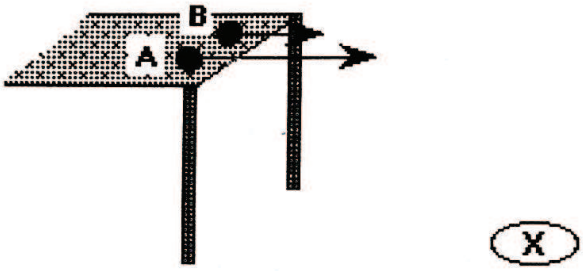
Review

Questions 1 and 2 refer to the situation and diagram described below.



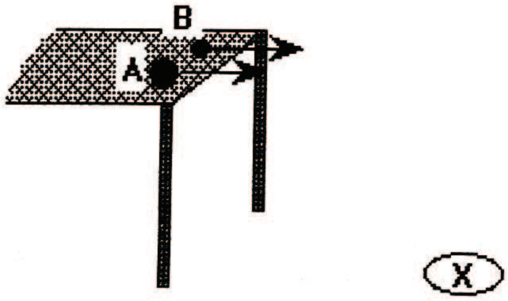
Two spheres **of equal mass**, A and B, are projected off the edge of a 2.0 m bench.

Sphere A has a horizontal velocity of 5.0 m/s and sphere B has a horizontal velocity of 2.5 m/s.

C__ 1. If both spheres leave the edge of the table at the same instant, sphere A will land
- a. at some time before sphere B.
- b. at some time after sphere B.
- c. at the same time as sphere B.
- d. There is not enough information to decide.

A__ 2. If both spheres leave the edge of the table at the same instant, sphere A hits the floor at the spot marked X. Sphere B will hit the floor
- a. at some point between the edge of the table and X.
- b. at the same distance from the table as X.
- c. at some point past X.
- d. There is not enough information to decide.

Questions 3 & 4 refer to the diagram and situation below:



Two spheres A & B are projected off the edge of a 2.0 m high table with the **same horizontal velocity.** Sphere A has a mass of 10. g and sphere B has a mass of 5 g.

C__ 3 If both spheres leave the edge of the table at the same instant, sphere A will land
- a. at some time before sphere B.
- b. at some time after sphere B.
- c. at the same time as sphere B.
- d. There is not enough information to decide.

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#5 Pg 3

The unknown in this problem is really the Δx distance!

