# Summer Physics/AP Physics Assignment

The following problems provide a review of important concepts learned in previous science and math courses. These skills will be utilized in both Physics and AP Physics throughout the entire course. Please complete the following sections to review and practice these concepts and skills.

**Part 1: Metric Conversions** (round your answers and show work with units)

The prefixes you will need to have memorized are the ones from **kilo- to milli-**,

| Common Prefixes used with SI Units | | | |
|---|---|---|---|
| Prefix | Symbol | Meaning | Order of Magnitude |
| *giga-* | G | 1 000 000 000 | $10^9$ |
| *mega-* | M | 1 000 000 | $10^6$ |
| *kilo-* | k | 1 000 | $10^3$ |
| *hecto-* | h | 100 | $10^2$ |
| *deka-* | da | 10 | $10^1$ |
| | base unit | 1 | $10^0$ |
| *deci-* | d | 0.1 | $10^{-1}$ |
| *centi-* | c | 0.01 | $10^{-2}$ |
| *milli-* | m | 0.001 | $10^{-3}$ |
| *micro-* | µ | 0.000 001 | $10^{-6}$ |
| *nano-* | n | 0.000 000 001 | $10^{-9}$ |

Make the following conversions:

a) 16.2 m to km

b) 5.44 L to mL

c) 25.3 mg into g

d) $4.5 \times 10^8$ nm into cm

e) 745 nm into m

f) $4.89 \times 10^7$ m into nm

g) 45.7 mL/s to kL/hr

## Part 2: Dimensional Analysis

For any dimensional analysis problems you will have to do this year, you will be given the conversion factor. For the following problems, use the conversion factors on the right.

**Conversion Factors**

| | |
|---|---|
| **Length:**<br>12 inches (in) = 1 foot (ft)<br>3 feet = 1 yard (yd)<br>5280 feet = 1 mile (mi) | **Capacity:**<br>3 teaspoons (tsp) = 1 tablespoon (tbsp)<br>16 tsp = 1 cup (c)<br>8 ounces (oz) = 1 c<br>2 c = 1 pint (pt)<br>2 pt = 1 quart (qt)<br>4 qt = 1 gallon (gal) |
| **Weight:**<br>16 ounces (oz) = 1 pound (lb)<br>2000 lb = 1 ton | |

| Metric to English | English to Metric |
|---|---|
| **Length:**<br>1 mm = 0.04 in<br>1 cm = 0.39 in<br>1 m = 39.37 in = 3.28 ft<br>1 m = 1.09 yd<br>1 km = 0.62 mi | **Length:**<br>1 in = 2.54 cm<br>1 ft = 30.48 cm = 0.305 m<br>1 yd = 0.914 m<br>1 mi = 1.609 km |
| **Weight:**<br>1 g = 0.035 oz<br>1 l = 1.057 qt | **Weight:**<br>1 oz = 28.350 g<br>1 lb = 0.453 kg |
| **Capacity:**<br>1 ml = .2 tsp<br>1 l = 1.057 qt | **Capacity:**<br>1 tsp = 5 ml<br>1 c = 236 ml<br>1 qt = 0.946 l<br>1 gal = 3.785 l |

1. **908 oz to kilograms**

2. **12.8 L to gallons**

3. **2.89 gallons to mL**

4. **4.48 lb to grams**

5. **55 miles per hour to m/s**

6. **2.3 $mi^2$ to $m^2$**

## Part 3: Scientific Notation

Express the following numbers in scientific notation. Keep the same unit provided.

7,640,000 kg

8,327.2 s

0.000000000300 m

0.0093 km/s

Determine the value for the following operations using scientific notation.

$(3 \times 10^6) \cdot (2 \times 10^4)$

$(1.2 \times 10^4) \div (6 \times 10^{-2})$

$(4 \times 10^8) \cdot (5 \times 10^{-3})$

$(7 \times 10^3)^2$

$(8 \times 10^3) \div (2 \times 10^5)$

$(2 \times 10^{-3})^3$

## Part 4: Algebra and Rearranging Equations

Solve the following questions. Units are included on numbers as they have meaning, but do not have any effect on the actual math you will be doing. Try your best to determine the correct unit for each answer.

Section 1: Use the following three equations with the provided values.

$$v_f = v_0 + at \qquad x_f = x_0 + v_0 t + \tfrac{1}{2}at^2 \qquad v_f^2 = v_0^2 + 2a(x_f - x_0)$$

a. Solve for t if $v_0$ = 5 m/s, $v_f$ = 25 m/s, and $a$ = 10 m/s².

b. Solve for t if $a$ = 10 m/s², $x_0$ = 0 m, $x_f$ = 120 m, and $v_0$ = 20 m/s.

c. Solve for $t/2$ if $v_f = -v_0$ and $a$ = 2 m/s².

d. Rewrite each formula simplified for if $a$ = 0 m/s² and $x_0$ = 0 m.

