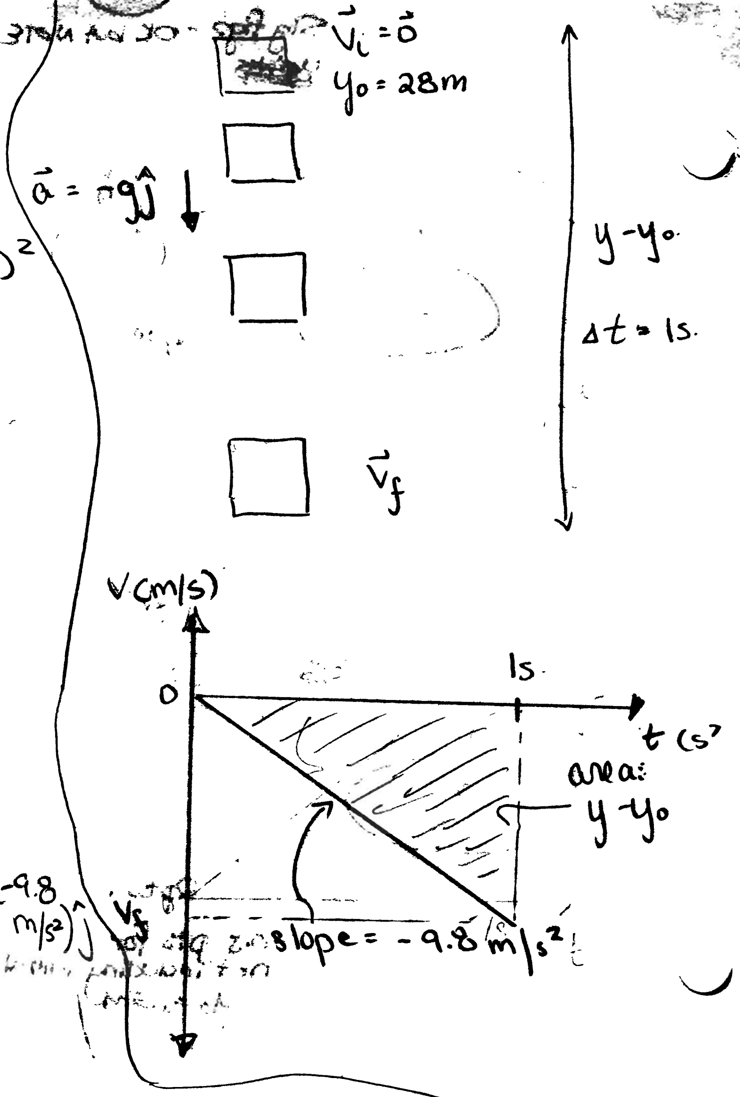
SP6-2) a) $y = y_0 + \cancel{v_{0,y}t}^{0} + \frac{1}{2}a_y t^2$

