

## Dear AP Physics Student:

Physics is interesting and beneficial, but challenging! In AP Physics Mechanics, you will learn the foundations of what makes the physical universe behave as it does. These foundations apply to things big and small.

**INTERESTING:** Why do the planets stay in orbit around the sun? How are planetary orbits similar to electron orbits in the atom, to roller coasters, and to a pendulum? How does gravity work and what makes neutron stars spin so fast? How is skiing similar and different from driving a car? What forces and torques do our bodies sustain as we move and lift weights? Begin to look at your surroundings in a whole new way.

**BENEFITS:** You will develop strong analytical skills (problem solving and math). Did you know that people with physics (and engineering) degrees are highly employable in areas as diverse as finance, business, medical school, and law? This is because physics and engineering graduates have learned how to THINK and SOLVE PROBLEMS! These skills apply to all walks of life, not just physics problems.

**CHALLENGING:** Physics requires the development of your mathematical, verbal, and analytical skills and is not easy! Learning takes time. You may be the student who could learn it all in class without struggling, but that will NOT be the case in this class! There is homework (up to 1 ½ hours) EVERY DAY and you must get help regularly when things get hard for you. Everything builds on what was previously learned, so you must keep up! DO NOT LET YOURSELF FALL BEHIND.

Follow these links to [required summer work](#) (math pre-requisites) and [textbooks](#). Work through the assignments NOW and again right before school starts. Come to class prepared for AP Physics. Our second day of class will include a quiz over these materials.

Sincerely, Mrs. Tanner

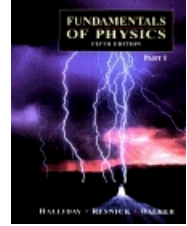
P.S. I can't stress enough how important it is for you to come to class on the first day feeling comfortable with the attached concepts. Additionally, practice your algebra! We will be using symbols in many of our problems, and you must be confident using algebra concepts.

## Textbooks and Webassign:

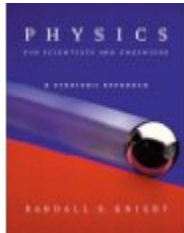
[www.webassign.com](http://www.webassign.com) will be our required online homework site. Cost is about \$12.00. Sign up the first week of class (Site is not ready yet).

### Textbooks:

**I will loan you this at no cost: Fundamentals of Physics, 5<sup>th</sup> edition, Halliday, Resnick and Walker (ISBN 0-471-10558-9). Homework problems come from this book. The text is very concise.**



**Buy: Physics for Scientist and Engineers: A Strategic Approach, 1<sup>st</sup> edition by Randall Knight, 2004. Physics for Scientists & Engineers: A Strategic Approach (Volume 1, Chapters 1-15) in paperback ISBN 0-8053-8963-6**

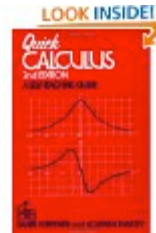


OR the entire book ISBN 0-8053-8960-1 (either is acceptable, the entire book is very heavy but you can leave it at home – we will be using chapters 1-15). Both books can be bought used at Amazon.com. Physics explanations are clear and detailed.

I will assign comparable readings in Knight and in Halliday so you may choose which to use.

**Optional summer work:** To help you review or quickly learn the fundamentals of calculus BEFORE class starts. We will not use this book during class.

**Quick Calculus** 2nd Edition A Self-Teaching Guide Calculus by Daniel Kleppner ISBN 0471827223. Learn the elementary techniques of differential and integral calculus quickly and painlessly. Your "calculus anxiety" will rapidly disappear as you work at your own pace on a series of carefully selected work problems. Each correct answer to a work problem leads to new material, while an incorrect response is followed by additional explanations and reviews.



## REQUIRED SUMMER WORK (quiz first day on these pages)

### Unit Conversions

1. Learn the metric prefixes and practice converting. I will give a *bit* of instruction and practice on converting other units, but you will need to know the metrics and will use this technique constantly. Practice this summer so you are able to convert units with ease! We will be using units from tera to pico.

