**X1.17a** **107**

**PHYS-107 (17) (Kaldon-37944)** **Name** S O L U T I O N
**WMU - Fall 2004**
**Exam 1A - 100,000 points** **Book Title** _____

Rev. 09/26/04 Su.A6

**State Any Assumptions You Need To Make – Show All Work – Circle Any Final Answers**
**Use Your Time Wisely – Work on What You Can – Be Sure to Write Down Equations**
**Short Answers Should Be Short! – Feel Free to Ask Any Questions**

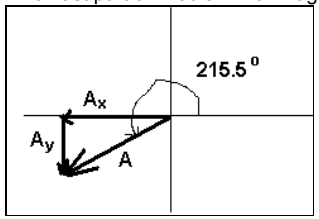
# EXAM 1 [FORM - A]

# PHYS-107 (KALDON-17)

# FALL 2004

# WMU

Diagram for last part of Problem 1 on Page 2…




Now aren't you glad you live in Michigan?

Over the weekend, Florida struck by the fourth hurricane in six weeks – and all you've got is one Physics exam…

(with cookies).

*Charley! Frances! Ivan! Jeanne!*



**I'll Bet Sky Captain Can Do These! (50,000 points)** *Multiple-Guess-Fill-In-The-Bubbles*

| mph | sec/ mile |
|---|---|
| 25 | 144.0 |
| 30 | 120.0 |
| 35 | 102.9 |
| 40 | 90.0 |
| 45 | 80.0 |
| 50 | 72.0 |
| 55 | 65.5 |
| 60 | 60.0 |
| 65 | 55.4 |
| 70 | 51.4 |
| 75 | 48.0 |
| 80 | 45.0 |
| 85 | 42.4 |
| 90 | 40.0 |
| 95 | 37.9 |
| 100 | 36.0 |
| 105 | 34.3 |
| 110 | 32.7 |
| 115 | 31.3 |
| 120 | 30.0 |
| 125 | 28.8 |
| 130 | 27.7 |
| 135 | 26.7 |
| 225 | 16.0 |

1.)(a) Bill drives 8.0 miles in 8.0 minutes on cruise control. What is his constant speed? *The handy chart at left may be useful.* *8.0mile ÷ 8.0 min = 60 sec/mile, so 60 mph.*
A = 30. mph B = 45. mph C = 60. mph D = 90. mph
E = 120. mph F = None of these
Ⓐ Ⓑ **Ⓒ** Ⓓ Ⓔ Ⓕ

(b) Bob also drives 8.0 miles in 8.0 minutes, but going from rest to some final speed at constant acceleration. What is his final speed? *Twice same average speed, so 120 mph.*
A = 30. mph B = 45. mph C = 60. mph D = 90. mph
E = 120. mph F = None of these
Ⓐ Ⓑ Ⓒ Ⓓ **Ⓔ** Ⓕ

(c) Bret drives 2.0 miles at 80. mph, then 4.0 miles in 5.0 minutes and then the final 2.0 miles at 80. mph. What is his average speed for the trip? *4×45.0sec + 300sec = 480sec, 60.sec/mile*
A = 30. mph B = 45. mph C = 60. mph D = 90. mph
E = 120. mph F = None of these
Ⓐ Ⓑ **Ⓒ** Ⓓ Ⓔ Ⓕ

(d) Bubba drives 4.0 miles in 4.0 minutes, but has to stop at 4 traffic lights at 1.0 minute each. How fast must Bubba go during the last 4.0 miles to average 45. mph for the whole trip? *Time allowed: 8×80.0sec=640.sec, Time used: 4×60.0sec + 4×60.0 sec =480.sec, Time left:160.sec OR 40.0sec/mile for last four miles.*
A = 30. mph B = 45. mph C = 60. mph D = 90. mph
E = 120. mph F = None of these
Ⓐ Ⓑ Ⓒ **Ⓓ** Ⓔ Ⓕ

**For each of the following, select the answer A-D that BEST represents the motion.**
(e) A man sits and reads the newspaper. This is an example of _____ Motion.
A = No B = Uniform C = Constant Acceleration
D = None of these
**Ⓐ** Ⓑ Ⓒ Ⓓ

(f) A bumblebee sitting on a flower. This is an example of _____ Motion.
A = No B = Uniform C = Constant Acceleration
D = None of these
**Ⓐ** Ⓑ Ⓒ Ⓓ

(g) A ball is tossed straight up and momentarily stops. This is an example of _____ Motion.
A = No B = Uniform C = Constant Acceleration
D = None of these
Ⓐ Ⓑ **Ⓒ** Ⓓ

**Use vector $\vec{A}$ with an *x*-component $A_x = -7.0\ m$ and a *y*-component $A_y = -5.0\ m$ in the follow problems:**
(h) The magnitude of this velocity vector is $A$ = _____ . $\sqrt{(-7.0m)^2 + (5.0m)^2}$
A = 1.41 m B = 3.46 m C = 4.90 m
D = 8.60 m E = 12.0 m F = 74.0 m
Ⓐ Ⓑ Ⓒ **Ⓓ** Ⓔ Ⓕ