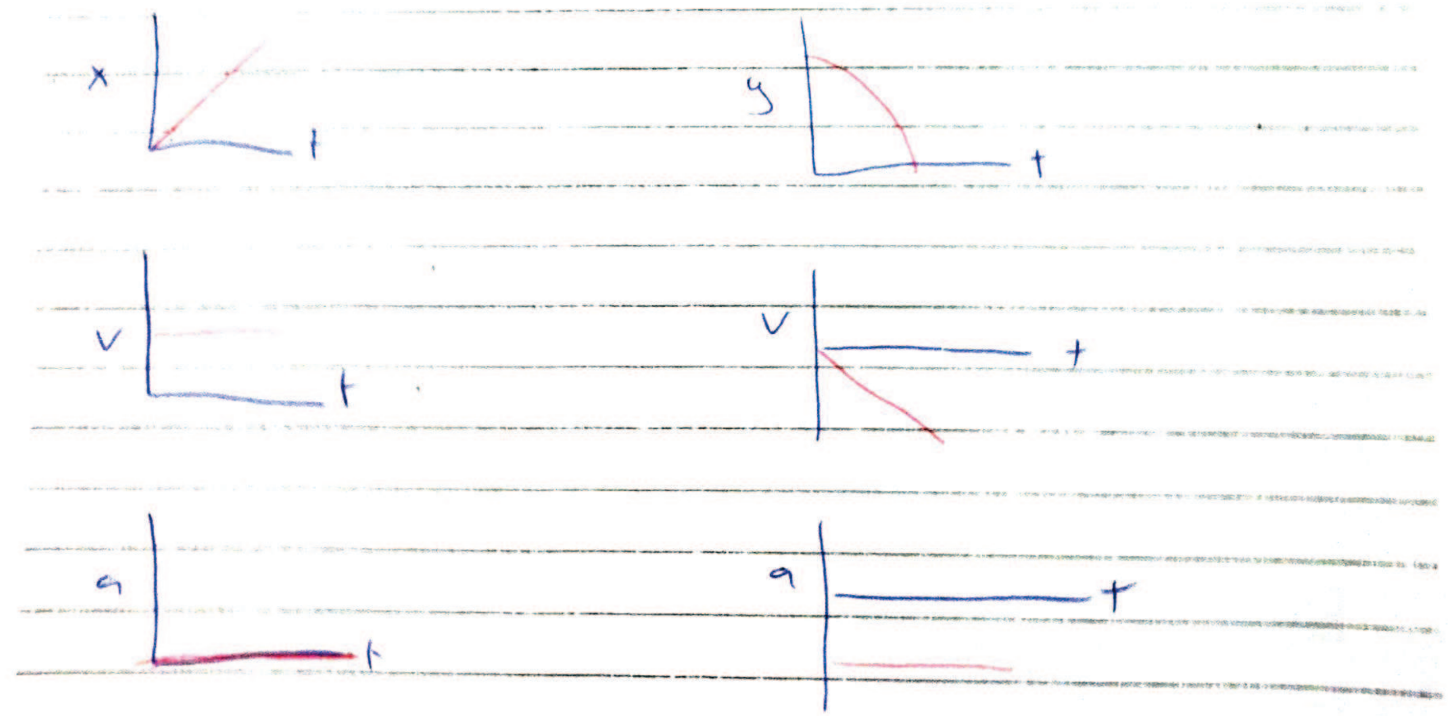
x	y
	t
$v = 6 m/s$	$v_i = 0 m/s$
	$v_f = ?$
$\Delta x = ?$	$a = -10 m/s^2$
	$\Delta y = -10 m$

Find time first!

$$t = \sqrt{\frac{2\Delta y}{g}} = \sqrt{\frac{2(-10 m)}{-10 m/s^2}} = 1.41 s$$

$$\Delta x = V_x \cdot t$$
$$= (6 m/s)(1.41 s) = 8.49 m$$ => He should [illegible] be ok to jump!

graphs (horizontal) (vertical)



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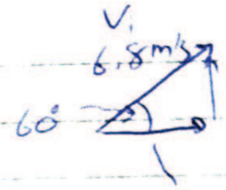
#6 Pg 5



$V_{y_i} = V_i \sin\theta$

$= 6.8 m/s (\sin 60) = 5.89 m/s$

There are several ways to do most of these problems, these are just my solutions.

$V_{x_i} = V_i \cos\theta$

$6.8 m/s \cos 60$

$= 3.4 m/s$

ⓐ displacement is zero!

$V_i = 5.89 m/s$

$V_f = -5.89 m/s$ $\quad a = \frac{\Delta v}{t}$

$a = -10 m/s^2$ $\quad t = \frac{v_f - v_i}{a}$

$t = ?$

$$= \frac{-5.89 m/s - 5.89 m/s}{-10 m/s^2}$$

$$= \frac{-11.78 m/s}{-10 m/s^2} = \boxed{1.178 s}$$

ⓑ at max height, object stops so we can say $V_f = 0$

$V_f = 0 m/s$

$V_i = 5.89 m/s$ $\quad \cancel{V_f}^{0\,2} = V_i^2 + 2a\Delta y$

$a = -10 m/s^2$ $\quad \frac{-V_i^2}{2a} = \Delta y$

$\Delta y = ?$

$$= \frac{(5.89 m/s)^2}{2(-10 m/s^2)} = \boxed{1.73 m}$$

ⓒ range = Δx

object is not accelerating in x-direction!

