SLO Practice Prob Solutions

1.

$V_i = 25\ m/s$

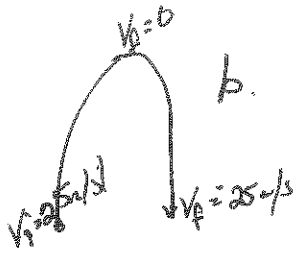
$a_g = -9.81\ m/s^2$

a. $V_f^2 = V_i^2 + 2a\Delta y$

$0 = (25\ m/s)^2 + 2(-9.81\ m/s^2)\Delta y$

$-625\ m^2/s^2 = -19.62\ \Delta y$

$31.855\ m = \Delta y$



b. $V_i = 25\ m/s$ $\quad V_f = -25\ m/s$ $\quad a = -9.81\ m/s^2$

$a = \frac{V_f - V_i}{t}$

$t = \frac{V_f - V_i}{a} = \frac{-25\ m/s - 25\ m/s}{9.81\ m/s^2} = 5.09\ s$

---

2. $V_i = 0$ $\quad a = -9.81\ m/s^2$ $\quad a = \frac{V_f - V_i}{t}$

$t = 8.0\ s$

a. $V_f = V_i + at$

$V_f = 0 + (-9.81)(8.0\ s)$

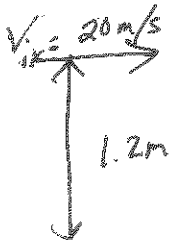
$V_f = -78.48\ m/s$

b. $\Delta y = V_i + \frac{1}{2}at^2$

$\Delta y = 0 + \frac{1}{2}(-9.81)(8.0\ s)^2$

$\Delta y = -313.92\ m$

3.



a. $V_{i,x} = 20\ m/s$ $\quad V_{y,i} = 0$

$V_{f,x} = 20\ m/s$ $\quad V_{y,f} =$

$a_x = 0\ m/s$ $\quad a_y = -9.81\ m/s$

a. $\Delta y = V_y t + \frac{1}{2} a t^2$

$1.2 = 0 + \frac{1}{2}(-9.81\ m/s^2) t^2$

$t = .494\ s$

b. $d_x = V_i t + \frac{1}{2} a_x t^2$

$d_x = (20\ m/s)(.494)$

$d_x = 9.88\ m$

$a = \frac{V_f - V_i}{t}$

c. $\frac{V_f - V_i}{t} = a$

$V_f - V_i = at$

$V_f = V_i + at$

$V_f = 20\ m/s + (-9.81)(.494)$

$V_f = -4.846\ m/s$

4. $V_{i,x} = 2.8\ m/s$

$a_y = -9.81\ m/s^2$

$t = 2.6\ s$

a $\Delta y = \cancel{V_i t} + \frac{1}{2}at^2$

$\Delta y = \frac{1}{2}at^2$

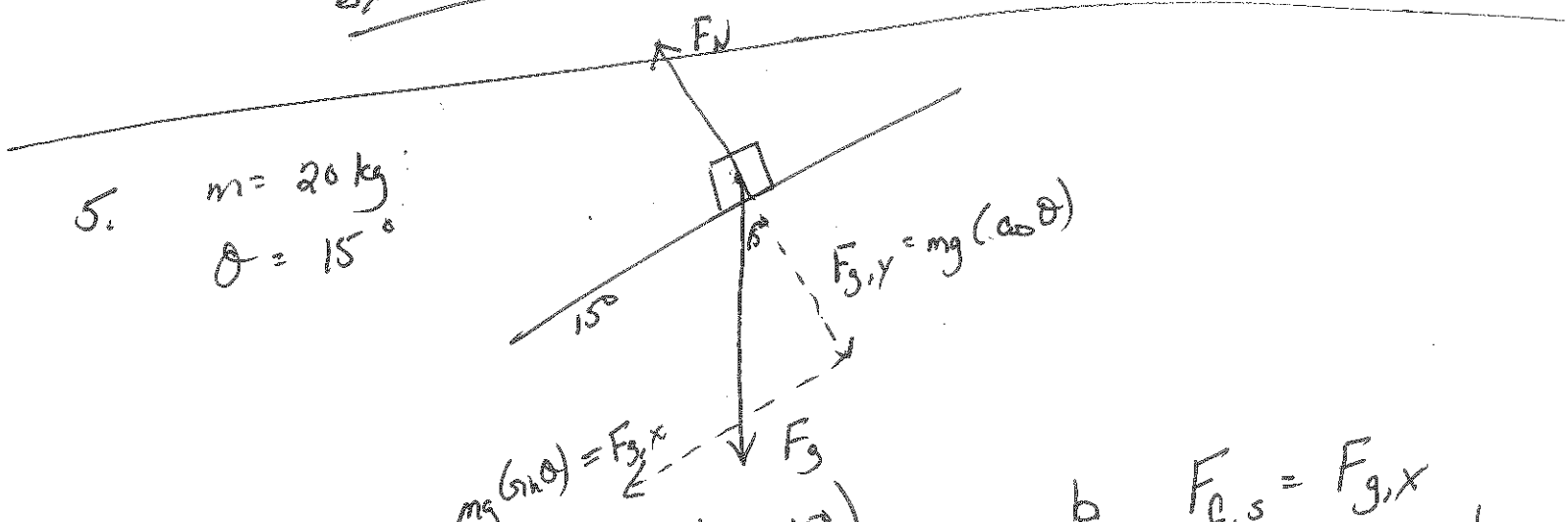
$\Delta y = \frac{1}{2}(-9.81\ m/s^2)(2.6)^2$

