Dear AP Physics Students,

The AP physics course centers around a National curriculum that is time based and standardized for all students. This curriculum must be completed by the beginning of May. To accomplish this, students are required to complete a portion of the coursework during the summer. This summer assignment will be collected the **first day** of school in September.

Many students find AP Physics to be a challenging time consuming course and spend many hours of their already limited time over the course of the year studying physics. This course is for serious students only. It requires dedication, commitment to hard work, and a willingness to be challenged. The pace of the course will be much more rapid than most courses you have taken and will seem overwhelming at times. AP Physics is **NOT** an honors level course; it is a college level course and is above the level of typical honors classes. I will be here to help and guide you through your exciting journey of AP Physics, but to a large degree you will be responsible for developing an understanding through your own efforts (this is a skill you need to develop for college).

The summer assignment for physics maybe a little different than some of the summer assignments you will receive from other classes. The major difference is when I am asking you to complete this assignment. I do **not** want you to complete this assignment as soon as school is over in June, but I would like you to wait until the last couple weeks of August just before we return to school to complete this assignment. The reason for this is so that you have a good review of the skills you need so we can begin learning on the first day when we return in September.

I am looking forward to seeing you next year in the best class ever

AP Physics!

Mr. McDonald
jmcdonald@hopatcongschools.org

AP Physics Math Review Packet

This packet is a fairly good representation of the math which you will need to do well in AP Physics. It is expected that you understand and know how to work out the problems in this packet. If you have forgotten how to do some things, you need to get yourself caught up; the internet is not just for social media and stupid YouTube videos.

Show All Work Neatly on separate sheets of paper or you will get no credit.

Algebra Equation Solving

The following are examples of physics problems you will see in AP Physics. Be sure to give your answers with the correct units.

1) $T = 2\pi \sqrt{\dfrac{8.5 \; x \; 10^5 m}{7.4 \; x \; 10^8 m/s^2}}$

2) $\dfrac{1}{75\text{cm}} = \dfrac{1}{83\text{cm}} + \dfrac{1}{d_i}$

3) $75\text{m} = 8\text{m} + v_o\,(2\text{s}) + \tfrac{1}{2}\,4.3\text{m/s}^2\,(2\text{s})^2$

4) $F = 6.67 \; x \; 10^{-11} \; \text{N m}^2/\text{kg}^2 \; \dfrac{(75\text{kg})\,(125\text{kg})}{(8.5\text{m})^2}$

5) $(1.5)\sin 25^o = (1.33)\sin\theta_2$

Many problems in AP physics contain no numbers only variables. The following are various physics formulas. Solve for the variable indicated.

6) $x = x_o + v_o t + \tfrac{1}{2}\,at^2$,   for v_o

7) $U_E = \dfrac{1}{4\pi\epsilon_o}\,\dfrac{q_1 q_2}{r^2}$,   for r

8) $F_B = qv\,B\,\sin\Theta$,   for Θ

9) $K = \tfrac{1}{2}\,mv^2$,   for v

10) $F = G\,\dfrac{m_1\,m_2}{d^2}$,   for m_2

Metric System

Fill in the power and the symbol for the following unit prefixes. Look them up as necessary. These should be **memorized** for next year. Kilo- has been completed as an example.

Prefix	Power	Symbol
giga		
mega		
kilo	10^3	k
centi		
milli		
micro		
pico		

Dimensional Analysis

Convert the following numbers into the specified unit. Use scientific notation when appropriate.

1) 85 g =   kg
2) 92.3MHz =   Hz
3) 85 Gs =   ks
4) 422 nm =   m
5) $8.5\ m^2 =$ cm^2
6) $1250\ mm^3 =$ m^3
7) $7\ g/cm^3 =$ kg/m^3
8) 125 m/s =   km/hr

Significant Figures

Rules for Counting Significant Figures

1. Always count nonzero digits
   Example: 21 has two significant figures, while 8.926 has four
2. Never count leading zeros
   Example: 021 and 0.021 both have two significant figures
3. Always count zeros which fall somewhere between two nonzero digits
   Example: 20.8 has three significant figures, while 0.00104009 has six
4. Count trailing zeros <u>if and only if</u> the number contains a decimal point
   Example: 210 and 210000 both have two significant figures, while 210. has three and 210.00 has five
5. For numbers expressed in scientific notation, ignore the exponent and apply Rules 1-4
   Example: -4.2010 x 10^{28} has five significant figures

Mathematics With Significant Figures

Addition and Subtraction

When adding or subtracting numbers, count the **NUMBER OF DECIMAL PLACES** to determine the number of significant figures. The answer cannot **CONTAIN MORE PLACES AFTER THE DECIMAL POINT THAN THE SMALLEST NUMBER OF DECIMAL PLACES** in the numbers being added or subtracted.