$\Delta x = V_x \cdot t$

$= (3.4 m/s)(1.178 s)$

$= \boxed{4 m}$

ⓓ Apex = Top of path

at apex, there is only x velocity

Therefore $V_{apex} = V_x = \boxed{3.4 m/s}$

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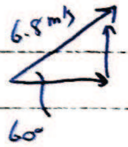
#6 Pg 5 continued

ⓔ acceleration is a constant $-10\,m/s^2$ in the y-direction!

ⓕ V_x initial is the same as V_x final

Vy_{final} is equal in magnitude + in the opposite direction as $V_{y\,initial}$

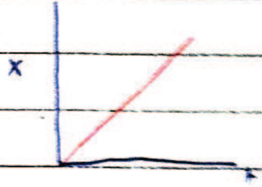
so if $V_i = 6.8$ m/s

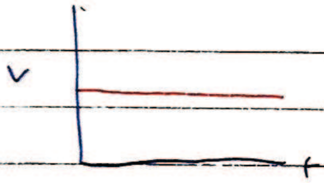


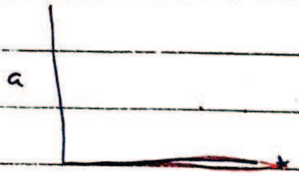
then V_f =

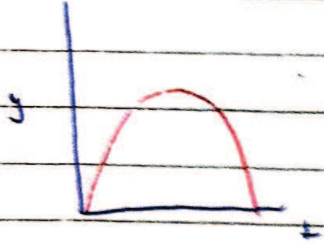
6.8m/s @ -60°

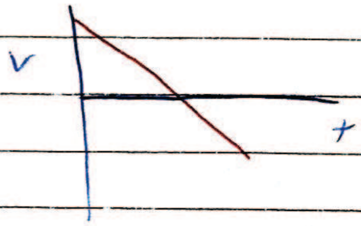
ⓖ

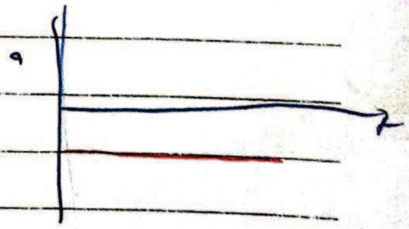












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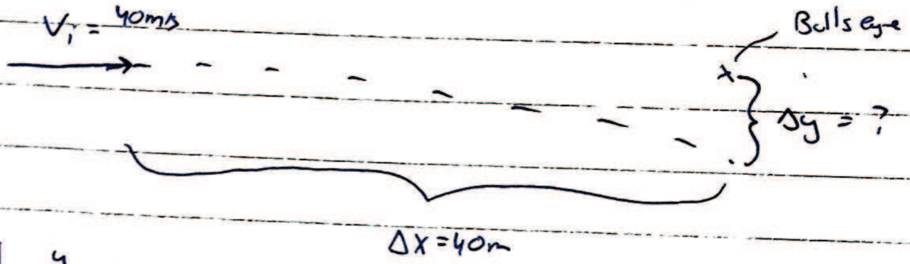


x	y
t = 1s	
Δx = 40m	Δy = ?
V_x = 40m/s	V_i = 0m/s
	V_f = X
	a = -10m/s²

Find time!

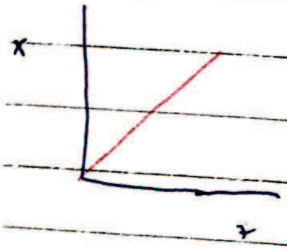
$$t = \frac{\Delta x}{V_x} = \frac{40m}{40m/s} = 1s$$

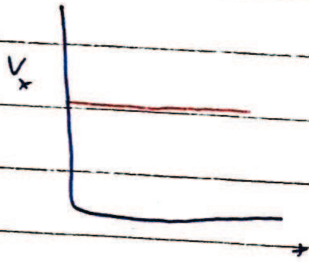
Then find Δy

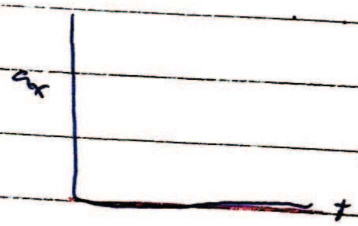
$$\Delta y = \cancel{V_i t}^{0} + \frac{1}{2}at^2$$

