

X1.15b

PHYS-107(15/16) (Kaldon-)
 WMU - Fall 2003
 Exam 1B - 100,000 points

Name _____ **S O L U T I O N** _____

Book Title _____

107

Rev. 09/28/02 Su.B4

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 - B]
PHYS-107 (KALDON-15)
FALL 2003
WMU

And now an important announcement:

The Chicago Cubs Major League Baseball Team Has Won
 the National League Central Division

Cubs Win! Cubs Win! Cubs Win!

Now Pay Attention – You Can Do This (50,000 points) Multiple-Guess-Fill-In-The-Bubbles

- | | |
|--|--|
| <p>mph sec/
 25 mile
 30 144.0
 35 120.0
 40 102.9
 45 90.0
 50 80.0
 55 72.0
 60 65.5
 65 60.0
 70 55.4
 75 51.4
 80 48.0
 85 45.0
 90 42.4
 95 40.0
 100 37.9
 105 36.0
 110 34.3
 115 32.7
 120 31.3
 125 30.0
 130 28.8
 135 27.7
 225 26.7
 16.0</p> | <p>1.)(a) Stephanie needs to drive her car 20. miles in 15. minutes. What is her constant speed?
 <i>The handy chart at left may be useful. $900\text{sec} \div 20\text{miles} = 45 \text{ sec/mile}$, so 80 mph</i>
 A = 50. mph B = 60. mph C = 70. mph <u>D = 80. mph</u> <input type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input checked="" type="checkbox"/>D <input type="checkbox"/>E <input type="checkbox"/>F</p> <p>(b) Serena also drives her car 20. miles in 15. minutes, but going from rest to some final speed at constant acceleration. What is her average speed? <i>Same as in (1a).</i>
 A = 50. mph B = 60. mph C = 70. mph <u>D = 80. mph</u> <input type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input checked="" type="checkbox"/>D <input type="checkbox"/>E <input type="checkbox"/>F</p> <p>(c) Susan drives 20. miles at the same constant speed as Stephanie while moving. But midway, she has to stop for 5.0 minutes at a long traffic light. What is her average speed for the trip?
 <i>($900\text{sec} + 300\text{sec}$) \div $20\text{miles} = 60 \text{ sec/mile}$, so 60 mph</i>
 A = 50. mph <u>B = 60. mph</u> C = 70. mph D = 80. mph <input type="checkbox"/>A <input checked="" type="checkbox"/>B <input type="checkbox"/>C <input type="checkbox"/>D <input type="checkbox"/>E <input type="checkbox"/>F</p> <p>(d) Sheila drives 20. miles at 50. mph. But midway, she also has to stop for 5.0 minutes at a long traffic light. How many minutes does her trip take? <i>$20 \times 72\text{sec} + 300\text{sec} = 1740 \text{ sec} = 29 \text{ min}$</i>
 A = 20. min B = 24. min C = 28. min <u>D = 29. min</u> <input type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input checked="" type="checkbox"/>D <input type="checkbox"/>E <input type="checkbox"/>F</p> <p>For each of the following, select the answer A-D that BEST represents the motion.</p> <p>(e) Wild buffalo thundering across the plains. This is an example of _____ Motion.
 A = No <u>B = Uniform</u> C = Constant Acceleration
 D = None of these <input type="checkbox"/>A <input checked="" type="checkbox"/>B <input type="checkbox"/>C <input type="checkbox"/>D</p> <p>(f) A butterfly sitting on a flower. This is an example of _____ Motion.
 <u>A = No</u> B = Uniform C = Constant Acceleration
 D = None of these <input checked="" type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input type="checkbox"/>D</p> <p>(g) A garden slug crossing the sidewalk. This is an example of _____ Motion.
 A = No <u>B = Uniform</u> C = Constant Acceleration
 D = None of these <input type="checkbox"/>A <input checked="" type="checkbox"/>B <input type="checkbox"/>C <input type="checkbox"/>D</p> <p>Use vector \vec{A} with an x-component $A_x = 5.0 \text{ m}$ and a y-component $A_y = -7.0 \text{ m}$ in the follow problems:</p> <p>(h) The magnitude of this velocity vector is $A = \underline{\hspace{1cm}}$. $\sqrt{(5.0\text{m/s})^2 + (-7.0\text{m/s})^2}$
 A = 1.41 m B = 3.46 m C = 4.90 m <input type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input checked="" type="checkbox"/>D <input type="checkbox"/>E <input type="checkbox"/>F
 <u>D = 8.60 m</u> E = 24.0 m F = 74.0 m</p> <p>(i) Bob'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° <input type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input checked="" type="checkbox"/>D <input type="checkbox"/>E <input type="checkbox"/>F
 D = 215.5° <u>E = 305.5°</u> F = 324.5°</p> <p>(j) Joan's calculation of \tan^{-1} gives her an angle of -35.5°. She finds the Standard Angle for \vec{A} as _____.
 A = 35.5° B = 54.5° C = 144.5° <input type="checkbox"/>A <input type="checkbox"/>B <input type="checkbox"/>C <input type="checkbox"/>D <input checked="" type="checkbox"/>E <input type="checkbox"/>F
 D = 215.5° <u>E = 305.5°</u> F = 324.5°</p> |
|--|--|

