



GREATER ATLANTA CHRISTIAN SCHOOL

Dual Credit and Honors Physics

Summer Work 2025

Text: Physics Prerequisite Skill Set Packet

Assignment: All students enrolled in Honors/Dual Credit Physics should complete this summer assignment. There will be an exam on the information covered in this work on the day we return from the spiritual retreat.

Rationale: The information covered in the summer assignment covers the prerequisite skill set for success in physics. This information is a combination of material from previous courses that will appear in the first semester of Hon/DC Physics. By entering the class with this information already mastered, students will stand the best chance of success.

Due Date: The completed packet will be due **August 11, 2025**. A test covering the information will be given during the first week of school. Students who add the course on the first day of school will be expected to complete the packet by Monday of the 2nd week of school and take the test by Thursday of that same week.

Physics Prerequisite Skill Set Packet

Name:

Using This Packet:

The goal of this packet is to serve as a refresher to the skills you need to be successful in physics this year. Remember you need to know this information well enough heading into the course to pass an exam over it in the first week of classes. This packet covers material from several different courses that every physics student has already taken. There should not be any information that is totally new. The skills covered are:

- Significant Figures (identification, addition/subtraction, multiplication/division)
- Right Triangles (Pythagorean Theorem, sin, cos, tan)
- S.I. Units and Dimensional Analysis (Metric prefixes)
- Scientific Notation
- Basic Algebraic Manipulation (Solving for variables)

Be sure to show your work where stated. If you have questions or need clarification, please email your teacher, tmeeker@gac.org

Section 1: Significant Figures

Significant figures are a vital source of information in physics (and science at large). The number of digits in a measurement tells us the degree of precision with which a measurement was made. In general the more digits there are, the more precise the measurement.

Significant Figures and Measurement

- If the number was obtained by counting, it has no uncertainty and therefore the number contains an infinite amount of significant digits.
- If the number is obtained through a digital measurement, all digits in the digital readout are significant¹
- If the number is obtained through an analog measurement (meter stick, graduated cylinder, or any other instrument that you read using your eyes) then the number is recorded to the precision of the smallest graduation/tick mark plus one estimated digit. In other words, if a meter stick's smallest tick is a millimeter (0.001 meter) then the reading will be taken to an estimated tenth of a millimeter (0.0001 meter).

Determining Significant Figures

- All nonzero digits are significant
 - 121, 457, 985, 9691, etc...
- Leading Zeros: Zeros that preceded non-zero digits are never significant.
 - 0.00001, 0123, 0.00023, etc...
- Sandwich Zeros: Zeros in between non-zero digits are significant.
 - 101, 5007, 5670009, etc...
- Trailing Zeros: Zeros the after all non-zero digits can be potentially be significant
 - When there is a decimal trailing zeros are significant
 - 1.12300, 156.0, 35.80
 - When there is not a decimal trailing zeros are not significant²
 - 100, 5600, 930, etc...

¹ This includes all trailing zeros even if there is not a decimal.

² There are notations where trailing zeros can be marked with a line or asterisk above them.

Significant Figures and Scientific Notation

- The only portion of a number expressed in scientific notation that is significant is the coefficient. For example in the number 3.11×10^{-7} , only the significant figures in the "3.11" portion of the number count; therefore, 3.11×10^{-7} has 3 significant figures

Significant Figures and Mathematical Operations

- Addition/Subtraction: Add or subtract like normal and then round to the place value of the least precise number.
- Multiplication/Division: Multiply or divide like normal and then round to the number of significant figures equal to the number of significant digits in the measurement with the least significant figures.
- Logarithm/Trigonometric Functions (sin, cos, tan): Execute the function as normal and then round to the number of significant figures equal to the number of significant digits in the measurement with the least significant figures.

Significant Figures Problem Set

- 1.) Mr. Meeker has 13 desks in his classroom. How many significant figures would 13 desks have? Explain your answer in a complete sentence.
- 2.) Mr. Meeker uses an analytical balance to determine the mass of a cube of aluminum metal. The display reads 13.870g. How many significant figures would that measurement have? Explain your answer in a complete sentence.
- 3.) Spartaduke uses a metric ruler to measure the length of a strip of cloth. The ruler has tick marks every millimeter. The measurement falls exactly on the tick mark for 11 cm. How many significant figures are in this measurement? Explain your answer in a complete sentence. (*Be Careful!!!*)

How many significant figures are in the following numbers?

