* Major Grade
*due: first day of class in August.

Conroe High School
AP Physics I
Summer Packet

AP Physics student,

Congratulations on your choice to challenge yourself. AP Physics I is a rigorous college level science course. It will be considerably more challenging than Honors Physics. Expect to spend 3-5 hours outside of class per week reading and doing problems to enjoy a high level of success. It is a very good idea to have a study group. You already know many of your classmates who will be in AP physics. Get on the phone and plan meetings to work on this together or class work when the semester begins. I suggest meeting places far away from televisions and other distractions (public libraries and restaurants are an option).

To prepare for a fast paced, challenging course, we need to start early, hit the ground running when classes begin in August.

This packet contains a lot of basic essential material to the course. Most of this packet is basic mathematical skills you should already possess. Please read through the sections that explain and review any material you may not recall. Keep in mind that this packet is written at the AP level. The more familiar you are with these topics, the easier the first nine weeks will be. The explanations will also assist you as you complete some assignments in the following pages.

I'm looking forward to being your teacher next school year.

Complete ALL the problems on the following pages….

The entire packet is due the first day of class in August.

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AP Physics 1 Summer Assignment

1. Scientific Notation:

The following are ordinary physics problems. Write the answer in scientific notation and simplify the units (π=3).

a. $T_s = 2\pi\sqrt{\dfrac{4.5\times10^{-2}\,kg}{2.0\times10^{3}\,kg/s^2}} =$ T_s=_______________

b. $F = \left(9.0\times10^{9}\,\dfrac{N\cdot m^2}{C^2}\right)\dfrac{(3.2\times10^{-9}\,C)(9.6\times10^{-9}\,C)}{(0.32m)^2}$ F=_______________

c. $\dfrac{1}{R_p} = \dfrac{1}{4.5\times10^{2}\,\Omega} + \dfrac{1}{9.4\times10^{2}\,\Omega}$ R_p=_______________

d. $K_{max} = (6.63\times10^{-34}\,J\cdot s)(7.09\times10^{14}\,s) - 2.17\times10^{-19}\,J$ K_{max}=_______________

e. $\gamma = 1\bigg/\sqrt{1-\dfrac{2.25\times10^{8}\,m/s}{3.00\times10^{8}\,m/s}}$ γ=_______________

f. $K = \frac{1}{2}(6.6\times10^{2}\text{ kg})(2.11\times10^{4}\text{ m/s})^2 =$ K=_______________

g. $(1.33)\sin 25.0^\circ = (1.50)\sin\theta$ θ=_______________

2. **Solving Equations:**

Often problems on the AP exam are done with variables only. Solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers.

a. $K = \frac{1}{2}kx^2$, $x =$ ______________

b. $T_p = 2\pi\sqrt{\frac{\ell}{g}}$, $g =$ ______________

c. $F_g = G\frac{m_1 m_2}{r^2}$, $r =$ ______________

d. $mgh = \frac{1}{2}mv^2$, $v =$ ______________

e. $x = x_o + v_o t + \frac{1}{2}at^2$, $t =$ ______________

f. $B = \frac{\mu_o}{2\pi}\frac{I}{r}$, $r =$ ______________

g. $x_m = \frac{m\lambda L}{d}$, $d =$ ______________

h. $pV = nRT$, $T =$ ______________

i. $\sin\theta_c = \frac{n_1}{n_2}$, $\theta_c =$ ______________

j. $qV = \frac{1}{2}mv^2$, $v =$ ______________

3. Conversion

Science uses the *KMS* system (*SI*: System Internationale). *KMS* stands for kilogram, meter, second. These are the units of choice of physics. The equations in physics depend on unit agreement. So you must convert to *KMS* in most problems to arrive at the correct answer.

kilometers (km) to meters (m)	and meters to kilometers	gram (g) to kilogram (kg)
centimeters (cm) to meters (m)	and meters to centimeters	Celsius (^oC) to Kelvin (K)
millimeters (mm) to meters (m)	and meters to millimeters	atmospheres (atm) to Pascals (Pa)
nanometers (nm) to meters (m)	and metes to nanometers	liters (L) to cubic meters (m^3)
micrometers (μm) to meters (m)		

Other conversions will be taught as they become necessary.