$\Delta y = \underline{-33.157\ m}$

b. $\Delta x = V_i t + \cancel{\frac{1}{2}at^2}$

$\Delta x = (2.8)(2.6)$

$\underline{\Delta x = 7.28\ m}$



5. $m = 20\ kg$

$\theta = 15°$

$mg(\sin\theta) = F_{g,x}$

a. $F_{g,y} = (20)(-9.81)(\cos 15°)$

$= \underline{189.5\ N}$

$F_{g,x} = (20)(-9.81)(\sin 15°)$

$= \underline{50.78\ N}$

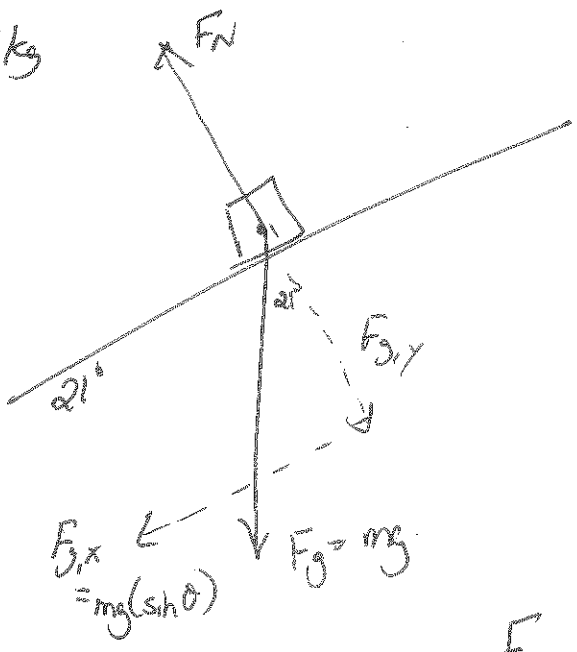
b $F_{f,s} = F_{g,x}$

Force ⊥ to the incline must be balanced

$F_{f_s} = 50.78\ N$

6. $m = 0.45\ kg$

$\theta = 21°$



$F_{g,x} = F_{f,k}$

$F_{g,x} = (.45)(-9.81)(\sin 21°)$

$F_{g,x} = \underline{1.58\ N}$

$\underline{F_{f,k} = 1.58\ N}$

---

7. $m_1 = 1\ kg$ $\quad m_2 = 0.5\ kg$

$v_{1,i} = 0\ m/s$ $\quad v_{2,i} = 13\ m/s$

$v_f = ?$

$m_1 v_{1,i} + m_2 v_{2,i} = (m_1 + m_2) v_f$

$0 + (.5)(13) = (1 + .5) v_f$

$\frac{6.5}{1.5} = v_f$

$\underline{4.33\ m/s = v_f}$

8. $m_1 = 0.012\ kg$ $\quad m_2 = 8.5\ kg$

$V_{1,i} = 150\ m/s$ $\quad V_{2,i} = 0\ m/s$

$V_{1,f} = -100\ m/s$ $\quad V_{2,f} = ?$

$m_1V_{1i} + m_2V_{2i} = m_1V_{1,f} + m_2V_{2f}$

$(0.012)(150) + 0 = (.012)(-100) + (8.5)(V_{2f})$

$1.8 + 0 = -1.2 + 8.5\,V_{2,f}$

$3 = 8.5\,V_{2,f}$

$.3529\ m/s = V_{2,f}$

9. $h_i = 52m$ $\quad h_f = 0m$

$K.E_i + P.E_i = K.E_f + P.E_f$

$\cancel{\frac{1}{2}mv_i^2} + mgh_i = \frac{1}{2}mv_f^2 + \cancel{mgh_f}$

$mgh_i = \frac{1}{2}mv_f^2$

$\frac{2\cancel{m}gh_i}{\cancel{m}} = \frac{\cancel{m}v_f^2}{\cancel{m}}$

$\sqrt{2gh_i} = v_f^2$

$\sqrt{2(-9.81)(52)} = v_f$

$31.9\ m/s = v_f$

b. $K.E_A + P.E_A = K.E_c + P.E_c$

$\cancel{\frac{1}{2}mv_A^2} + mgh_A = \frac{1}{2}mv_c^2 + mgh_c$

$mgh_A = \frac{1}{2}mv_c^2 + mgh_c$

$\frac{\cancel{m}gh_A}{\cancel{m}} = \frac{m(\frac{1}{2}v_c^2 + gh_c)}{m}$

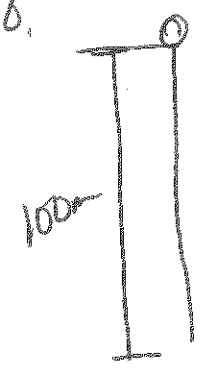
$gh_A = \frac{1}{2}v_c^2 + gh_c$

$gh_A - gh_c = \frac{1}{2}v_c^2$

$g(h_A - h_c) = \frac{1}{2}v_c^2$