- | | | |
|------------|-------------|-----------------------------|
| 4.) 0.0100 | 8.) 0.9811 | 12.) 4.33×10^{-7} |
| 5.) 863.0 | 9.) 1.047 | 13.) 4.201×10^{14} |
| 6.) 5000 | 10.) 753.00 | 14.) 3,300 |
| 7.) 407 | 11.) 396.2 | 15.) 3.00×10^8 |

Solve the following with the correct number of significant figures.

$$16.) \quad \begin{array}{r} 17.1 \\ + 3.442 \\ \hline \end{array}$$

$$20.) \quad \begin{array}{r} 11.31 \\ \times 2.5 \\ \hline \end{array}$$

$$24.) \quad \sin 34.1^\circ$$

$$17.) \quad \begin{array}{r} 20.771 \\ - 16.312 \\ \hline \end{array}$$

$$21.) \quad 16.442 \div 7.83$$

$$25.) \quad \log_{10} 4.9$$

$$18.) \quad \begin{array}{r} 8.3 \\ + 4.66 \\ \hline \end{array}$$

$$22.) \quad 9.00 \div 9.0$$

$$26.) \quad \cos^{-1} 0.904$$

$$19.) \quad \begin{array}{r} 135 \\ - 51.6 \\ \hline \end{array}$$

$$23.) \quad 3.50 \times 6.11$$

$$27.) \quad \log_{10} 0.004291$$

28.) Coach Meeker collected the following data about a wooden block. Solve for the density of the block using the correct significant figures and units.

length: 3.00 cm
width: 6.05 cm
height: 2.95 cm
mass: 50.115 g

29.) Use the formula for percent error and solve for the percent error of Coach Meeker's work, if the accepted value for the density of wood is 0.886 g/cm^3 . *Hint: Significant figures must be determined after each step.*

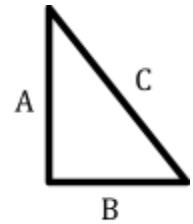
$$\text{percent error} = \frac{\text{literature value} - \text{lab value}}{\text{literature value}} \times 100$$

Section 2: Right Triangles

Algebra-based physics requires a sound understanding of triangles and how triangles can be used to solve for resultant and component vectors.

Pythagorean Theorem:

- In any right triangle the square of the hypotenuse is equal to the sum of the squares of the other two sides. ($A^2 + B^2 = C^2$)



Sine, Cosine, Tangent

- The sine of an angle is equal to the ratio of the side opposite of the angle and the hypotenuse
 - $\sin \theta = \frac{\text{opposite side}}{\text{hypotenuse}}$
 - Inverse Function: $\left(\frac{\text{opposite side}}{\text{hypotenuse}} \right) = \theta$
- The cosine of an angle is equal to the ratio of the side adjacent to the angle and the hypotenuse
 - $\cos \theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$
 - Inverse Function: $\left(\frac{\text{adjacent side}}{\text{hypotenuse}} \right) = \theta$
- The tangent of an angle is equal to the ratio of the side opposite of the angle and side adjacent to the angle.
 - $\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}}$
 - Inverse Function: $\left(\frac{\text{opposite side}}{\text{adjacent side}} \right) = \theta$
- These functions can be remembered as SOH, CAH, TOA

Right Triangles Problem Set

Find the value of the missing side in the following triangles. (NOT DRAWN TO SCALE)

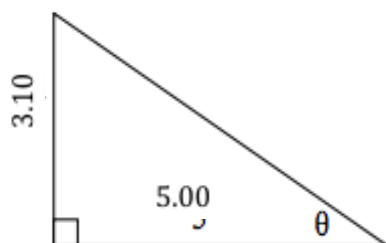
1.) 	3.) 	5.)
2.) 	4.) 	6.)

Find θ in each of the following triangles (NOT DRAWN TO SCALE)

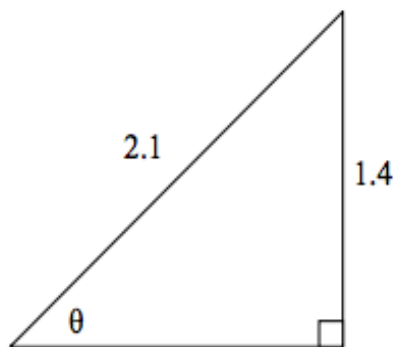
7.)

Ex: $\tan \theta = \frac{3.1}{5}$, so

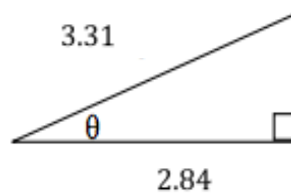
$\theta = \tan^{-1}\left(\frac{3.1}{5}\right)$, thus $\theta = 31.8^\circ$



9.)

