Name _____ Date _____ AP Physics 1

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AP Physics 1 Summer Assignments

Worksheet A - Sig Figs & Units Worksheet

All questions are worth 2 pts - Due when you get back to school

I. An Introduction to Significant Digits - Watch this VIDEO

The number of significant figures in a number is the number of digits whose value are known with certainty.

Example: a person's height: 1.78 m, with the measurement error being in the third decimal place.
All three digits are known with certainty, so the number contains 3 sig figs.

Rules used in determining significant figures:

1. All non-zero numbers are significant. (Ex: 1, 2, etc)
2. All zeros between 2 non-zero numbers are significant. (Ex: 4004, these 2 zeros count as sig figs)
3. All final zeros after the decimal point are significant. (Ex: 4.000, these zeros count)
4. Zeros that act as placeholders are not significant. (Ex: 0.0004 or 400, these don't count)
   Exception: 400. When a decimal point follows placeholders, they no longer act as placeholders, but now are definite sig figs. So "400." has 3 sig figs.

1. How many significant figures are there in each of the following?

a. 273.16 _____
b. 186,000 _____
c. 505 _____
d. 1000 _____
e. 2,000,000 _____
f. 13.8 _____
g. 0.00928 _____
h. 60.080 _____

II. Scientific Notation

In science, very large and very small decimal numbers are conveniently expressed in terms of powers of ten. Numbers expressed with the aid of powers of ten are said to be in scientific notation.

Examples: Earth's radius = 6,380,000 m = 6.38×10^{6} m
Bohr radius of H atom = 0.0000000000529 m = 5.29×10^{-11} m

All scientific notations are composed of an integer ($0 < m \leq 1$) and powers of ten.

On the calculator: you can punch in scientific notation on a scientific calculator using the following buttons, depending on your calculator:

[EE] or [Exp]

Example: 6.38×10^{6} m : 6.38 [EE] 6 = 6.38E6 (the scientific notation on the calculator)

NOTE: Do not punch 6.38 [X] 10 [EE] 6, or your notation will be incorrect.

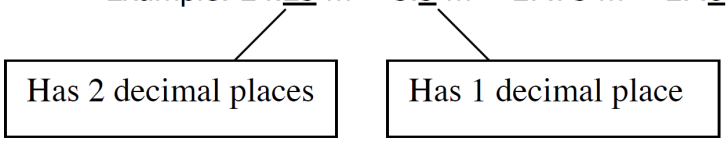
In the following, convert numbers in common notation to scientific notation or vice versa.

a. 93,000,000 _____
b. 0.000019 _____
c. 606.39 _____
d. 2.997×10^{10} _____
e. 6.02×10^{-5} _____
f. 2.5359×10^{2} _____

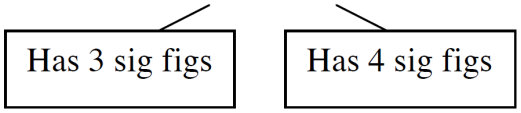
III. Performing Mathematical Operations With Significant Digits

Math and sig figs

1. When adding/subtracting: round answer to the least number of decimal places
   Example: 24.25 m + 3.5 m = 27.75 m = 27.8 m



2. When multiplying/dividing: round answer to the least number of total sig figs
   Example: 36.5 ÷ 3.414 = 10.69127… = 10.7



**Never write the entire number from the calculator as your answer. Always round answers to the correct sig figs.

1. In the following, **how many decimal places** will the **solution have**? **DO NOT SOLVE.**

a. 6.0 m + 10.73 m + 111.250 m _____
b. 4050 L – 2.06 L _____
c. 96.75 km + 108.43 km + 77 km _____
d. 93.4 cm + 10.975 cm _____
e. 0.005070 cm + 6.90 cm + 2000.860 cm _____
f. 10.970 mL – 5.0 mL _____

2. In the following, how many digits should be in the solution to have the proper number of sig figs? **DO NOT SOLVE.**

For example, the answer for a) would be 2 significant figures

a. (797.6 m)(54 m) _____
b. (851 cm)(24.3 cm) _____
c. 1075 kg ÷ 15 L _____
d. 93.4 m ÷ 10.975 m _____
e. $(6.02 \times 10^{23}$ m)(12.00 m)$(1.660 \times 10^{-24}$ m) _____
f. (453.6 m)$(9.050 \times 10^{4}$ m)(239.1 m) _____

IV. An Intro to Standard Units

In science, all numbers involve units, because all numbers are measurements of a quantity. Numbers without units mean nothing in physics, unless they are referring to a ratio.