Section 2: Use the following four equations with the provided values.

$$\Sigma F = ma \qquad f_k = \mu_k N \qquad f_s \le \mu_s N \qquad F_s = -kx$$

a. If $\Sigma F$ = 10 N and $a$ = 1 m/s², calculate $m$.

b. Given $\Sigma F = f_k$, $m$ = 250 kg, $\mu_k$ = 0.2, and $N = 10m$. Calculate $a$.

c. Given $\Sigma F = T - 10m$ and $a$=0 m/s². Solve for $m$ in terms of $T$.

d. Using equations in Sections 1 and 2, calculate $\Sigma F$. $m$= 12 kg, $v_0$= 15 m/s, $v_f$= 5 m/s, and $t$= 12 s

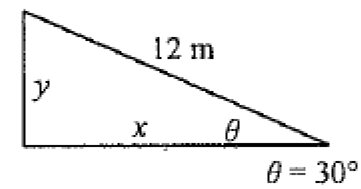
e. Solve for $F_s$ if $k$= 900 N/m and $x$= 0.15 m.

**Part 5: Trigonometry**

Write the formulas for the following trigonometric functions:

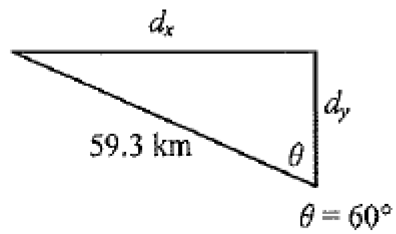
sin(Θ) = cos(Θ) = tan(Θ) =

Calculate the following unknowns using trigonometry. Use a calculator, but show all of your work. Include units!



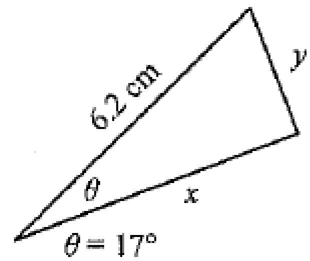

y = ______

x = ______



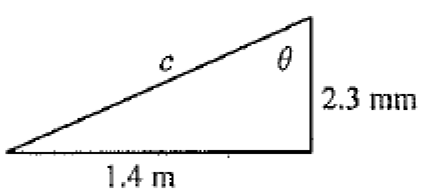

$d_x$ = ______

$d_y$ = ______



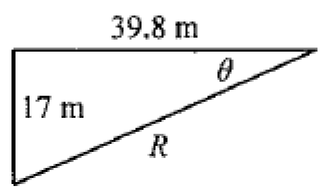

x = ______

y = ______



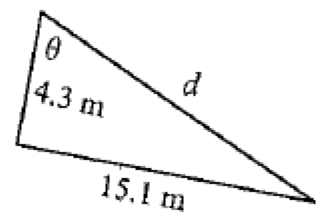

c = ______

Θ = ______




R = ______

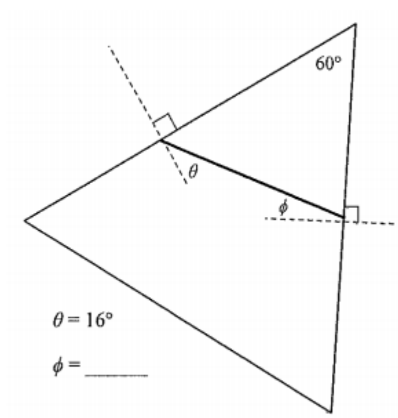
Θ = ______

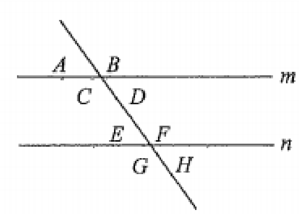



d = ______

Θ = ______

Calculate the unknown angle values for each diagram.



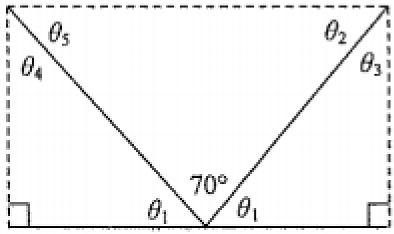




Lines *m* and *n* are parallel.