Steve just did it backwards – your sketch will show the SAME angle based on x- & y-components.

To Be Continued 2 (50,000 points)

2.) Dr. Phil was on the road Saturday night, traveling back to his home in West Michigan from the intersection of US-30 and I-65 in Merrillville IN. The 1989 S-10 Blazer's odometer started at 250,131.8 miles (402,462.1 km) and ended 3.00 hours later at 250,288.0 miles (402,713.4 km). What was his average speed on the way home?

$$d = 402,713.4\text{km} - 402,462.1\text{km} = 251.3\text{km}$$

$$t = (3.00\text{hours})(3600\text{sec}/\text{hour}) = 10,800\text{sec}$$

$$v = \frac{d}{t} = \frac{251,300\text{m}}{10,800\text{s}} = 23.27\text{m}/\text{s}$$

(b) After stopping for gas, Dr. Phil has to accelerate his Blazer from rest up to 70.0 mph (31.3 m/s) accelerating at 3.40 m/s². How much time does this acceleration take?

$$v = v_0 + at \quad , \quad v - v_0 = at$$

$$t = \frac{v - v_0}{a} = \frac{31.3\text{m}/\text{s} - 0}{3.40\text{m}/\text{s}^2}$$

$$= 9.206\text{s}$$

(c) How far does Dr. Phil's Blazer travel during acceleration? *This can be solved with or without (b).*

$$x = x_0 + v_0t + \frac{1}{2}at^2 = \frac{1}{2}at^2$$

$$= \frac{1}{2}(3.40\text{m}/\text{s}^2)(9.206\text{s})^2 = 144.1\text{m}$$

OR

$$v^2 = v_0^2 + 2a(x - x_0) = 2ax$$

$$x = \frac{v^2}{2a} = \frac{(31.3\text{m}/\text{s})^2}{2(3.40\text{m}/\text{s}^2)} = 144.1\text{m}$$

(d) During the conference, word started circulating around that the Chicago Cubs had won their doubleheader against Pittsburgh, and Houston lost to Milwaukee. In that spirit, we offer the following: During a baseball game, the pitcher throws a ball horizontally 60 feet 6 inches (18.5 meters) to home plate, during which time it drops by 30.0 inches (0.762 meters). How long (time) does it take for the baseball to fall?

$$v_{0y} = 0$$

$$y_0 = 7.63\text{m}$$

$$y = 0$$

$$a_y = -g$$

$$y = y_0 + v_{0y}t - \frac{1}{2}gt^2$$

$$0 = y_0 - \frac{1}{2}gt^2$$

$$t^2 = \frac{2y_0}{g}$$

$$t = \sqrt{\frac{2y_0}{g}} = \sqrt{\frac{2(0.762\text{m})}{(9.81\text{m}/\text{s}^2)}}$$

$$= +0.3941\text{sec}$$

(e) Find the y-component of the baseball's velocity at home plate. *This problem can be solved with or without the answer to (d).*

$$v_y = v_{0y} - gt = -gt$$

$$= -(9.81\text{m}/\text{s}^2)(0.3941\text{sec})$$

$$= -3.866\text{m}/\text{s}$$

OR

$$v_y^2 = v_{0y}^2 - 2g(y - y_0)$$

$$v_y^2 = -2g(-y_0) = 2gy_0$$

$$v_y = \sqrt{2gy_0}$$

$$= \sqrt{2(9.81\text{m}/\text{s}^2)(0.762\text{m})}$$

$$= -3.867\text{m}/\text{s}$$