$10^{12}$	tera	T	Trillion	1 000 000 000 000
$10^9$	giga	G	Billion	1 000 000 000
$10^6$	mega	M	Million	1 000 000
$10^3$	kilo	k	Thousand	1 000
$10^2$	hecto	h	Hundred	100
$10^1$	deca	da	Ten	10
$10^0$	(none)	(none)	One	1
$10^{-1}$	deci	d	Tenth	0.1
$10^{-2}$	centi	c	Hundredth	0.01
$10^{-3}$	milli	m	Thousandth	0.001
$10^{-6}$	micro	$\mu$	Millionth	0.000 001
$10^{-9}$	nano	n	Billionth	0.000 000 001
$10^{-12}$	pico	p	Trillionth	0.000 000 000 001

Here is a website that has metric unit conversion practice:

<http://www.aaamath.com/mea69-metric-meter.html>

The website above is set up for Middle School students, but will work for you. (Take a hint: you should have learned this in Middle School! If you didn't, study it well now. Move beyond the "King Henry Died Many Deaths Counting Money".)

2. We will often convert from one type of unit to another (not just metric prefixes). The website below has very clear and detailed instructions on converting all types of units. Work through it until you are comfortable with this! There are practice problems at the very end of the webpage.

<http://oakroadsystems.com/math/convert.htm>

## Greek Alphabet

Some of our symbols will use Greek letters! Your learning will be easier if you are familiar with several Greek letters. Learn the lower case Greek letters (plus D, capital delta) that are defined below. There is a Greek Alphabet and on-line flashcard game at <http://aol.org/Greek/greekalphabet.html>

Used in AP Physics at LHS:

⇒	α	A	alpha	a	f <u>a</u> ther	Angular acceleration
	β	B	beta	b	<u>b</u> ig	
	γ	Γ	gamma	g, n	<u>G</u> od, <u>a</u> nkle	
	δ	⇒ Δ	delta	d	<u>d</u> oor	Capital Δ= "change in"
	ε	E	epsilon	e	met <u>e</u>	
	ζ	Z	zeta	z, dz	<u>z</u> eal, kud <u>z</u> u	
	η	H	eta	ē	ob <u>e</u> y	
⇒	θ	Θ	theta	th	<u>t</u> hing	Angle (radians or °)
	ι	I	iota	i	pit, pol <u>i</u> ce	
⇒	κ	K	kappa	k	<u>k</u> ee <u>p</u>	Torsion spring constant
⇒	λ	Λ	lambda	l	<u>l</u> aw	Wavelength
⇒	μ	M	mu	m	<u>m</u> other	Micro (metric prefix)
⇒	ν	N	nu	n	<u>n</u> umber	Sometimes frequency but not in our class
	ξ	Ξ	xi (ksee)	x	fo <u>x</u>	
	ο	O	omicron	o	<u>n</u> ot	
⇒	π	Π	pi	p	<u>p</u> oor	Pi
⇒	ρ	P	rho	r, rh	<u>r</u> od	Density (mass/volume)
	σ	Σ	sigma	s	<u>s</u> ave	
⇒	τ	T	tau	t	<u>t</u> ime	Torque (lever arm x force)
	υ	Υ	upsilon	u, y	German <u>ü</u>	
⇒	φ	Φ	phi	ph	<u>p</u> hone	Phase shift (phase angle)
	χ	X	chi	ch	German <u>i</u> ch	
	ψ	Ψ	psi	ps	<u>t</u> ipsy	
⇒	ω	Ω	omega	ō	<u>v</u> ote	Angular velocity

For fun and practice: Use the chart above to decipher these messages

Στυδψ ωελλ ανδ ψου ωιλλ συχχεεδ!

Λεαρν Γρεεκ φορ φυν ανδ Πηψιχσ!

## Scientific Notation – we use it every day!

You may think you are proficient using scientific notation, but in my experience about half of the students entering physics do not really know how to accurately enter a power of 10 on their calculators. If your answers are always off by a factor of 10, come see me for a “quicky” calculator lesson!