$a_y = -g$

$y = 28\text{m} + \frac{1}{2}(-9.8\text{m/s}^2)(1\text{s})^2$

$= 23.1\text{m}$ //



b) $v_f = \cancel{v_i}^{0} + at$

$v_f = (-9.8\text{m/s}^2)(1\text{s})$

$= -9.8\text{m/s}$ //

c) $\vec{F}_g = m\vec{g}$

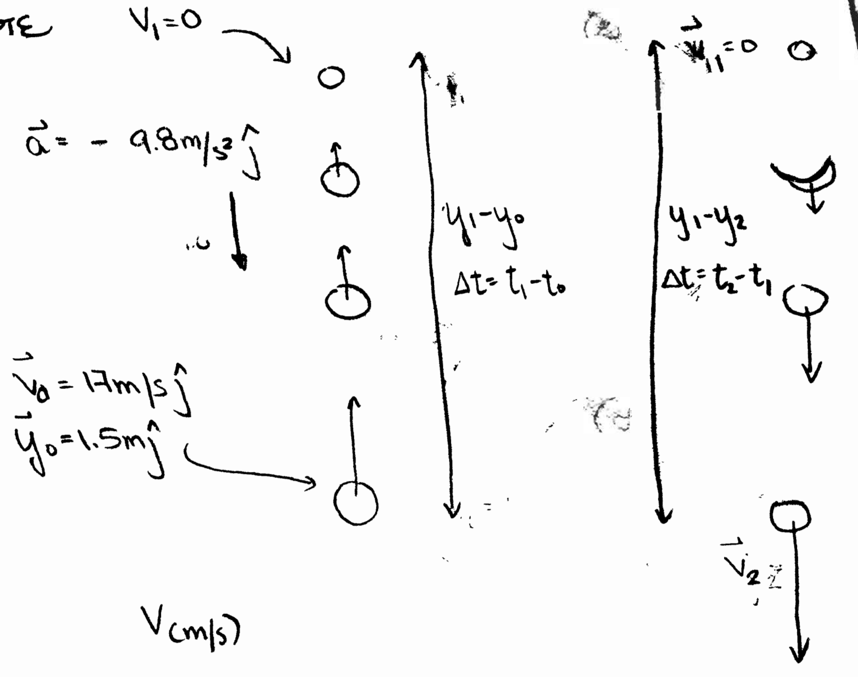
$\to [(8 \times 55\text{kg}) + 200\text{kg}] \cdot (-9.8\text{m/s}^2)\hat{j}$

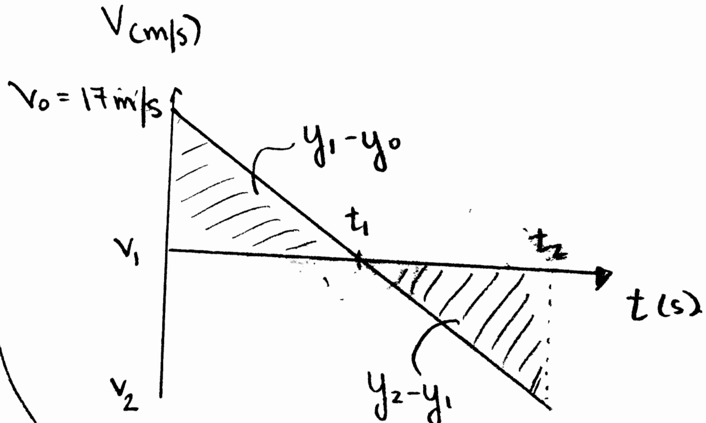
$= (-6.3 \times 10^3\text{ N})\hat{j}$ //

d) N/A.

SP6-3)

Sig figs - OK but NOTE





a) $\cancel{V_{11}}^{0} = V_0 + a t_1$

$$t_1 = \frac{-V_0}{a} = -\frac{(17 m/s)}{(-9.8 m/s^2)}$$

$$= 1.73 s$$

2pts.

b) $\cancel{V_1^2}^{0} = V_0^2 + 2a(y_1 - y_0)$

$$\frac{-V_0^2}{2a} + y_0 = y_1$$

$$y_1 = 1.5 m + \frac{-(17 m/s)^2}{2(-9.8 m/s^2)}$$

$$16.2 m.$$

$$\vec{y}_1 = 16.2 m \hat{j}$$

2pts.

-0.5 pts for not including initial $y_0 = 1.5m$

c) $V = V_0 + at$

(i) $V = 4.0 m/s$.

$$t = \frac{V - V_0}{a} = \frac{(4 - 17) m/s}{-9.8 m/s^2} = 1.33 s$$

(ii) $V = -4.0 m/s$.

right formula, wrong usage (-1.5)

$$t = \frac{(-4 - 17) m/s}{-9.8 m/s^2} = 2.14 s$$

2pts.

d) $V^2 = V_0^2 + 2a(y - y_0)$.

-1.5 major error.

$$y = \frac{V^2 - V_0^2}{2a} + y_0$$

-0.5pts if y_0 = 1.5m is neglected.