What if you don't know the conversion factors? Colleges want students who can find their own information (so do employers). Hint: Try a good dictionary and look under "measure" or "measurement". Or the Internet? Enjoy.

a. 4008 g = ______________ kg

b. 1.2 km = ______________ m

c. 823 nm = ______________ m

d. 298 K = ______________ ^oC

e. 0.77 m = ______________ cm

f. $8.8\text{x}10^{-8}$ m = ______________ mm

g. 1.2 atm = ______________ Pa

h. 25.0 μm = ______________ m

i. 2.65 mm = ______________ m

j. 8.23 m = ______________ km

k. 40.0 cm = ______________ m

l. $6.23\text{x}10^{-7}$ m = ______________ nm

m. $1.5\text{x}10^{11}$ m = ______________ km

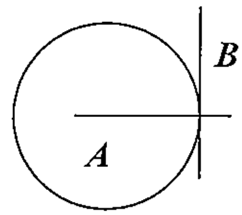
4. Geometry

Solve the following geometric problems.

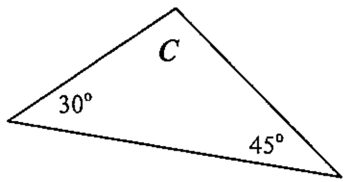
a. Line B touches the circle at a single point. Line A extends through the center of the circle.

   i. What is line B in reference to the circle?

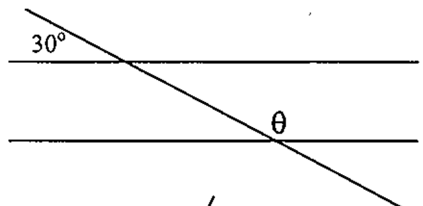
   ii. How large is the angle between lines A and B?



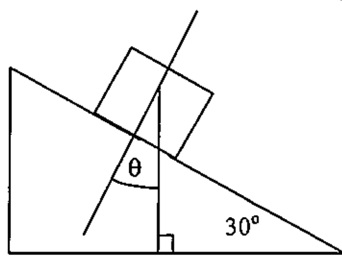
b. What is angle C?



c. What is angle θ ?



d. How large is θ?

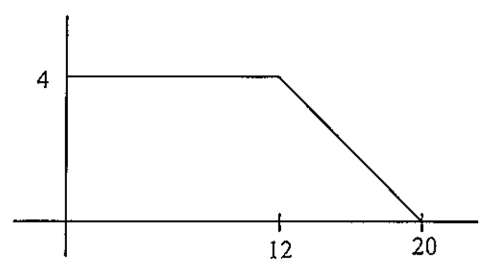


e. The radius of a circle is 5.5 *cm*,

   i. What is the circumference in <u>meters</u>?

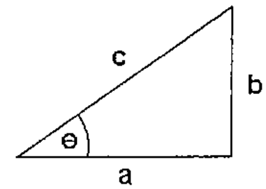
   ii. What is its area in <u>square meters</u>?

f. What is the area under the curve at the right?



5. Trigonometry

Using the generic triangle to the right, Right Triangle Trigonometry and Pythagorean Theorem solve the following. ***Your calculator must be in degree mode.***



g. $\theta = 55°$ and $c = 32\ m$, solve for a and b.

____

h. $\theta = 45°$ and $a = 15\ m/s$, solve for b and c.

____

i. $b = 17.8\ m$ and $\theta = 65°$, solve for a and c.

____

j. $a = 250\ m$ and $b = 180\ m$, solve for θ and c.

____

k. $a = 25\ cm$ and $c = 32\ cm$, solve for b and θ.

