Dynamics Worksheet #3

(1) (a) $F_g = mg$
$= 60(3.72) = 223.2\ N$

(b) $F_g = mg$
$= 60(10.49) = 629.4\ N$

(c) $F_g = mg$
$= 60(0.31) = 18.6\ N$

(2) Constant Velocity

$F_g = mg$
$= 2(9.8) = 19.6\ N$

$F_p = \frac{19.6}{4} = 4.9N$

Accelerate

$v_i = 0$
$v_f = 3\ m/s$
$t = 4.0s$
$a = ?$

$v_f = v_i + at$
$3 = 0 + a(4)$
$a = 0.75\ m/s^2$

$F_a = ma = 2(0.75) = 1.5\ N$

$F_{net} = 4.9 + 1.5 = \underline{6.4\ N}$

(3) $v_i = 0$
$v_f = ?$
$t = 3s$
$d = -18m$

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

$-18 = \left(\frac{0 + v_f}{2}\right)3$

$v_f = -12\ m/s$

$v_f = v_i + at$
$-12 = a(3)$
$a = -4\ m/s^2$

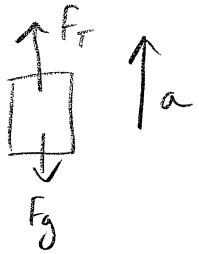
on earth

$F_g = mg$
$710 = m(9.8)$
$m = 72.4\ kg$

on planet

$F_g = mg$
$= 72.4(4)$
$F_g = \underline{290\ N}$

(4)



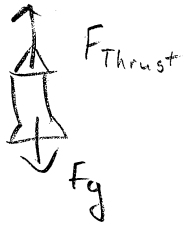
$F_{net} = F_T - F_g = ma$

$F_T - mg = ma$

$F_T - (1\times10^3)(9.8) = (1\times10^3)(21)$

$F_T = \underline{30\ 800\ N}$

(5) (a) (i)



(ii)

(b) $v_i = ?$

$v_f = 0$

$a = -9.8\ m/s^2$

$d = 5.0\times10^3 - 1\times10^3 = 4\times10^3\ m$

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

$4\times10^3 = \left(\frac{v_i}{2}\right)t$

$t = \frac{8\times10^3}{v_i}$

$v_f = v_i + at$

$0 = v_i - 9.8\left(\frac{8\times10^3}{v_i}\right)$

$\frac{78\ 400}{v_i} = v_i$

$78\ 400 = v_i^2$

$\underline{v_i = 280\ m/s}$

(c) Engine on

$v_i = 0$

$v_f = 280\ m/s$

$a = ?$

$d = 1\times10^3\ m$

$t = ?$

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

$1\times10^3 = \left(\frac{0 + 280}{2}\right)t$

$t = 7.14s$

$v_f = v_i + at$

$280 = 0 + a(7.14)$

$\underline{a = 39\ m/s^2}$

Engine off

$a = -9.8\ m/s^2$ (only force acting is gravity)

5 continued

(d) $F_{net} = F_E - F_g = ma$

$F_E - mg = ma$

$F_E - (1\times10^3)(9.8) = (1\times10^3)(39)$

$F_E = 49000\ N \quad (4.9\times10^4\ N)$

(6)

$F_{net} = F_{jump} - F_g = ma$

$= F_j - mg = ma$

$m = 70\ kg$

$g = 9.8\ m/s^2$

$a = ?$

$F_j - 70(9.8) = 70(39.2)$

$F_j = 3430\ N$

pushing

$d = 0.2\ m$

$v_i = 0$

$v_f = ?$

$a = ?$

$t = ?$

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

$0.2 = \left(\frac{0 + 3.96}{2}\right)t$

$t = 0.101\ s$

$v_f = v_i + at$

$3.96 = 0 + a(.101)$

$a = 39.2\ m/s^2$

In air

$d = 0.8\ m$

$v_f = 0$

$v_i = ?$

$a = -9.8\ m/s^2$

$v_f = v_i + at$

$0 = v_i - 9.8t$

$t = \frac{v_i}{9.8}$

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

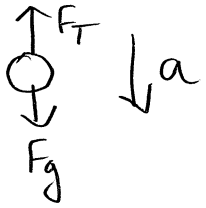
$.8 = \left(\frac{v_i}{2}\right)\left(\frac{v_i}{9.8}\right)$

$.8 = \frac{v_i^2}{19.6}$

$v_i^2 = 15.68$

$v_i = 3.96\ m/s$

(7)



$m = .1g = 1\times10^{-4}\ kg$

$F_T = 5.6\times10^{-4}\ N$

$g = 9.8\ m/s^2$

$F_{net} = F_T - F_g = ma$

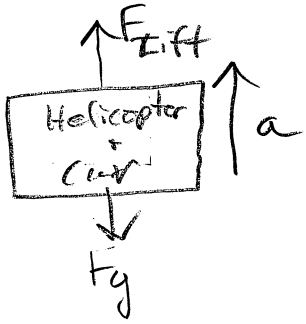
$F_T - mg = ma$

$(5.6\times10^{-4}) - (1\times10^{-4})(9.8) = (1\times10^{-4})a$

$a = -4.2\ m/s^2$

$(a = 4.2\ m/s^2\ down)$

(8)



(a) $m = 5000 + 2000 = 7000$ kg

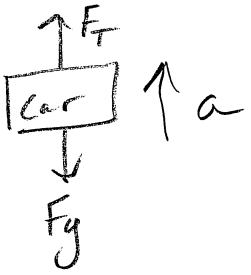
$F_{net} = F_{Lift} - F_g = ma$

$F_{Lift} - mg = ma$

$F_{Lift} - 7000(9.8) = 7000(0.5)$

$F_{Lift} = \underline{72\ 100\ N}$ (up)

(b)



$m = 2000$ kg

$F_{net} = F_T - F_g = ma$

$F_T - mg = ma$

$F_T - 2000(9.8) = 2000(.5)$

$F_T = \underline{20\ 600\ N}$ (up)