$\therefore$ at $V = \pm 4 m/s$

2pts

$$y = \frac{(4 m/s)^2 - (17 m/s)^2}{2(-9.8 m/s^2)} + 1.5 m = 15.4 m$$

e) $\vec{a} = -9.8 m/s^2$ throughout

$$\vec{F}_{net} = m\vec{a} = (0.50 kg)(-9.8 m/s^2 \hat{j})$$

$$= -4.9 N \hat{j}$$

throughout the force is $-4.9 N \hat{j}$ (downwards)

1pt: no magnitude

0.5pts if they say force is 4.9N but in diff dir's

2pts

(SP64)

a) $\cancel{y} = y_0 + \cancel{v_{0y}t} + \frac{1}{2}a_y t^2$

$a_y = \frac{-y_0 \cdot 2}{t^2} = \frac{-(4.5m)(2)}{(0.83s)^2} = -13.1\ m/s^2$

b) $F_g\ (earth) = mg$

$m = \frac{-20N}{-9.8\ m/s^2} = 2.0\ kg$

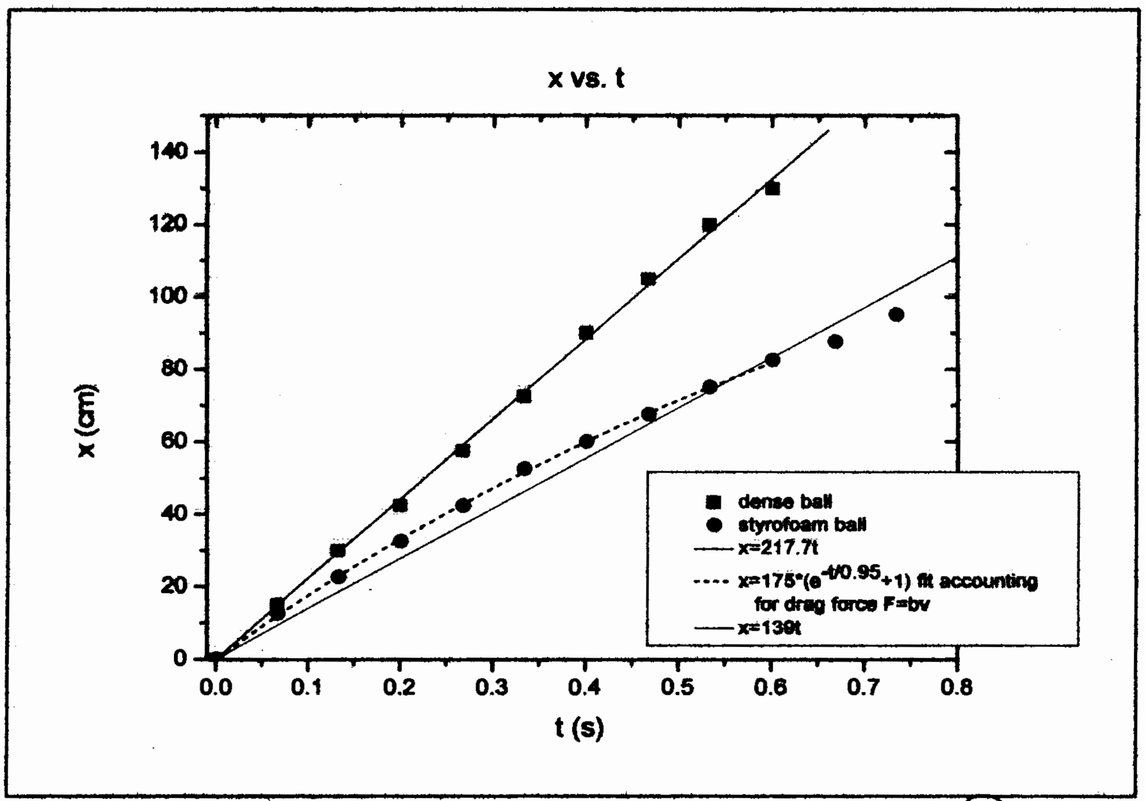
$F_{g(x)} = mg_x = 2.0kg\ (-13.1\ m/s^2) = -26.7N$

3

SP6 (5).

