1) = (4)(9.8) - \mu(5)(9.8)$$

$$9 = 39.2 - 49\mu$$

$$\mu = \frac{39.2 - 9}{49}$$

$$\mu = \boxed{0.616}$$

(22)



$$v_f^2 = v_i^2 + 2ad$$

$$(5.25)^2 = 0^2 + 2a(8.35)$$

$$27.5625 = 16.7a$$

$$a = 1.65 \text{ m/s}^2$$

$$\Sigma F = F_x - F_f$$

$$\cancel{m}a = \cancel{m}g\sin\theta - \mu \cancel{m}g\cos\theta$$

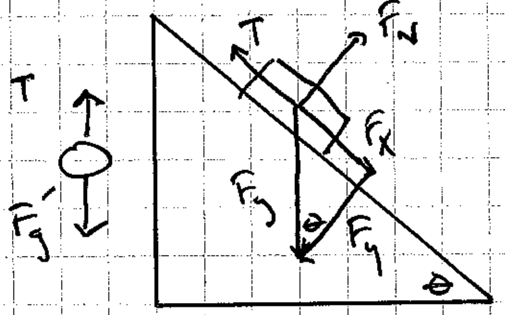
$$1.65 = 9.8\sin 20 - \mu(9.8)\cos 20$$

$$1.65 = 3.35 - 9.21\mu$$

$$\mu = \frac{3.35 - 1.65}{9.21}$$

$$\mu = \boxed{0.185}$$

(23)



a) $\Sigma F = F_x - F_g'$

Since it is motionless, $\Sigma F = 0$.

$0 = mg\sin\theta - m'g$

$0 = (10)(9.8)\sin\theta - (5)(9.8)$

$0 = 98\sin\theta - 45$

$\sin\theta = \frac{45}{98}$

$\theta = \sin^{-1}\left(\frac{45}{98}\right)$

$\theta = \boxed{27.3^\circ}$

b) $\Sigma F = F_x - F_g'$

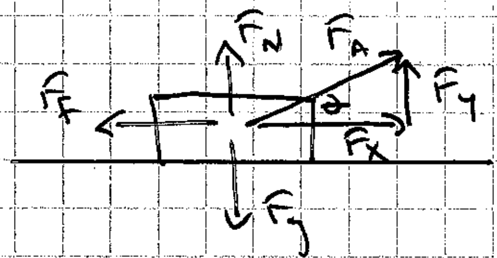
$(m+m')a = mg\sin\theta - m'g$

$15a = (10)(9.8)\sin 37 - (5)(9.8)$

$15a = 9.978$

$a = \boxed{0.67\ m/s^2\ [cw]}$

(24)



$F_N + F_y = F_g$

$F_N = mg - F_A \sin\theta$

$\Sigma F = F_x - F_f$

$0 = F_A \cos\theta - \mu\,(mg - F_A \sin\theta)$

$0 = F_A \cos\theta - \mu mg + \mu F_A \sin\theta$

$0 = F_A(\cos\theta + \mu \sin\theta) - \mu mg$

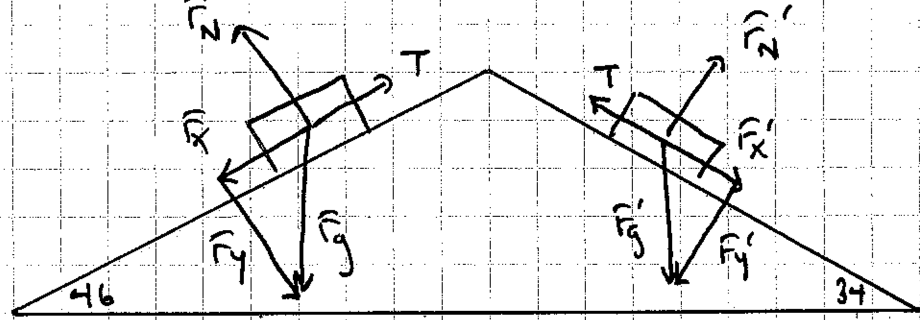
$0 = F_A\,[\cos 45 + (0.6)\sin 45] - (0.6)(40)(9.8)$

