Physics

Dynamics WS $\Sigma F \neq 0$ W 3.11

$\Sigma F = ma$ $F_a + (-F_f) = ma$ $a = \frac{F_a - F_f}{m}$

1) $WT = 50\ N$

$\mu = .2$

$m = 5.10\ kg$

$a = \frac{10N - (.2)(50N)}{5.10\ kg} = 0\ m/s^2$

---

2) 

$\Sigma F_y = 0$ $-F_g + F_{ay} + F_N = 0$ $F_N = F_g - F_{ay}$

$F_N = 100N - 50N \sin 36.87° = 70.0N$

$WT = 100N$ $\mu = .20$

$m = 10.2\ kg$

$a = \frac{F_a - F_f}{m} = \frac{(50N \cos 36.87°) - (.2)(70.0N)}{10.2\ kg}$

$a = 2.6\ m/s^2$

---

3) 

$\Sigma F_y = 0$ $F_N - F_g - F_{ay} = 0$ $F_N = F_g + F_{ay}$

$F_N = 40N + 50 \sin 53.13° = 80.0N$

$WT = 40N$

$m = 4.09\ kg$

$a = \frac{F_a - F_f}{m} = \frac{50N \cos 53.13° - (.2)(80N)}{4.08\ kg}$

$a = 3.4\ m/s^2$

---

4) 

Box 2) $F_N = F_g + F_{ay} = 10N + 50 \sin 36.87$

$F_N = 40N$

$\theta = 36.87°$

$a = \frac{F_a - F_f}{m} = \frac{50N \cos 36.87° - .2(40N)}{1.02\ kg}$

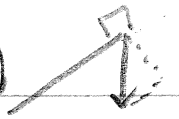
$W_1 = 10N$ $m_1 = 1.02\ kg$

$W_2 = 60N$ $m_2 = 6.12\ kg$

$a_1 = 31.\ m/s^2$

Box 2) $\Sigma F = ma$ $a = \frac{\Sigma F}{m} = \frac{F_a + F_{a_{B1}} - F_f}{m}$

$a_2 = \frac{80N + (.2)(40N) - (.2)(70N + 50 \sin 36.87)}{7.12\ kg} = 11\ m/s^2$

7.) 

$\Sigma F = ma \quad -F_{g_x} - F_F + F_a = ma$

$W_T = 100N$

$m = 10.2\,kg$

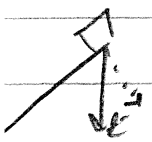
$a = \dfrac{100N - 100N \sin 36.87° - (.2)(100N)(\cos 36.87°)}{10.2\,kg}$

$m = 10.2kg \quad F_a = 100N$

$\theta = 36.87°$

$a = 2.4\,m/s^2$

6.) $W_T = 100N$



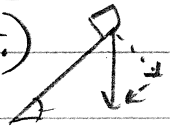
$m = 10.2\,kg$

$F_a = 20.N$

$\Sigma F = ma \quad F_a + F_F - F_{g_x} = ma$

$a = \dfrac{20.N - 100N \sin 36.87° + (.2)(100N)(\cos 36.87°)}{10.2\,kg}$

$\theta = 36.87° \quad a = -2.4\,m/s^2$

5.) 

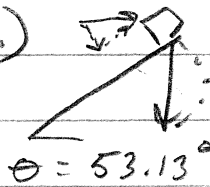
$\Sigma F = ma \quad F_{a_x} - F_F = ma$

$a = \dfrac{-(100N \sin 36.87°) + (.2)(100N)\cos 36.87°)}{10.2\,kg}$

$W_T = 100N \quad m = 10.2kg$

$\theta = 36.87°$

$a = 4.3\,m/s^2$

8.) 