(i) Beth's calculation of $\tan^{-1}$ gives her an angle of +35.5°. She finds the Standard Angle for $\vec{A}$ as _____.
(j) Steve's calculation of $\tan^{-1}$ gives him an angle of +54.5°. He finds the Standard Angle for $\vec{A}$ as _____.
A = 35.5° B = 54.5° C = 125.5°
D = 215.5° E = 234.5° F = 324.5°
Ⓐ Ⓑ Ⓒ **Ⓓ** Ⓔ Ⓕ
*Doesn't matter which way they put it in the calculator, you look at your sketch and determine if you have the large angle or the small angle .*
Ⓐ Ⓑ Ⓒ **Ⓓ** Ⓔ Ⓕ

**Remember *The Matrix* (50,000 points)**

2.) In the movie *The Matrix*, Morpheus demonstrates to Neo how one can "cheat" the physics in the computer reality of The Matrix by leaping from the roof of one building to the next. Suppose you tried to jump from one building to another building in real life. Assume the two roofs are at the same height above the ground. (Don't look down!) First you would have to run really fast, in order to cross the 50.0 meter gap in 5.00 seconds. (a) How fast would your horizontal speed, $v_x$, be?


$$v = \frac{d}{t} = \frac{50.0m}{5.00\sec} = 10.00m/s$$

(b) Halfway across the gap between buildings, you would be at a maximum height $h$ above the roofs. Find $h$.

Time to Fall = Time to Rise

$$y = y_0 + v_{0y}t - \tfrac{1}{2}gt^2$$
$$0 = y_0 - \tfrac{1}{2}gt^2$$
$$y_0 = \tfrac{1}{2}gt^2$$
$$h = \tfrac{1}{2}\left(9.81m/s^2\right)\left(2.50\sec\right)^2$$
$$= 30.66m$$

Falling from rest at the turning point.

OR

$$y = y_0 + v_{0y}t - \tfrac{1}{2}gt^2$$
$$y = 0 + v_{0y}t - \tfrac{1}{2}gt^2$$
$$y = v_{0y}t - \tfrac{1}{2}gt^2$$
$$h = \left(24.53m/s\right)\left(2.50\sec\right) - \tfrac{1}{2}\left(9.81m/s^2\right)\left(2.50\sec\right)^2$$
$$= 30.67m$$

If you start with the answer to (c), travel up to turning point.

(c) Find the initial vertical speed $v_{oy}$ you would need to successfully make the jump.

$$v_y = -v_{0y}$$
$$v_y = v_{0y} - gt$$
$$-v_{0y} = v_{0y} - gt$$
$$2v_{0y} = gt$$
$$v_{0y} = \frac{gt}{2} = \frac{\left(9.81m/s^2\right)\left(5.00\sec\right)}{2}$$
$$= 24.53m/s$$

Calculate over the whole time.

OR

$$v_y = 0$$
$$v_y = v_{0y} - gt$$
$$0 = v_{0y} - gt$$
$$v_{0y} = gt$$
$$v_{0y} = gt = \left(9.81m/s^2\right)\left(2.50\sec\right)$$
$$= 24.53m/s$$

Calculate over half the time = Same.



(d) Find the final vertical speed $v_y$ you would have when you reached the other roof.

$$v_y = -v_{0y}$$
$$= -24.53m/s$$

OR

$$v_y = -v_{0y}$$
$$v_y = v_{0y} - gt$$
$$v_y = -v_y - gt$$
$$2v_y = -gt$$
$$v_y = \frac{-gt}{2} = \frac{-\left(9.81m/s^2\right)\left(5.00\sec\right)}{2}$$
$$= -24.53m/s$$

You can also use the Equation Without Time, if you have the height from (b) and do half the trip.

(e) Find the initial vector velocity $\vec{v}_0$ you would need to successfully leap the 50.0 meter gap in 5.00 seconds. Give your answer in Standard Form. *If you did not get the answer to (a) use $v_x$ = 8.00 m/s; if you did not get the answer to (c) use $v_{0y}$ = 16.0 m/s.* ***[ Alternate answer = 17.89 m/s @ 63.4° ]***

$$v_0 = \sqrt{v_{0x}^2 + v_{0y}^2}$$
$$= \sqrt{(10.00m/s)^2 + (24.53m/s)^2}$$
$$= 26.49m/s$$

$$\theta = \tan^{-1}\left(\frac{v_{0y}}{v_{0x}}\right)$$
$$= \tan^{-1}\left(\frac{24.53m/s}{10.00m/s}\right)$$
$$= 67.8^\circ$$

$$\vec{v}_0 = 26.49m/s@67.8^\circ$$