$0 = 1.131\,F_A - 235.2$

$F_A = \dfrac{235.2}{1.131}$

$F_A = \boxed{207.9\ \text{N}}$

25



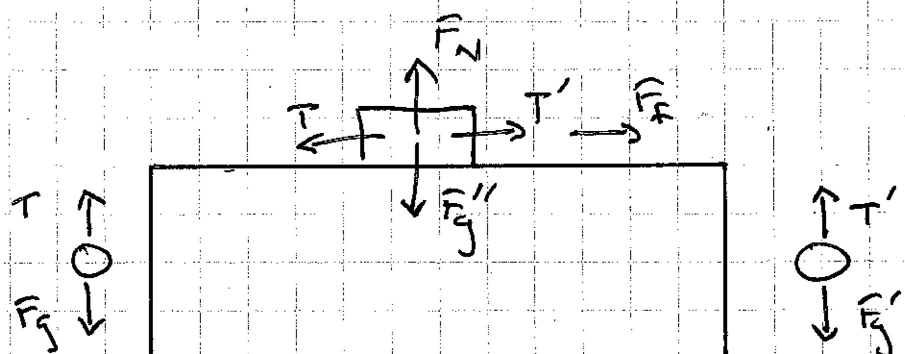
$$\Sigma F = F_x' - F_x$$

$$(m+m')a = m'g\sin 34 - mg\sin 46$$

$$2a = (1)(9.8)\sin 34 - (1)(9.8)\sin 46$$

$$a = -0.78 \quad \text{or} \quad \boxed{0.78\ m/s^2\ [ccw]}$$

26 a)



$$\Sigma F = F_g' - F_g + F_f$$

$$(m+m'+m'')a = m'g - mg + \mu m''g$$

$$9.31\,a = (3.62)(9.8) - (4.85)(9.8) + (0.47)(0.84)(9.8)$$

$$a = -0.88 \quad \text{or} \quad \boxed{0.88\ m/s^2\ [ccw]}$$

26 b) Left hanging mass:

$$\Sigma F = T - F_g$$

$$ma = T - mg$$

$$T = ma + mg$$

$$= (4.85)(-0.88) + (4.85)(9.8)$$

$$T = \boxed{43.3\ N}$$

Right hanging mass:

$$\Sigma F = F_g' - T'$$

$$m'a = m'g - T'$$

$$T' = m'g - m'a$$

$$= (3.62)(9.8) - (3.62)(-0.88)$$

$$T' = \boxed{38.7\ N}$$

27 a) $\Delta p = p' - p$

$$= mv_f - mv_i$$

$$= (0.145)(-58) - (0.145)(42)$$

$$\Delta p = \boxed{-14.5\ \text{Kg}\cdot\text{m/s}}$$

or

14.5 Kg·m/s [towards the batter]

(27) b) $F\Delta t = \Delta p$

$F(4.6\times10^{-4}) = -14.5$

$F = \boxed{-31\,521.7 \text{ N}}$

(28) a) $p = mv$

$= (550)(24)$

$p = \boxed{13\,200 \text{ Kg}\cdot\text{m/s}}$

b) $\Delta p = p' - p$

$= 0 - 13\,200$

$\Delta p = \boxed{-13\,200 \text{ Kg}\cdot\text{m/s}}$

c) In order to satisfy conservation of momentum,

$\Delta p\text{ (car)} = -\Delta p\text{ (truck)}$

$\therefore \Delta p = \boxed{13\,200 \text{ Kg}\cdot\text{m/s}}$ for the truck

d) $p = mv$

$-13\,200 = 680\,v$

$v = \boxed{-19.4 \text{ m/s}}$

(Note: The truck had $-13\,200$ Kg·m/s initially because it was travelling in the opposite direction)