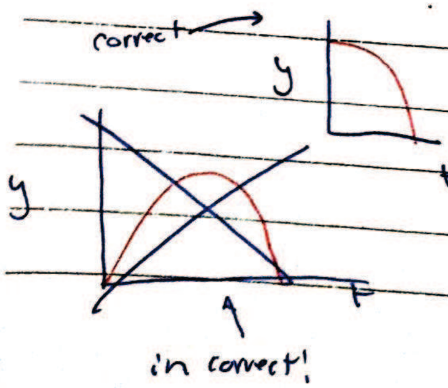
$$= \frac{1}{2}(-10)(1)^2$$

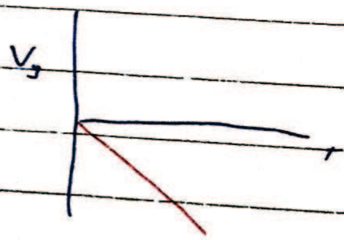
$$= \boxed{-5m}$$

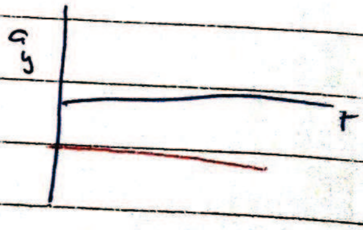












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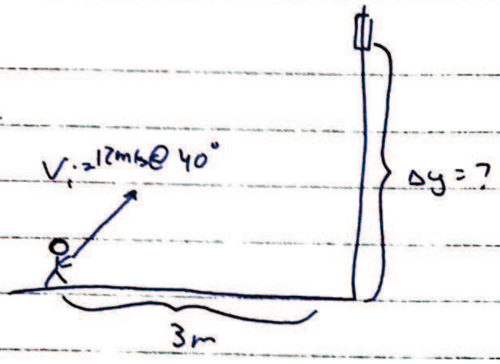
⑧



__First__ break V_i into $V_x + V_y$!

$V_{x_i} = V_i \cos\theta$
$= (12 m/s)(\cos 40°)$
$= 9.19 m/s$

$V_{y_i} = V_i \sin\theta$
$(12 m/s)(\sin 40)$
$= 7.71 m/s$

X	y
t =	
$V_x = 9.19 m/s$	$\Delta y = ?$
$\Delta x = 3m$	$V_i = 7.17 m/s$
	$V_f = ?$
	$a = -10 m/s^2$

~~Fi~~ Next, find the time it takes to reach the wall!

$t = \frac{\Delta x}{V_x} = \frac{3m}{9.19 m/s} = \cancel{3.06 s}$ .326s

Find the height at time t = 3.06s

$\Delta y = V_i t + \frac{1}{2} a t^2$
$= (7.17 m/s)(\overset{.326}{\cancel{3.06 s}}) + \frac{1}{2}(-10 m/s^2)(\overset{.326}{\cancel{3.06 s}})^2$
$= \cancel{21.94} +$
$2.34 - .531 m$
$= \boxed{1.8 m}$

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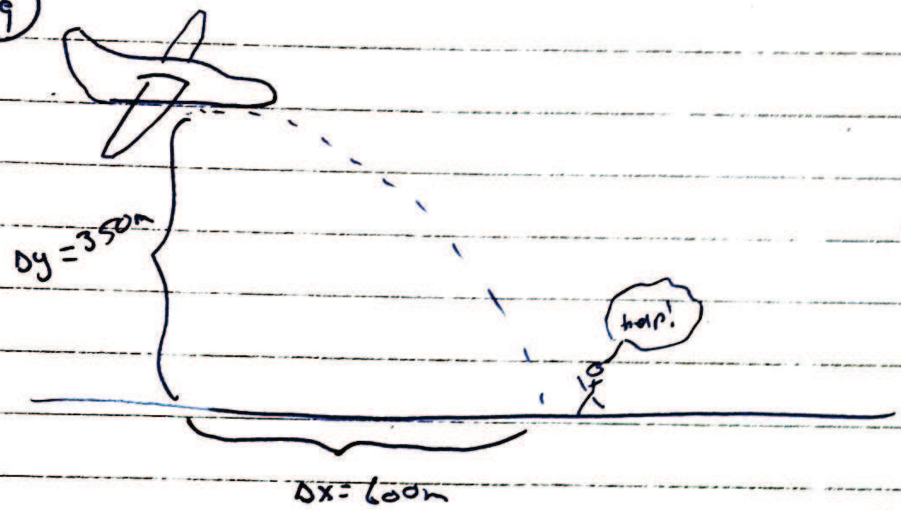