Example:

45.33113	*(6 places after the decimal point)*
2.5533	*(4 places after the decimal point)*
+ .36	*(2 places after the decimal point)*
48.24443	*(from the calculator)*
48.24	*(rounded to 2 places in the final answer)*

Note: There are 4 significant figures in the answer.

Multiplication and Division

When multiplying or dividing numbers, count the **NUMBER OF SIGNIFICANT FIGURES**. The answer cannot **CONTAIN MORE SIGNIFICANT FIGURES THAN THE NUMBER BEING MULTIPLIED OR DIVIDED** with the **LEAST NUMBER OF SIGNIFICANT FIGURES.**

Example:

52.3456873	*(9 significant figures)*
x 2.4455	*(5 significant figures)*
128.0113783	*(from the calculator)*
128.01	*(rounded to 5 significant figures)*

Significant Figures

1. State the number of significant digits in the following measurements.
   - A. 753 N
   - B. 4056 s
   - C. 42.03250 kg
   - D. 0.000032 m

2. Add or subtract as indicated and state the answer with correct number of significant digits.
   - A. 45.32 g + 7.2 g
   - B. 12.2365 kg – 85.435 kg
   - C. 8.536km + 0.8 km
   - D. 42.35 s – 12 s

3. Multiply or divide as indicated using significant digits correctly.
   - A. $(4.52 \times 10^8 \text{ m})(8.3 \times 10^7 \text{ m})$
   - B. $(2.64 \text{ kg}) \div (29.4 \text{ m}^3)$
   - C. $(1.67 \text{ km})(788.5 \text{ km})$
   - D. $(26.3 \text{ m}) \div (533.8 \text{ s})$

4. State the number of significant digits in the following measurements.
   - A. $3.80 \times 10^2 \text{m}$
   - B. $9.0 \times 10^{53} \text{ m}$
   - C. $5.0007 \times 10^{-25} \text{ m}$
   - D. $8.105 \times 10^{-38} \text{ m}$

Trigonometry
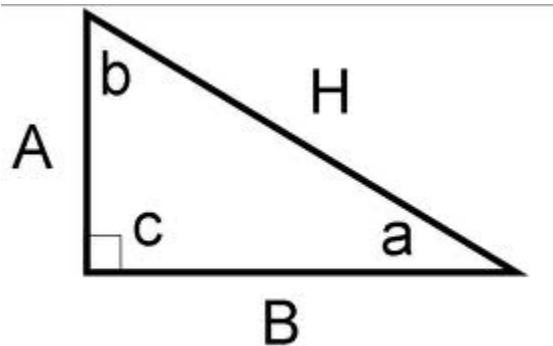
For the following questions use the above diagram

1. A= 8 N, B= 12 N, H=?, a=?, b=?, c=?

2. A= ?, B= 45 m, H=?, a=22°, b=?, c=?

3. A= 33 m/s, B= ?, H=?, a=?, b=48°, c=?

4. A= ?, B= ?, H=83 m/s^2, a=22°, b=?, c=?

Vectors

1. A plane flying at 90° at 45 m/s is blown toward 0° at 62 m/s by a strong wind. Find the plane's resultant velocity.

2. If you walk 367-m north and 785 m west what is your total displacement from you original location?
3. A plane travels on a heading of 127.0° at a velocity of 25 km/hr. What are the horizontal and vertical components of the plane's velocity?

Graphing
The total distance a lab cart travels during specified lengths of time is given in the following table.

Time (s)	Distance (m)
1.0	0.32
2.0	0.60
3.0	0.95
4.0	1.18
5.0	1.45

1. Plot distance versus time from the values given in the table and draw the curve that best fits all points.
2. Describe the resulting curve.
3. According to the graph, what type of relationship exists between the total distance traveled by the lab cart and the time?
4. Write an equation relating distance and time for these data.
5. Find the slope of the graph.

Define the Following Terms

1. Physics
2. Mechanics
3. Kinematics
4. Dynamics
5. Reference Frame
6. Translational Motion
7. Vector
8. Scalar
9. Distance
10. Displacement
11. Speed
12. Velocity
13. Instantaneous Velocity