(29) $(m_1 + m_2)v = m_1 v_1 + m_2 v_2$

$(4.65 + 0.05)(2) = (0.05)(647) + 4.65\, v_2$

$9.4 = 32.35 + 4.65\, v_2$

$v_2 = \frac{9.4 - 32.35}{4.65}$

$v_2 = \boxed{-4.94 \text{ m/s}}$

(30) $0 = m_1 v_1 + m_2 v_2$

$0 = (5)(0.12) + (2)\, v_2$

$v_2 = -\frac{(5)(0.12)}{2}$

$v_2 = \boxed{-0.3 \text{ m/s}}$

(31) $m_1 v_1 + m_2 v_2 = m_1 v_1' + m_2 v_2'$

$(0.012)(150) + 0 = (0.012)(-100) + 8.5\, v_2'$

$1.8 = -1.2 + 8.5\, v_2'$

$v_2' = \frac{1.8 + 1.2}{8.5}$

$v_2' = \boxed{0.35 \text{ m/s}}$

(32) $W = \text{area}$

$= (1)(60) + \frac{1}{2}(1)(60)$

$W = 90\ J$

$W = \Delta E_K$

$= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$90 = \frac{1}{2}(0.005)v_f^2 - 0$

$v_f = \sqrt{\frac{2(90)}{0.005}}$

$v_f = \boxed{189.7\ m/s}$

(33) $E_{top} = E_{bottom}$

$\frac{1}{2}\cancel{m}v_i^2 + \cancel{m}gh_i = \frac{1}{2}\cancel{m}v_f^2 + \cancel{m}gh_f$

$0 + (9.8)(32) = \frac{1}{2}v_f^2 + 0$

$313.6 = \frac{1}{2}v_f^2$

$v_f = \sqrt{2(313.6)}$

$v_f = \boxed{-25.0\ m/s}$

(34) $E_{top} = E_f$

$\frac{1}{2}\cancel{m}v_f^2 + \cancel{m}gh_f = \frac{1}{2}\cancel{m}v_i^2 + \cancel{m}gh_i$

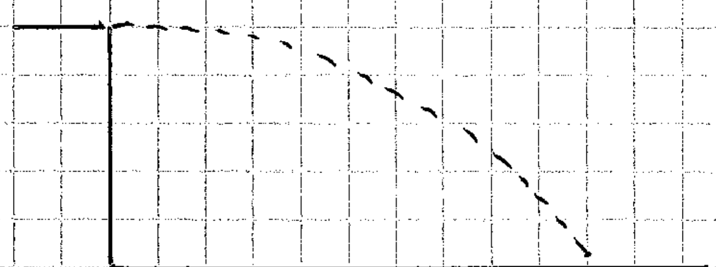
$0 + (9.8)(25) = \frac{1}{2}v_i^2 + (9.8)(5)$

$245 = \frac{1}{2}v_i^2 + 49$

$v_i = \sqrt{2(245-49)}$

$v_i = \boxed{19.8 \text{ m/s}}$

(35) a)



b)