You will be working with very large and very small numbers, many of which will be given in scientific notation. Proper scientific notation specifies a **mantissa** (a number between 1 and 10) multiplied by some power of ten, as in

$$\text{mantissa} \times 10^{\text{exponent}}$$

The power of ten tells you which way to move the decimal point and by how many places. As a quick review:

$$10 = 1 \times 10^1$$

$$253 = 2.53 \times 100 = 2.53 \times 10^2$$

$$15,000,000,000 = 1.5 \times 10^{10} \text{ which you will sometimes see written as } 15 \times 10^9.$$

For small numbers we have:

$$\frac{1}{10} = 1 \times 10^{-1}$$

$$\frac{1}{253} = \frac{1}{2.53 \times 100} = \frac{1}{2.53} \times 10^{-2} \text{ or about } 0.395 \times 10^{-2} = 3.95 \times 10^{-3}.$$

In Physics, it's nice, but NOT necessary, to have the answer in scientific notation (a number between 1 and 10 in the mantissa). The answer  $0.395 \times 10^{-2}$  is also acceptable.

## Multiplying and Dividing with Scientific Notation

When you multiply two values given with powers of ten:

**multiply the mantissa values and add the exponents in the power of ten.**

For example:  $(3 \times 10^{10}) \times (6 \times 10^{23})$  is the same as  $3 \times 6 \times 10^{(10+23)} = 18 \times 10^{33}$  or  $1.8 \times 10^{34}$ .

When you divide two values given with powers of ten:

**divide the mantissa values and subtract the exponents in the power of ten.**

For example:  $\frac{3 \times 10^{10}}{6 \times 10^{23}} = \frac{3}{6} \times 10^{10-23} = 0.5 \times 10^{-13}$  or  $5 \times 10^{-14}$ .

Notice what happened to the decimal point and exponent in the examples. You *subtract* one from the exponent for every space you move the decimal to the *right*. You *add* one to the exponent for every space you move the decimal to the *left*.

## Entering scientific notation on your scientific calculator

Please read this if you have not used a scientific calculator for a while!

USE THE ``EE'' key or ``EXP'' key when working with powers of ten.

Do NOT use the  $\wedge$  (carat) or  $y^x$  (y to the x) key to raise a number to the power of ten, as this requires extra key strokes and often causes you to get the wrong answer.

The EE or EXP key replaces the keystrokes "  $\times 10^{\wedge}$  "

For example: To enter  $2.53 \times 10^{24}$ , enter "2 EE (or EXP) 24".

Webassign (our online homework system) will use this notation when presenting numbers with powers of ten. The number  $2.53 \times 10^{24}$  will be written as 2.53E24. Get used to this notation!

Try this problem and see if you get the right answer. If you do, you are using the EXP key correctly.

$$(5.46 \times 10^3)(2.18 \times 10^{-8}) = \underline{\hspace{4cm}}$$

Answer:  $1.19 \times 10^{-4}$  or 0.000119. Your keystrokes should be "5.46 EE 3  $\times$  2.18 EE-8" If your answer comes out as a decimal, find the **mode** button and change to scientific notation. Notice that the calculator displays the answer as **1.19 -4** with a space between the mantissa and the exponent. This means  $1.19 \times 10^{-4}$ , not  $1.19^{-4}$ .

Some things NOT to do:

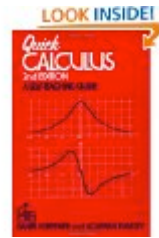
Sometimes students want to enter a 10 before or after pressing the EE key. You will get the wrong answer since EE includes " $\times 10^{\wedge}$ " (In English I say EE means "times ten to the..."). If you enter the keystrokes " $5.46 \times 10$  EE 3" you will get  $5.46 \times 10^4$ , which is incorrect.

Once you get used to the EE key, you might want to write your answer as  $5.46^3$ . This is incorrect since it means  $5.46 \times 5.46 \times 5.46$  instead of  $5.46 \times 10 \times 10 \times 10$ . Write your answer as 5.46 E 3 or  $5.46 \times 10^3$ .

One other word of warning: the EE or EXP key is used only for raising a number to a power of ten and NOT for raising some number (not 10) to a power. To raise a number to some exponent use the  $y^x$  key. For example, to raise 3 to the 4th power as in  $3^4$  enter "3  $y^x$  4". If you instead entered it using the EE or EXP key as in "3 EE 4", you would be entering  $3 \times 10^4$  (which is 30,000) rather than  $3^4$  (which is 81).

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