In this class, we emphasize the system of units known as SI units. By agreement of the scientific world, a set of units are used as the standard. CGS, another system of units, may also be used:

	SI	CGS
Length	Meter (m)	Centimeter (cm)
Mass	Kilogram (kg)	Gram (g)
Time	Second (s)	Second (s)

The units for length, mass, and time, along with a few other units that will arise later, are regarded as base SI units. The word "base" refers to the fact that these units are used along with various laws to define additional units for other quantities. The units for these other quantities are referred to derived units, since they are a combination of the base units. We will discuss more about the derived units as they come up.

Unit Prefixes: you need to memorize these:

Prefix	symbol	Factor
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}

Other conversion factors you should know:

1 h = 3600 s

1 yr = 365.24 days

1 in = 2.54 cm

1 kg = 2.205 lb

1 m = 3.281 ft

1 m^3 = 1000 L

1 mile = 5280 ft = 1.609 km

V - Unit Conversion - Watch this VIDEO

Many quantities can be measured in several different units. Therefore, it is important to know how to convert from one unit to another.

**Note: Only quantities with the same units can be added or subtracted. If not the same unit, convert them to the same units before doing the math.
When multiplying and dividing, units can be treated as algebraic quantities.

Example: Express 979.0 m in kilometers and in feet.

$$979.0\ \text{m} \times \frac{1\ \text{km}}{10^3\ \text{m}} = 0.9790\ \text{km}$$

$$979.0\ \text{m} \times \frac{3.281\ \text{ft}}{1\ \text{m}} = 3212\ \text{ft}$$

1 meter = 100 cm = 1000 mm = 3.281 feet

1. Convert each of the following measurements into meters.

a. 42.3 cm

b. 0.023 mm

c. 21 km

2. Convert each of the English quantities below to their metric equivalents

1 meter = 100 cm = 1000 mm = 3.281 feet

a. 353 ft to m =

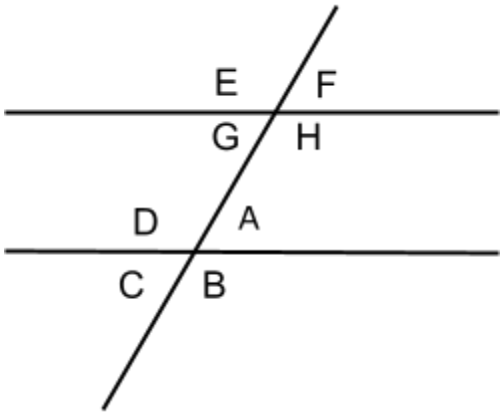
b. 2.0 in to mm x $\frac{1\ \text{foot}}{12\ \text{inches}}$ X _____ =

VI. Geometry

1. Two parallel lines cut by a transversal. Angle A = 60 degrees. Find the rest of the angles. **Find angles B - H**

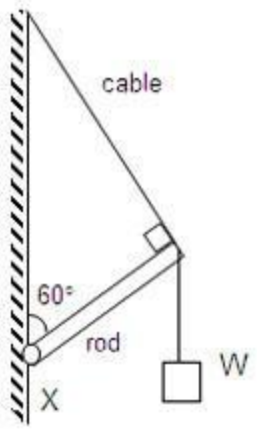
*When two **parallel lines are cut by a transversal**, the alternate interior angles formed are congruent. When two **lines are cut by a transversal**, the pairs of angles on either side of the **transversal** and outside the two **lines** are called the alternate exterior angles.*

B . _____ C _____ D _____ E _____ F _____ G _____ H _____



2. What is the angle between the weight force W and the rod? Explain.

*When two **parallel lines are cut by a transversal**, then the alternate interior angles formed are congruent. When two **lines are cut by a transversal**, the pairs of angles on either side of the **transversal** and outside the two **lines** are called the alternate exterior angles*



VI. Solving Simultaneous Equations

The substitution method can be used to solve systems of linear equations.

To use the substitution method, use one of the equations to solve for one variable in terms of the other. Substitute this expression into the other equation and solve the resulting equation. Substitute the value into one of the original equations to find the value of the other variable.

1. $5x + y = 13$
$3x = 15 - 3y$

2. $2x + 4y = 36$
$10y - 5x = 0$

3. $2x - 4y = 12$
$3x = 21 + 6y$

4. $4x - 4y = -4$
$3x + 2y = 12$

5. $2x - 5y = 9$
$y = 3x - 7$