X	y
t =	
$V_x = ?$	$\Delta y = -350m$
$\Delta x = 600m$	$V_i = 0m/s$
	$V_f = ?$
	$a = -10m/s^2$

Find time!

$\Delta y = \cancel{V_i}^{0} t + \frac{1}{2}at^2$

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

$2\Delta y = at^2$

$\frac{2\Delta y}{a} = t^2$

$t = \sqrt{\frac{2\Delta y}{a}} = \sqrt{\frac{2(-350)}{-10}} = \sqrt{70}$

$= 8.37s$

$V_{y\ \text{final}}$?

$V_f^2 = \cancel{V_i^2}^{0} + 2a\Delta y$

$V_F = \sqrt{2a\Delta y}$

$\sqrt{2(-10m/s^2)(-350m)}$

$\boxed{= -83.67m/s}$

find v_x final

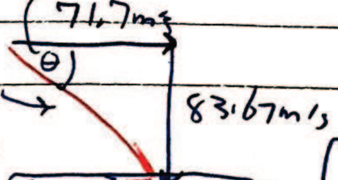
$V_x = \frac{\Delta x}{F} = \frac{600m}{8.37s} = \boxed{71.7m/s}$

angle $= \tan^{-1}\frac{V_y}{V_x}$

$= \tan^{-1}\frac{83.67}{71.7}$

= 49° but it is in quadrant 4!!

Final velocity is



$V_F = \sqrt{V_x^2 + V_y^2}$ $\sqrt{(71.7)^2 + (83.67^2)} = \boxed{110 m/s @ -40°}$

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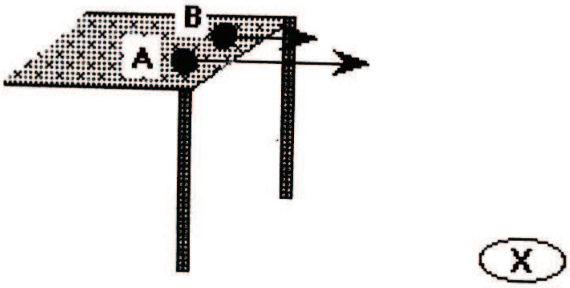
Review

Questions 1 and 2 refer to the situation and diagram described below.

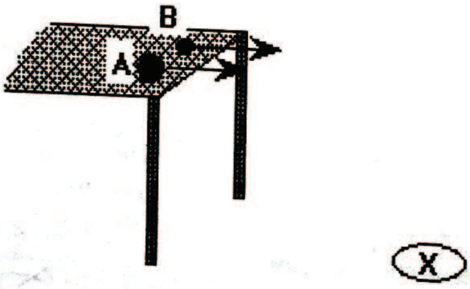


Two spheres **of equal mass**, A and B, are projected off the edge of a 2.0 m bench.
Sphere A has a horizontal velocity of 5.0 m/s and sphere B has a horizontal velocity of 2.5 m/s.

C 1. If both spheres leave the edge of the table at the same instant, sphere A will land
- a. at some time before sphere B.
- b. at some time after sphere B.
- c. at the same time as sphere B.
- d. There is not enough information to decide.

A 2. If both spheres leave the edge of the table at the same instant, sphere A hits the floor at the spot marked X. Sphere B will hit the floor
- a. at some point between the edge of the table and X.
- b. at the same distance from the table as X.
- c. at some point past X.
- d. There is not enough information to decide.