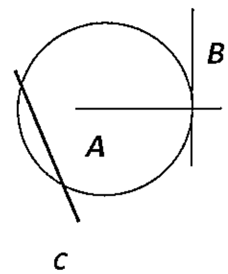
____

l. $b = 104\ cm$ and $c = 65\ cm$, solve for a and θ.

____

M. Line *B* touches the circle at a single point. Line *A* extends through the center of the circle.

N. What is line *B* in reference to the circle?



O. How large is the angle between lines *A* and *B*?

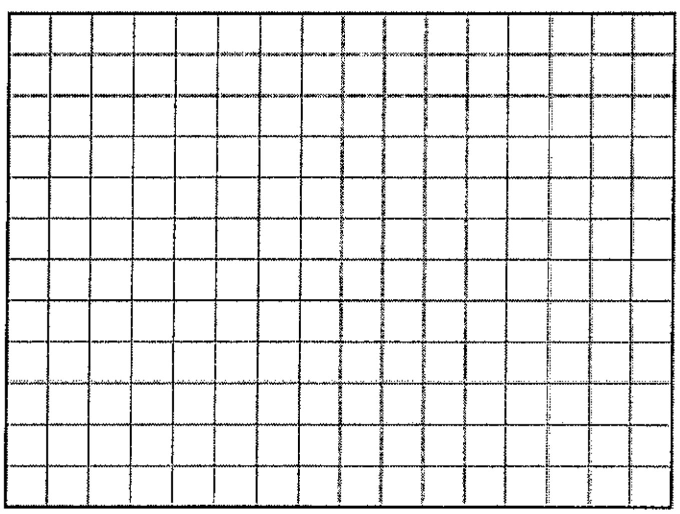
P. What is line *C*?

6. GRAPHING TECHNIQUES

Graph the following sets of data using proper graphing techniques.

The first column refers to the *y*-axis and the second column to the *x*-axis

1. Plot a graph for the following data recorded for an object falling from rest:



Velocity (ft/s)	Time (s)
32	1
63	2
97	3
129	4
159	5
192	6
225	7

a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What do you expect the velocity to be after 4.5 s?

d. How much time is required for the object to attain a speed of 100 ft/s?

2. Plot a graph showing the relationship between frequency and wavelength of electromagnetic waves:

Frequency (kHz)	**Wavelength** (m)
150	2000
200	1500
300	1000
500	600
600	500
900	333

a. What kind of curve did you obtain?

b. What is the relationship between the variables?

c. What is the wavelength of an electromagnetic wave of frequency 350 Hz?

d. What is the frequency of an electromagnetic wave of wavelength 375 m?

7. Vectors

Most of the quantities in physics are vectors. ***This makes proficiency in vectors extremely important.***

Magnitude: Size or extend. The numerical value.

Direction: Alignment or orientation of any position with respect to any other position.

Scalars: A physical quantity described by a single number and units. A quantity described by **magnitude only**.

Examples: time, mass, and temperature

Vector: A physical quantity with **both a magnitude and a direction**. A directional quantity.

Examples: velocity, acceleration, force

Notation: $\vec{A}$ or $\xrightarrow{\vec{A}}$ — Length of the arrow is proportional to the vectors magnitude. Direction the arrow points is the direction of the vector.

Negative Vectors

Negative vectors have the same magnitude as their positive counterpart. They are just pointing in the opposite direction.

$\xrightarrow{\vec{A}}$ $\xleftarrow{-\vec{A}}$

Vector Addition and subtraction

Think of it as vector addition only. The result of adding vectors is called the resultant. $\vec{R}$

$\vec{A}+\vec{B}=\vec{R}$ $\xrightarrow{\vec{A}}$ + $\xrightarrow{\vec{B}}$ = $\xrightarrow{\quad\vec{R}\quad}$

So if ***A*** has a magnitude of 3 and ***B*** has a magnitude of 2, then ***R*** has a magnitude of 3+2=5.