Conversions: /2

t(s)	dense ball x(mm)	y(mm)	x(cm)	(cm)	styrofoam ball x(mm)	y(mm)	x(cm)	(cm)
0.000	0	0	0	0	0	0	0	0
0.067	6	8	15	20	5	7	12.5	17.5
0.133	12	14	30	35	9	12	22.5	30
0.200	17	19	42.5	47.5	13	16	32.5	40
0.267	23	22	57.5	55	17	18	42.5	45
0.333	29	24	72.5	60	21	17	52.5	42.5
0.400	36	25	90	62.5	24	16	60	40
0.467	42	22	105	55	27	13	67.5	32.5
0.533	48	20	120	50	30	9	75	22.5
0.600	52	18	130	45	33	3	82.5	7.5
0.667					35	-3	87.5	-7.5
0.733					38	-10	95	-25



/4

line doesn't fit -1

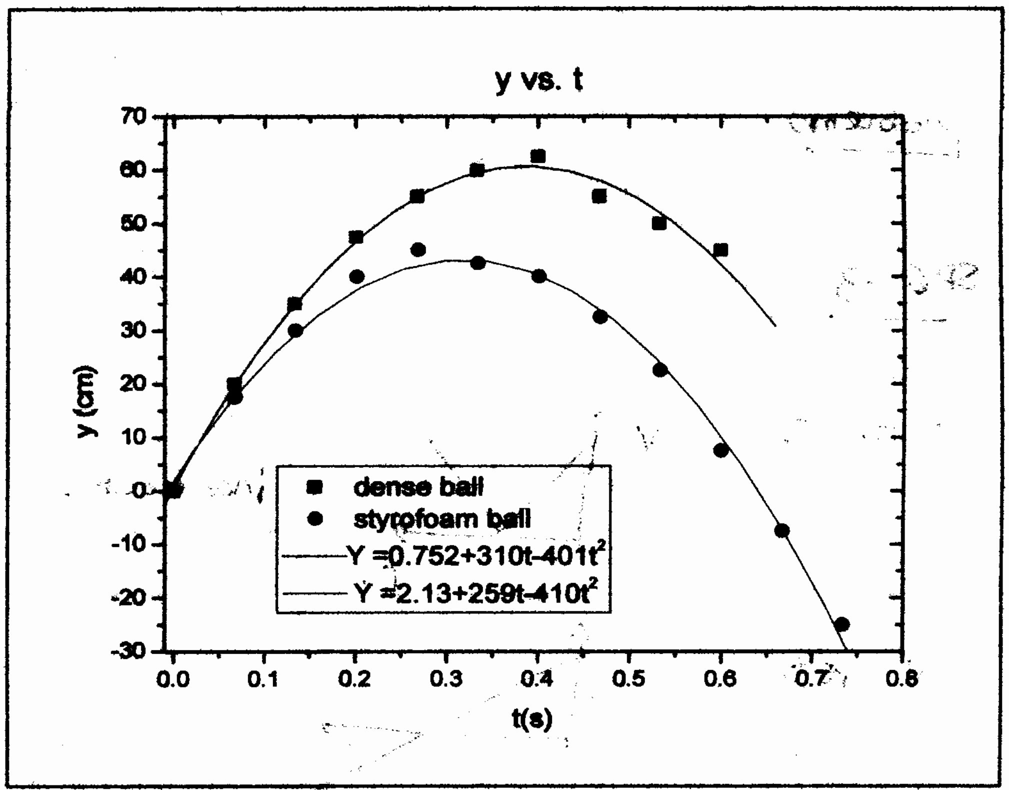
a) dense ball: $x=(2.2m/s)*t$ styrofoam ball: $x=(1.4m/s)*t$
horizontal acceleration is (assumed to be) zero
dense ball: $v(0) = 2.2m/s$ styrofoam ball $v(0)=1.4m/s$

/3

equations doesn't show source -50%

trendlines OK.

4



14.

graph doesn't fit -1

b) y=y(0)+v(0)*t+(1/2)*a*(t^2) ← 1pt
dense ball: ay=-9.0m/s^2 styrofoam ball: ay=-9.2m/s^2 ← 1pt.
dense ball: v(0)=3.1m/s styrofoam ball: v(0)=2.66m/s ← 1pt.