Horizontal

$v_x = 8.25$ m/s

Vertical

$v_i = 0$

$a = -9.8$ m/s^2

$d = -3.215$ m $\leftarrow \left(6.43 / 2 \right)$

$v_f^2 = v_i^2 + 2ad$

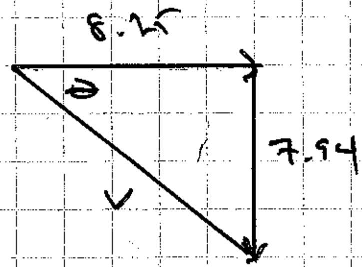
$= 0 + 2(-9.8)(-3.215)$

$v_f = \sqrt{63.014}$

$v_f = -7.94$ m/s

continues on next page

(35) b) continued



$\theta = \tan^{-1}\left(\frac{7.94}{8.25}\right)$

$\theta = 44°$

$v = \sqrt{8.25^2 + 7.94^2}$

$v = 11.4$ m/s

$v = \boxed{11.4 \text{ m/s } [44° \text{ BTH}]}$

(36) Vertical

$v_i = 0$
$a = -9.8$ m/s²
$d = -13$ m

$d = v_i t + \frac{1}{2} a t^2$

$-13 = \frac{1}{2}(-9.8)t^2$

$t = \sqrt{\frac{2(-13)}{-9.8}}$

$t = 1.63$ s

Horizontal

$d_x = 5$ m
$t = 1.63$ s

$v_x = \frac{d_x}{t}$

$= \frac{5}{1.63}$

$v_x = \boxed{3.07 \text{ m/s}}$

(37) $E_{top} = E_{bottom}$

$$\cancel{m}gh_1 + \frac{1}{2}\cancel{m}v_1^2 = \cancel{m}gh_2 + \frac{1}{2}\cancel{m}v_2^2$$

$$(9.8)(5.2) + \frac{1}{2}(15)^2 = 0 + \frac{1}{2}v_2^2$$

$$163.46 = \frac{1}{2}v^2$$

$$v = \sqrt{2(163.46)}$$

$$v = \boxed{18.1 \text{ m/s}}$$

(38) $a = \frac{v^2}{r}$ 　　　　 $40 \text{ km/h} = 11.\bar{1} \text{ m/s}$

$$= \frac{(11.1)^2}{20}$$

$$a = \boxed{6.17 \text{ m/s}^2}$$

(39) a) $v = \frac{2\pi r}{T}$

$$= \frac{2\pi(6.67 \times 10^8)}{306720}$$

$$v = \boxed{13\,664 \text{ m/s}}$$

b) $a = \frac{v^2}{r} = \frac{13\,664^2}{6.67 \times 10^8} = \boxed{0.28 \text{ m/s}^2}$

(40) $\Sigma F = \frac{mv^2}{r}$

$= \frac{(2000)(13.\bar{8})^2}{175}$

$\Sigma F = \boxed{2205 \text{ N}}$

(41) Electron

$\Sigma F = \frac{mv^2}{r}$

$= \frac{(9.11 \times 10^{-31})(2 \times 10^6)^2}{0.0285}$

$\Sigma F = 1.279 \times 10^{-16} \text{ N}$

Proton

$\Sigma F = \frac{mv^2}{r}$

$r = \frac{mv^2}{F}$

$= \frac{(1.67 \times 10^{-27})(2 \times 10^6)^2}{1.279 \times 10^{-16}}$

$r = \boxed{52.2 \text{ m}}$

(42) a) $a = \frac{v^2}{r}$

$= \frac{(61.1)^2}{180}$

$a = 20.75\ m/s^2$

$\#\ of\ g = \frac{a}{9.8} = \boxed{2.11\ g}$

b) $\Sigma F = F_N - F_g$

$F_N = \Sigma F + F_g$

$= ma + mg$

$= m(2.11g) + mg$

$F_N = 3.11\ mg$

$\therefore\ F_N = 3.11\ F_g$

He feels $\boxed{3.11 \times}$ his normal weight.

(43) $\Sigma F = F_f$

$\frac{\cancel{m}v^2}{r} = \mu \cancel{m} g$

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

$= \sqrt{(0.6)(85)(9.8)}$

$v = \boxed{22.4\ m/s}$

(44) a) $F_f = \mu \cdot F_N$

$= \mu \cdot mg$

$= (0.13)(50)(9.8)$

$F_f = \boxed{63.7\ N}$

b) Assuming the sled is moved at a constant speed, then

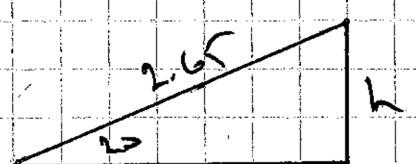
$F_A = F_f = 63.7\ N$

$W = F_A \cdot d$

$= (63.7)(20)$

$W = \boxed{1274\ J}$

(45) a)