When you need to subtract one vector from another think of the one being subtracted as being a negative vector. Then add them.

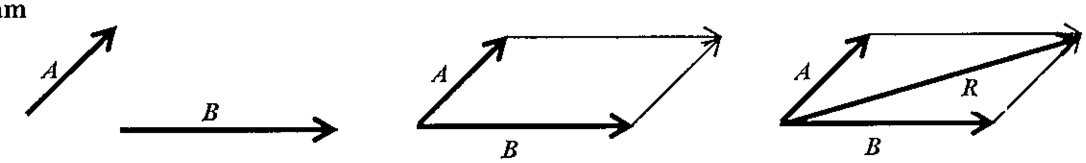
A negative vector has the same length as its positive counterpart, but its direction is reversed.
So if ***A*** has a magnitude of 3 and ***B*** has a magnitude of 2, then ***R*** has a magnitude of 3+(-2)=1.

This is very important. In physics a negative number does not always mean a smaller number. Mathematically –2 is smaller than +2, but in physics these numbers have the same magnitude (size), they just point in different directions (180° apart).

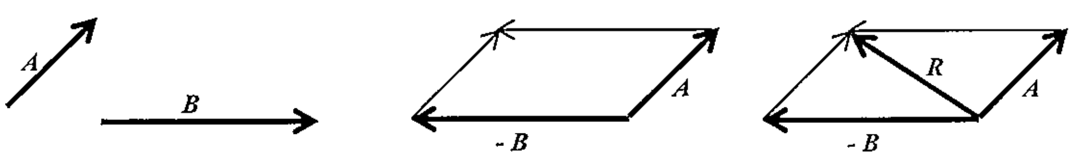
There are two methods of adding vectors

Parallelogram

$A+B$

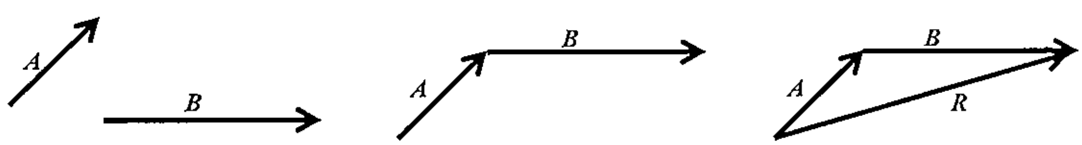


$A-B$

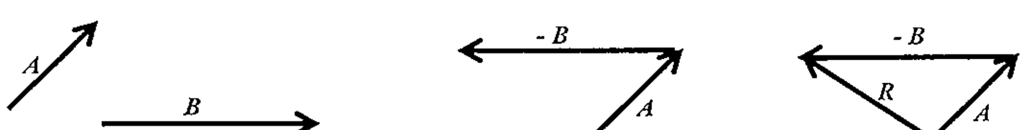


Tip to Tail

$A+B$



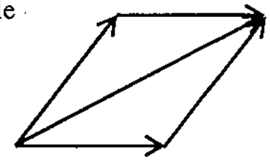
$A-B$



7. Drawing Resultant Vectors

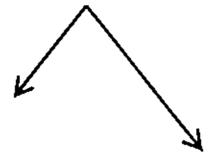
Draw the resultant vector using the parallelogram method of vector addition.

Example

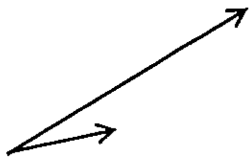


b.

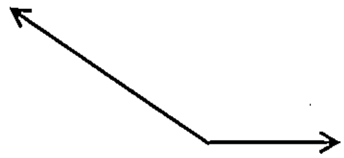
d.



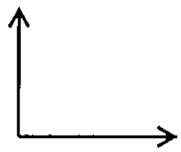
a.



c.

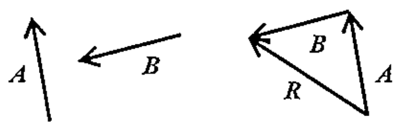


e.