Questions 3 & 4 refer to the diagram and situation below:



Two spheres A & B are projected off the edge of a 2.0 m high table with the **same horizontal velocity.** Sphere A has a mass of 10. g and sphere B has a mass of 5 g.

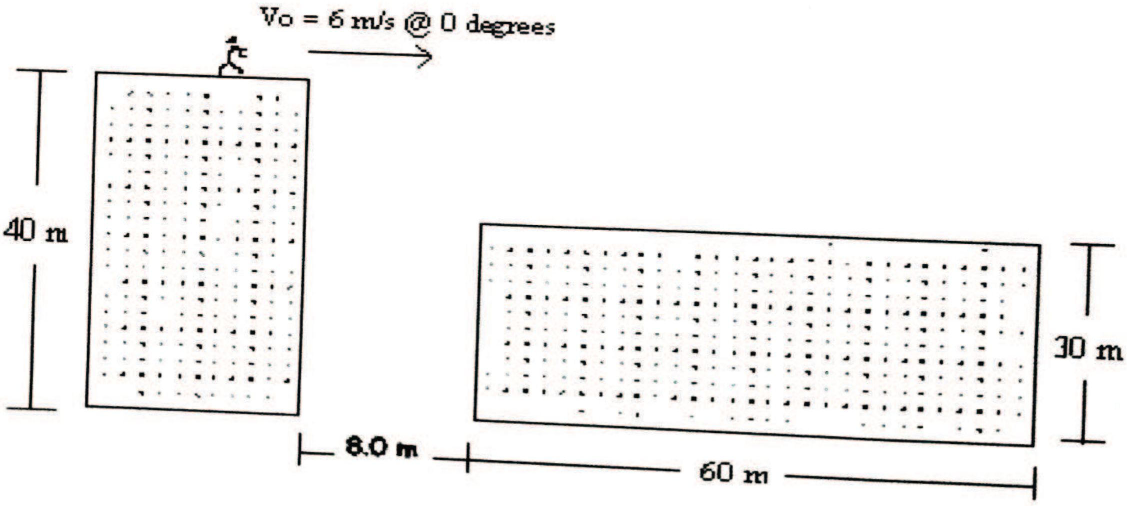
C 3 If both spheres leave the edge of the table at the same instant, sphere A will land
- a. at some time before sphere B.
- b. at some time after sphere B.
- c. at the same time as sphere B.
- d. There is not enough information to decide.

b 4. If both spheres leave the edge of the table at the same instant, sphere A hits the floor at the spot marked X. Sphere B will hit the floor

a. at some point between the edge of the table and X.
b. at the same distance from the table as X.
c. at some point past X.
d. There is not enough information to decide.

5. Nike ® is doing a commercial with professional tennis players Roger Federer and Serena Williams. The commercial calls for the two of them to be playing tennis on the roof of a 40 m tall building. Serena's supposed to hit a top spin lob and Roger is to chase it and run right off the roof without jumping. Roger's initial velocity will be 6.0 m/s horizontally and he will land on a 30 m tall building 8.0 m away and keep running. You are the physics adviser for the two tennis players. Roger comes to you and says "Will I make the jump?"
What do you say?

A. Predict whether Roger makes the jump. Write out a full solution.
B. Draw Displacement, Velocity and Acceleration Graphs for both "x" and "y" directions.



6. Alice Springs, an Olympic high jumper, accelerates towards the high jumper's bar during a practice run in Sydney, Australia. She jumps with an initial velocity of 6.8 m/s at an angle of 60° above the horizontal. Assume her total vertical displacement is zero.

A. What is the high jumpers total time in flight?
B. What is the maximum height the high jumper reaches?
C. What is the range of the high jumper?
D. What is the high jumper's velocity at the apex?
E. What is the acceleration of the high jumper 0.05 s before the apex?
F. What is the final velocity of the high jumper just before hitting the pad?
G. Draw Displacement, Velocity and Acceleration graphs of her 2D motion.