A = 75° B = _____ C = _____

D = _____ E = _____ F = _____

G = _____ H = _____



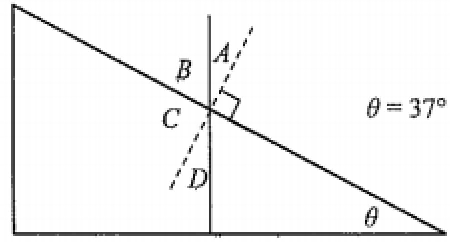

$\theta_1 =$ _____

$\theta_2 =$ _____

$\theta_3 =$ _____

$\theta_4 =$ _____

$\theta_5 =$ _____



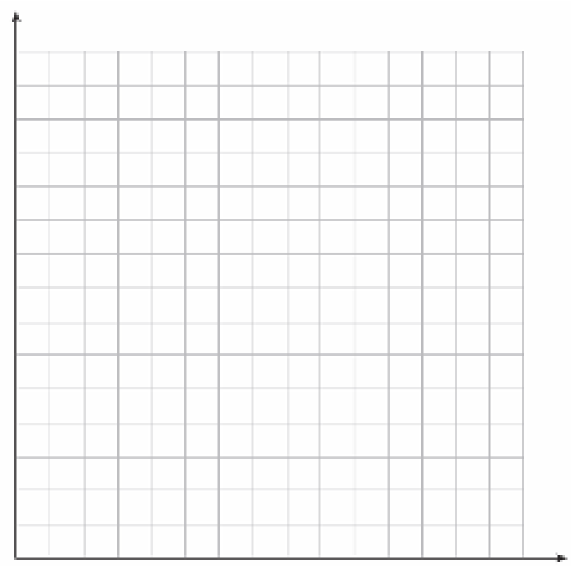

$A =$ _____ $B =$ _____

$C =$ _____ $D =$ _____

**Part 6: Graphing**

1. You have been asked by your teacher to measure the diameter and circumference of some round objects, such as tin cans, lids, CDs, coins, etc. You have collected the measurements and recorded them in the table below

| Radius (cm) | Circumference (cm) |
|---|---|
| 1.1 | 3.5 |
| 3.2 | 10.0 |
| 4.8 | 15.1 |
| 8.8 | 27.5 |
| 9.6 | 29.9 |
| 12 | 37.6 |



Graph the data in the graph below. First which quantity is the independent and which is the dependent? In other words, which quantity depends (dependent) on the other (independent)? Does the radius depend on the circumference or does the circumference depend on the radius?

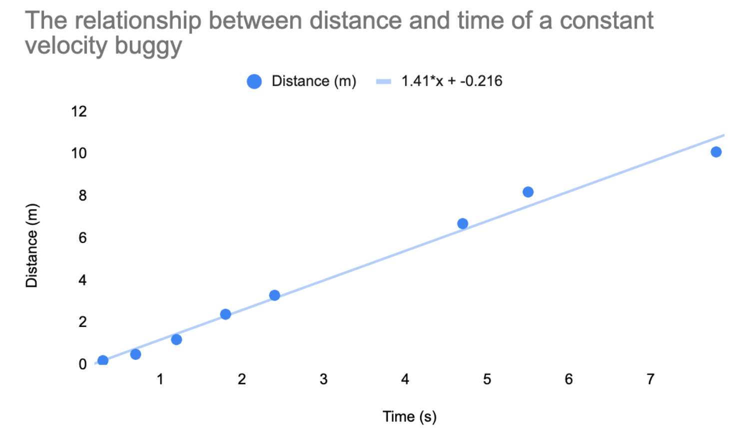
3. Label the axis and with the name of the quantity, and appropriate scaling of numbers and units. Then plot the points and draw the best straight line through as many points as possible, known as best-fit-curve (DO NOT JUST CONNECT THE DOTS!)

4. Find the slope of the graph and does it have a name or a physical meaning?

5. Does your graph have a y-intercept, if it does, what is it and does it have any significance?

6. Using the fact that the equation for a straight line is $y = mx + b$, write the specific equation for this graph using the appropriate symbols for radius and circumference in place of the $y$ and $x$ symbols.

The graph below is a collection of data from a recent physics lab examining the motion of a constant-velocity car. Using the graph and additional information below, answer the following questions.




1. Identify the independent variable and the dependent variable in the graph above.

2. What are the units for the slope of this graph?

3. Predict the distance the buggy has traveled after 4 seconds.

4. Write the mathematical model using the trend line equation for the relationship between distance and time.

5. Using your mathematical model above, calculate the vehicle's distance traveled after 9 seconds.

**Part 7: Relationships**

1. Consider: $z = \frac{x}{y}$, $c = ab$, $l = m - n$, or $r = \frac{s^2}{t^2}$.

a.) As x increases and y stays constant, z ______________________.

c.) As x increases and z stays constant, y ______________________.

d.) As a increases and c stays constant, b ______________________.

g.) As n increases and m stays constant, l ______________________.

i.) If s is tripled and t stays constant, r is multiplied by ______________________.

j.) If t is doubled and s stays constant, r is multiplied by ______________________.