**X1.15a** **107**

**PHYS-107(15/16) (Kaldon-)** **Name** S O L U T I O N
**WMU - Fall 2003**
**Exam 1A - 100,000 points** **Book Title** _____

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**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-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*

| 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) Theresa needs to drive her car 40. miles in 30. minutes. What is her constant speed? *The handy chart at left may be useful.* *1800sec ÷ 40miles = 45 sec/mile, so 80 mph*
A = 50. mph B = 60. mph C = 70. mph D = 80. mph
E = 90. mph F = None of these
Ⓐ Ⓑ Ⓒ **Ⓓ** Ⓔ Ⓕ

(b) Tabitha also drives her car 40. miles in 30. minutes, but going from rest to some final speed at constant acceleration. What is her average speed? *Same as in (1a).*
A = 50. mph B = 60. mph C = 70. mph D = 80. mph
E = 90. mph F = None of these
Ⓐ Ⓑ Ⓒ **Ⓓ** Ⓔ Ⓕ

(c) Trina drives 40. miles at the same constant speed as Stephanie while moving. But midway, she has to stop for 2.0 minutes at a long traffic light. What is her average speed for the trip? *1920sec ÷ 40miles = 48 sec/mile, so 75 mph*
A = 65. mph B = 70. mph C = 75. mph D = 80. mph
E = 85. mph F = None of these
Ⓐ Ⓑ **Ⓒ** Ⓓ Ⓔ Ⓕ

(d) Tammy drives 40. miles at 50. mph. But midway, she also has to stop for 2.0 minutes at a long traffic light. How many minutes does her trip take? *40×72sec + 120sec=3000 sec = 50 min.*
A = 46. min B = 48. min C = 50. min D = 52. min
E = 54. min F = None of these
Ⓐ Ⓑ **Ⓒ** Ⓓ Ⓔ Ⓕ

**For each of the following, select the answer A-D that BEST represents the motion.**
(e) An ant crossing a sidewalk. 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) Wild horses thundering across the desert valley. 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 $A =$ _____ . $\sqrt{(7.0m/s)^2 + (-5.0m/s)^2}$
A = 1.41 m B = 3.46 m C = 4.90 m
D = 8.60 m E = 24.0 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 _____.
A = 35.5° B = 54.5° C = 125.5°
D = 215.5° E = 305.5° F = 324.5°
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ **Ⓕ**

(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 = 144.5°
D = 234.5° E = 305.5° F = 324.5°
Ⓐ Ⓑ Ⓒ Ⓓ Ⓔ **Ⓕ**
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 morning, traveling from his home in West Michigan to the intersection of US-30 and I-65 in Merrillville IN. The 1989 S-10 Blazer's odometer started at 249,973.1 miles (402,206.7 km) and ended 3.00 hours later at 250,131.8 miles (402,462.1 km). What was his average speed on the way down?

$$d = 402{,}462.1km - 402{,}206.7km = 255.4km$$
$$t = (3.00hours)(3600\,\text{sec}/\,hour) = 10{,}800\,\text{sec}$$
$$v = \frac{d}{t} = \frac{255{,}400m}{10{,}800s} = 23.65m/s$$

(b) After stopping for gas, Dr. Phil has to accelerate his Blazer from rest up to 65.0 mph (29.1 m/s) accelerating at 3.16 m/s². How much time does this acceleration take?

$$v = v_0 + a\,t \quad , \quad v - v_0 = a\,t$$
$$t = \frac{v - v_0}{a} = \frac{29.1m/s - 0}{3.16m/s^2}$$
$$= 9.209s$$

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

$$x = x_0 + v_0 t + \tfrac{1}{2}at^2 = \tfrac{1}{2}at^2$$
$$= \tfrac{1}{2}(3.16m/s^2)(9.209s)^2 = 134.0m$$
*OR*
$$v^2 = v_0^2 + 2a(x - x_0) = 2\,a\,x$$
$$x = \frac{v^2}{2a} = \frac{(29.1m/s)^2}{2(3.16m/s^2)} = 134.0m$$



(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 36.0 inches (0.914 meters). How long (time) does it take for the baseball to fall?

$v_{0y} = 0$
$y_0 = 0.914\ m$
$y = 0$
$a_y = -g$

$$y = y_0 + v_{0y} - \tfrac{1}{2}gt^2$$
$$0 = y_0 - \tfrac{1}{2}gt^2$$
$$t^2 = \frac{2y_0}{g}$$
$$t = \sqrt{\frac{2y_0}{g}} = \sqrt{\frac{2(0.914m)}{(9.81m/s^2)}}$$
$$= +0.4317\,\text{sec}$$

(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).*

$$v_y = v_{0y} - g\,t = -g\,t$$
$$= -(9.81m/s^2)(0.4317\,\text{sec})$$
$$= -4.235m/s$$

OR

$$v_y^2 = v_{0y}^2 - 2g(y - y_0)$$
$$v_y^2 = -2g(-y_0) = 2gy_0$$
$$v_y = \sqrt{2gy_0}$$
$$= \sqrt{2(9.81m/s^2)(0.914m)}$$
$$= -4.235m/s$$