$\theta = 53.13°$

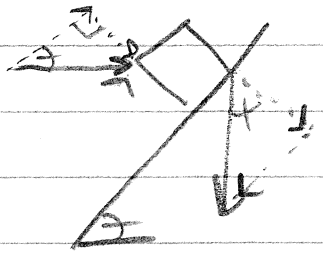
$\Sigma F_x = ma \quad F_{a_x} - F_{g_x} - F_F = ma$

$\Sigma F_y = 0 \quad F_N - F_{g_y} - F_{a_y} = 0 \quad F_N = F_{g_y} + F_{a_y}$

$F_N = (100N \cos 53.13°) + (50N \sin 53.13°)$

$W_T = 100N \quad m = 10.2kg \quad F_N = 100N$

$F_a = 50N$



$a = \dfrac{(50N \cos 53.13°) - (100N \sin 53.13°) + (.2)(100N)\cos 53.13°)}{10.2\,kg}$

$a = -3.7\,m/s$

Football Problem Worksheet

1) $V = 25.0\ m/s$, $\theta = 60.0^\circ$

$V_x = 25.0\ m/s \cos\theta = 12.5\ m/s$

$V_y = 25.0\ m/s \sin\theta = 21.65\ m/s$

$d = d_0 + v_0 t + \frac{1}{2} a t^2$

$0_m = 0_m + (21.65\ m/s)t + \frac{1}{2}(-9.80\ m/s^2)t^2$

$t = 4.42\ s$

---

2) $\theta = 35.0^\circ$

$V_x = 7.70\ m/s$

V_y, $\theta = 35^\circ$, $V_x = 7.70\ m/s$

$\tan\theta = \frac{o}{a}$ a $\tan\theta = o$

$7.70\ m/s \tan 35^\circ =$

$V_y = 5.39\ m/s$

---

3) $\theta = 58.0^\circ$ $V = 6.60\ m/s$ 1.20m

$V_x = 6.60\ m/s \cos 58.0^\circ = 3.497\ m/s$

$V_y = 6.60\ m/s \sin 58.0^\circ = 5.597\ m/s$

a) $V^2 = v_0^2 + 2a(d - d_0)$ at t^2

$d = \frac{V^2 - v_0^2}{2a} + d_0 = \frac{(0\ m/s)^2 - (5.597\ m/s)^2}{2(-9.80\ m/s^2)} + 1.2m = 2.80\ m$

B) $V = v_0 + at$ $t_{TOP} = \frac{v - v_0}{a} = \frac{0\ m/s - 5.597\ m/s}{-9.80\ m/s^2} = .571\ s$

$d_x = V_x t = (3.497\ m/s)(.571\ s) = 2.00\ m$

---

4) 0_m, 3.0m, $V = 14.0\ m/s$, $\theta = 40.0^\circ$

$V_x = 14.0\ m/s \cos 40.0^\circ = 10.72\ m/s$

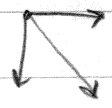
$V_y = 14.0\ m/s \sin 40.0^\circ = 9.000\ m/s$

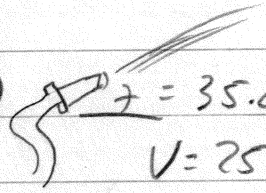
$V_y^2 = v_0^2 + 2a\Delta d = (9.000\ m/s)^2 + 2(-9.80\ m/s^2)(3.00m)$

$V_y = 4.712\ m/s$

$V = \sqrt{(-4.712\ m/s)^2 + (10.72\ m/s)^2}$

Speed $= 11.7\ m/s$



5.) 

$\theta = 35.0^\circ$ $\quad V_x = 25.0\,m/s \cos 35.0^\circ = 20.48\,m/s$

$V = 25.0\,m/s$ $\quad V_y = 25.0\,m/s \sin 35.0^\circ = 14.34\,m/s$

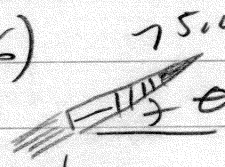
$V^2 = V_0^2 + 2a\Delta d$ $\qquad \Delta d = \dfrac{V^2 - V_0^2}{2a} = \dfrac{(0\,m/s)^2 - (14.34\,m/s)^2}{2(-9.80\,m/s^2)} = 10.49\,m$

$d = d_0 + V_0 t + \frac{1}{2} a t^2$

$10.49\,m = 0\,m + (14.34\,m/s)t + \frac{1}{2}(-9.80\,m/s^2)t^2$

$t = 1.46\,s$ $\qquad d_x = V_x t = (20.48\,m/s)(1.46\,s) = 30.0\,m$

---

6) 

$75.0\,m/s$

$\theta = 60.0^\circ$ $\quad V_x = 75.0\,m/s \cos 60^\circ = 37.5\,m/s$ $\quad V_y = 75.0\,m/s \sin 60^\circ = 64.95\,m/s$