$9.81(52 - 18) = \frac{1}{2}v_c^2$

$v_c = 26m/s$

10. 

$m = 20kg$
$h = 100m$

a. $P.E. = mgh$
$P.E. = (20)(9.8)(100m)$
$P.E. = 19,600J$

b. $K.E = 19,600J$ - P.E is converted to K.E.

c. ~~$KE_i + PE_i = KE_f + PE_f$~~
$KE_f = 19,600J$
$19,600J = \frac{1}{2}mv^2$
$19,600J = \frac{1}{2}(20)(v^2)$
$v = 44m/s$

---

11. a. $x = 0.2m$ $F = 5N$
$F = -kx$
$5N = -k(-0.2m)$
$k = 25\ N/m$

b. $P.E_{sp} = \frac{1}{2}kx^2$
$P.E_{sp} = \frac{1}{2}\left(25\frac{N}{m}\right)(0.2m)^2$
$P.E_{sp} = 0.5J$

---

12. $k = 35\ \frac{N}{m}$ $P.E. = 1.5J$
a. $P.E_{sp} = \frac{1}{2}kx^2$
$1.5J = \frac{1}{2}\left(35\frac{N}{m}\right)(x^2)$
$x = .29m$

b. $m = 0.022kg$
$P.E_{sp}$ converts to K.E.
$K.E. = 1.5J$
$K.E. = \frac{1}{2}mv^2$
$1.5 = \frac{1}{2}(0.022kg)v^2$
$v = 12m/s$

13. $h_o = 2\text{cm}$ $\quad f = -30\text{cm}$ ← neg. b/c convex

$d_o = 40\text{cm}$

• must show at least 2 of 3 rays.

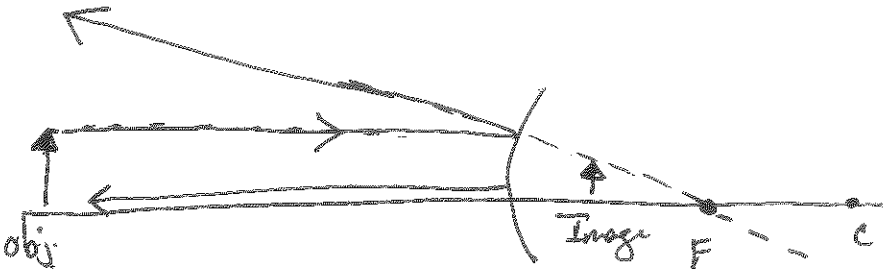


Image Distance

b. $\frac{1}{F} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{-30\text{cm}} = \frac{1}{40\text{cm}} + \frac{1}{d_i}$

$d_i = -17.1\text{cm}$

Image height

$\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

$\frac{h_i}{2\text{cm}} = -\frac{(-17.1\text{cm})}{40\text{cm}}$

$h_i = 0.86\text{cm}$

---

14. $h_o = 3.0\text{cm}$ $\quad R = 34.0\text{cm} \Rightarrow f = \frac{1}{2}R$

$d_o = 22.4\text{cm}$

$f = \frac{1}{2}(34.0\text{cm})$

$f = 17.0\text{cm}$

a) $\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$

$\frac{1}{17.0\text{cm}} = \frac{1}{22.4\text{cm}} + \frac{1}{d_i}$

$d_i = 70.5\text{cm}$

b) $\frac{h_i}{h_o} = \frac{-d_i}{d_o}$

$\frac{h_i}{3.0\text{cm}} = -\frac{(70.5\text{cm})}{22.4\text{cm}}$

$h_i = -9.44\text{cm}$

L = Beyond C (C would be at 34cm)
O - Inverted (b/c h_i is neg.
S. Enlarged ($h_i > h_o$)
T. Real (b/c d_i is pos. / h_i is neg).