$h = 2.65 \sin 20 = 0.906\ m$

$W = \Delta E_g$

$= mgh$

$= (132)(9.8)(0.906)$

$W_A = \boxed{1172\ J}$

(45) b) $F_f = \mu \cdot mg \cos\theta$ (inclined plane)

$= (0.2)(132)(9.8)\cos 20$

$F_f = 243.12\ N$

Work Lost to Friction:

$W_f = F_f \cdot d$

$= (243.12)(2.65)$

$W_f = 644.3\ J$

Total Work Needed:

$W_T = W_A + W_f$

$= 1172 + 644$

$W_T = \boxed{1816\ J}$

(46) a) $W = \Delta E_k$

$= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}(1200)(8.\bar{3})^2 - \frac{1}{2}(1200)(2.\bar{7})^2$

$W = \boxed{37\ 037\ J}$

(46) b) $W = \Delta E_K$

$= \frac{1}{2}mv_f^2 - \frac{1}{2}mv_i^2$

$= \frac{1}{2}(1200)(13.\overline{8})^2 - \frac{1}{2}(1200)(8.\overline{3})^2$

$W = \boxed{74\ 074\ J}$

(47) $E_{release} = E_{compressed}$

$mgh = \frac{1}{2}Kx^2$

$(1.25)(9.8)(0.452) = \frac{1}{2}K(0.0324)^2$

$K = \boxed{10\ 549\ N/m}$

(48) $E_A = E_B$

$\cancel{m}gh_A = \cancel{m}gh_b + \frac{1}{2}\cancel{m}v_b^2$

$(9.8)(30) = (9.8)(10) + \frac{1}{2}v_B^2$

$294 = 98 + \frac{1}{2}v_B^2$

$v_B = \sqrt{2(294-98)}$

$v_B = 19.8\ m/s$

$\Sigma F = F_f$

$ma = F_f$

$500a = -440$

$a = -0.88\ m/s^2$

continued on next page

(48) continued

$v_f^2 = v_i^2 + 2ad$

$0 = 19.8^2 + 2(-0.88)d$

$d = \frac{-(19.8)^2}{2(-0.88)}$

$d = \boxed{222.7\ m}$

(49) $E_{top} = E_{bottom}$

$\frac{1}{2}mv_i^2 + mgh_1 = E_K + mgh_2$

$\frac{1}{2}m(15.7)^2 + m(9.8)(12.7) = 293 + m(9.8)(1.29)$

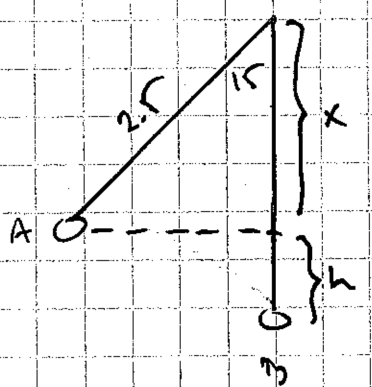
$123.245m + 124.46m = 293 + 12.642m$

$247.705m = 293 + 12.642m$

$235.063m = 293$

$m = \boxed{1.25\ Kg}$

(50)



$x + h = 2.5$ $\quad x = 2.5\cos 15$

$h = 2.5 - x$

$= 2.5 - 2.5\cos 15$

$h = 0.085\ m$

$E_A = E_B$

$mgh_A = \frac{1}{2} m v_B^2$

$(40)(9.8)(0.085) = \frac{1}{2}(40)\, v_B^2$

$33.39 = 20\, v_B^2$

$v_B = \sqrt{\frac{33.39}{20}}$

$v_B = \boxed{1.29\ m/s}$