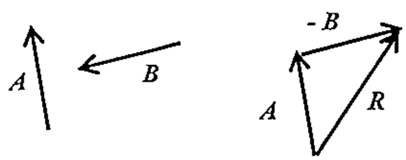


Draw the resultant vector using the tip to tail method of vector addition. Label the resultant as vector ***R***

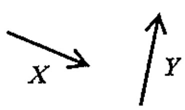
Example 1: $A + B$



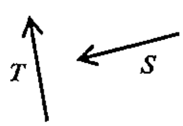
Example 2: $A - B$



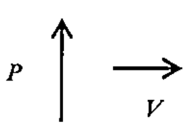
f. $X + Y$



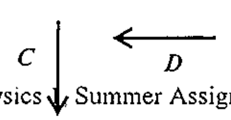
g. $T - S$



h. $P + V$



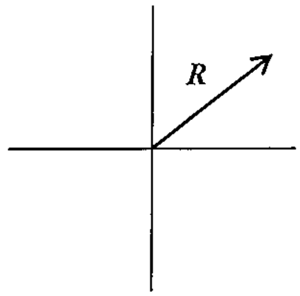
i. $C - D$

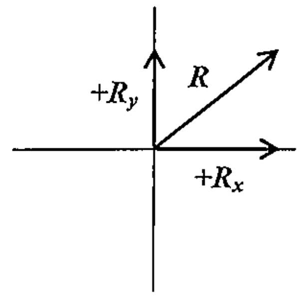


Component Vectors

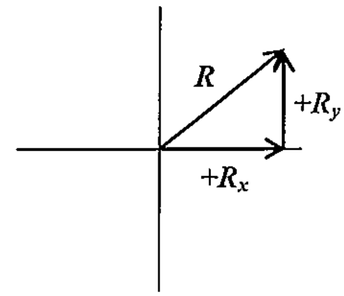
A resultant vector is a vector resulting from the sum of two or more other vectors. Mathematically the resultant has the same magnitude and direction as the total of the vectors that compose the resultant. Could a vector be described by two or more other vectors? Would they have the same total result?

This is the reverse of finding the resultant. You are given the resultant and must find the component vectors on the coordinate axis that describe the resultant.





or

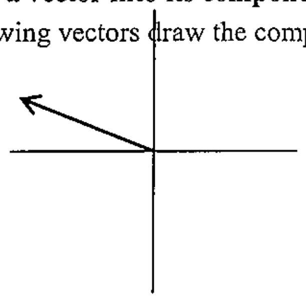


Any vector can be described by an x axis vector and a y axis vector which summed together mean the exact same thing. The advantage is you can then use plus and minus signs for direction instead of the angle.

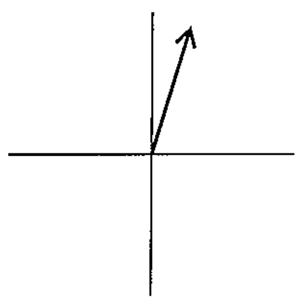
8. Resolving a vector into its components

For the following vectors draw the component vectors along the x and y axis.

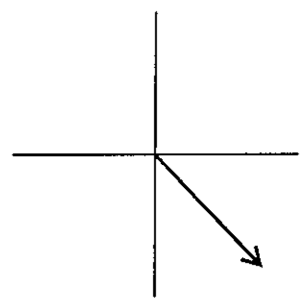
a.



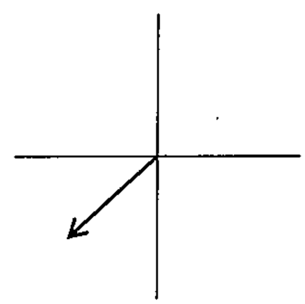
b.



c.



d.



Obviously the quadrant that a vector is in determines the sign of the x and y component vectors.