11.0 m

$d_x = 27.0\,m$

$t = \dfrac{d_x}{V} = \dfrac{27.0\,m}{37.5\,m/s} = .720\,s$

$d = d_0 + V_0 t + \frac{1}{2} a t^2$

$d_m = 0\,m + (64.95\,m/s)(.720\,s) + \frac{1}{2}(-9.80\,m/s^2)(.720\,s)^2$

$d = 44.22\,m$ $\qquad$ Pocket Change $44.22\,m - 11.0\,m = 33.2\,m$

Brighton Area Schools
Learning For Life

Phys Cliff Probs

1.) 20 m/s →, h = 100.0 m

$y = y_0 + v_0 t + \frac{1}{2} a t^2$

$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2(100\text{m})}{9.81\text{m/s}^2}} = 4.51\text{s}$

$d = vt = (20\text{m/s})(4.51\text{s}) = 90.\text{m}$

2.) → , h = 2.00 m, v_x = ?, d_x = 1.50 m

$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2(2.0\text{m})}{9.80\text{m/s}^2}} = .6389\text{s}$

$d = vt \quad v = \frac{d}{t} = \frac{1.50\text{m}}{.6389\text{s}} = 2.35\text{m/s}$

3) ↑ $v_0 = 32.0\text{m/s}$, O, y, d = 16m, $d_0 = 0\text{m}$

A) $d = d_0 + v_0 t + \frac{1}{2} a t^2$

$0 = -16.0\text{m} + (32.0\text{m/s})t + \frac{1}{2}(-9.80\text{m/s}^2)t^2$

$t = 5.99\text{s}, .546\text{s}$

B) $v = v_0 + at$

$= 32.0\text{m/s} + (-9.80\text{m/s}^2)(.546\text{s})$

$v_1 = 26.6\text{m/s}$

$v = v_0 + at$

$v = 32\text{m/s} + (-9.80\text{m/s}^2)(5.99\text{s})$

$v_2 = -26.7\text{m/s}$

4) → $v = 45.0\text{m/s}$, h = 1.30 m

a) Both h.t @ same time

$y = y_0 + v_0 t + \frac{1}{2} a t^2$

$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2(1.30\text{m})}{9.80\text{m/s}^2}} = .515\text{s}$

B) $d = vt = (45.0\text{m/s})(.515\text{s}) = 23.2\text{m}$

5) $a = 4.25\text{m/s}^2$, d = 50.0 m, d_R = 12.5 m, h = 4.5 m, $d_{RAMP} = 50.0\text{m}$

$v^2 = v_0^2 + 2ad$

$v^2 = 0\text{m/s} + 2(4.25\text{m/s})(50.0\text{m})$

$v = 20.62\text{m/s}$

$t = \sqrt{\frac{2h}{a}} = \sqrt{\frac{2(4.5\text{m})}{9.80\text{m/s}}}$

$t = .958\text{s}$

$d = vt = (20.62\text{m/s})(.958\text{s}) = 19.7\text{m}$

Clears River

Produced by Brighton High School Graphics/Printing
"Your impression of our image is important to us"

Brighton Area Schools
Learning For Life

PHY Cliff Problems WS

6) $V = 11.4\ m/s$, $h = 15.5\ m$, $t = ?$

a) $t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2(15.5\ m)}{9.80\ m/s^2}} = 1.78\ s$

B) $d = vt = (11.4\ m/s)(1.78\ s) = 20.3\ m$

---

7) $V = 24.0\ m/s$, $d = vt$, $a = 4.0\ m/s^2$ ←, $90\ m$

$d = d_0 + v_0 t + \frac{1}{2} a t^2$

a) $d = 90\ m + (0\ m/s)t + \frac{1}{2} a t^2$

$vt = d_0 + \frac{1}{2} a t^2$

$0 = d_0 + vt + \frac{1}{2} a t^2$

$0 = 90\ m - (24.0\ m/s)t + \frac{1}{2}(-4.0\ m/s^2)t^2$

$t = 3.0\ s$

B) $t = \sqrt{\frac{2h}{g}}$ $\quad h = \frac{g t^2}{2}$ $\quad h = \frac{(9.80\ m/s^2)(3.0\ s)^2}{2}$

$h = 44.1\ m$

Produced by Brighton High School Graphics/Printing
"Your impression of our image is important to us"