/3.

c) tan(vy(0)/vx(0))=theta (wrt horizontal)

dense ball: theta=55deg
styrofoam ball: theta=62 deg

initial speed: $|\vec{V}|_0 = \sqrt{(V_{0x})^2 + (V_{0y})^2}$

dense ball: $|\vec{V}|_0 = \sqrt{(2.2)^2 + (3.1)^2}$ m/s $= 3.8$ m/s

styrofoam ball: $|\vec{V}|_0 = \sqrt{1.4^2 + 2.7^2}$ m/s $= 3.0$ m/s

/4

any ballpark values are OK..

no work — no credit.

5

a) the text predicts $a_y = -9.8 m/s^2$ (vertical), $a_x = 0$; a_y expt $\sim 9.0 m/s^2$

the difference is due to drag; this ~~seemed~~ more severe for the styrofoam ball than the dense one; horizontal deceleration was evident in the styrofoam ball due to this effect. 1/2

bonus +5pts for mentioning drag force

b)

$x = V_{ox} t$

$\hookrightarrow V_x = x' = V_{o,x}$ 1pt

$\hookrightarrow$ $y = y_o + V_{o,y} t + \frac{1}{2} a_y t^2$

$V_y = y' = V_{o,y} + a_y t$ 1pt. 1/2

no pts if no evidence of diff.

c) will accept answers for <u>either</u> dense / styrofoam ball.

<u>dense ball:</u>

$V_x = V_{o,x} = 2.2 m/s$ at all t.

sign error -0.5pt.

$V_y(0s) = 3.1 m/s$

$V_y(0.500s) = 3.1 m/s + (-9.0 m/s^2)(0.500) = -1.85 m/s$

$V_y(0.200s) = (3.1 m/s + (-9.0 m/s^2)(0.200s) = 1.3 m/s$ 1/3

<u>styrofoam ball</u>

$V_x = 1.4 m/s$ at all t.

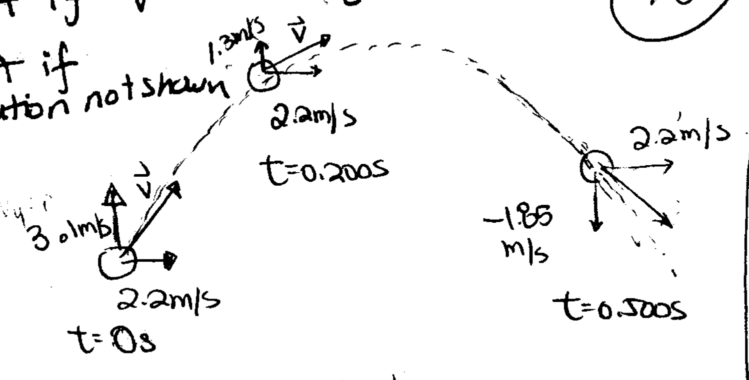
$V_y(0) = 2.6 m/s$

$V_y(0.500s) = 2.6 m/s + (-9.2 m/s^2)(0.5) = -2.0 m/s$

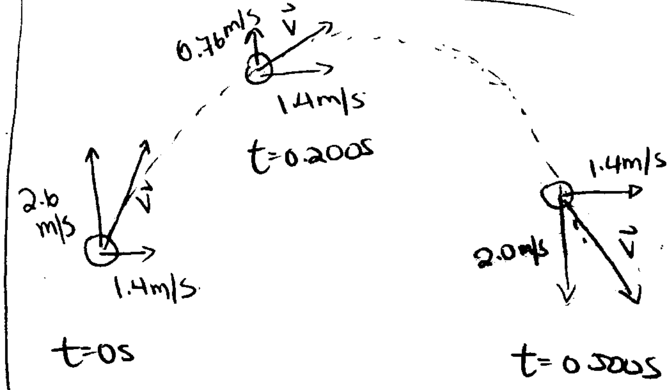
-50% no work shown

$V_y(0.200s) = 2.6 m/s + (-9.2 m/s^2)(0.200s) = 0.76 m/s$

-1 pt if V_x, V_y incorrect.
-1 pt if $\vec{v}$ NOT tangent to path. 1/3.
-1 pt if location not shown



dense ball.



styrofoam ball

6