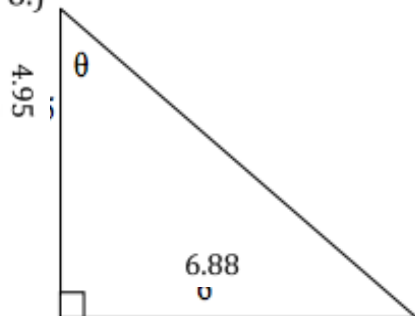


11.)

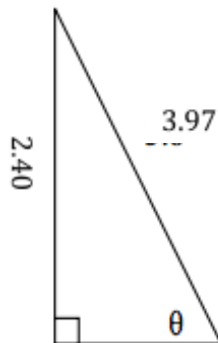


7.)

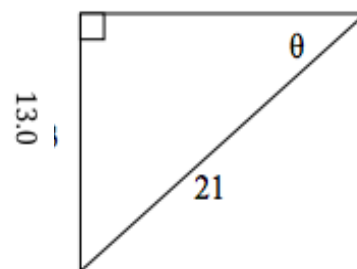
8.)



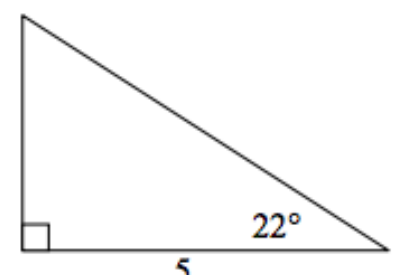
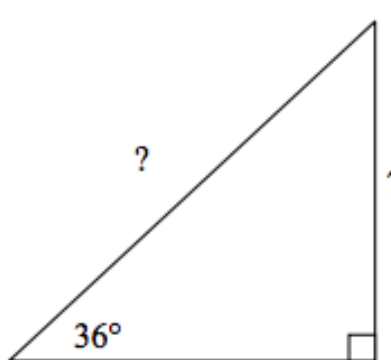
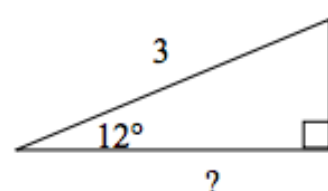
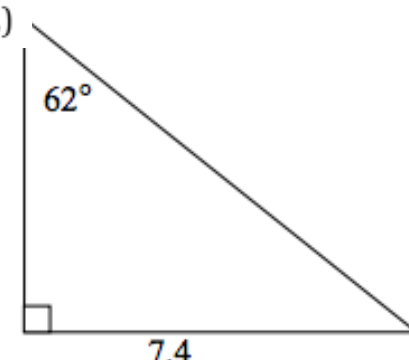
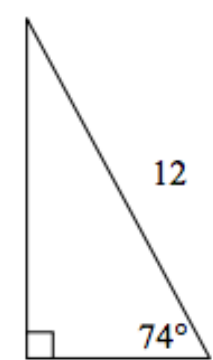
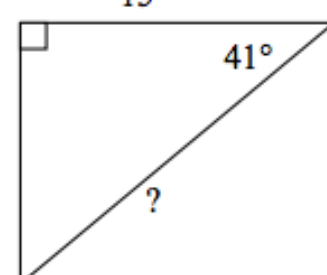
10.)



12.)



Find the value of the missing side using sine, cosine, and tangent.

13.)  A right triangle with a right angle at the bottom-left vertex. The angle at the bottom-right vertex is 22°. The side adjacent to this angle (the bottom side) is labeled 5. The side opposite to this angle (the left side) is labeled ?.	15.)  A right triangle with a right angle at the bottom-right vertex. The angle at the bottom-left vertex is 36°. The side opposite to this angle (the right side) is labeled 7. The hypotenuse is labeled ?.	17.)  A right triangle with a right angle at the bottom-right vertex. The angle at the bottom-left vertex is 12°. The hypotenuse is labeled 3. The side adjacent to this angle (the bottom side) is labeled ?.
14.)  A right triangle with a right angle at the bottom-left vertex. The angle at the top-left vertex is 62°. The side adjacent to this angle (the bottom side) is labeled 7.4. The side opposite to this angle (the left side) is labeled ?.	16.)  A right triangle with a right angle at the bottom-left vertex. The angle at the bottom-right vertex is 74°. The hypotenuse is labeled 12. The side adjacent to this angle (the left side) is labeled ?.	18.)  A right triangle with a right angle at the top-left vertex. The angle at the top-right vertex is 41°. The hypotenuse is labeled 15. The side opposite to this angle (the left side) is labeled ?.

- 19.) A legion of Spartans goes for a walk in the woods. They travel 1.75 km due south and 2.44 km due east. Draw a diagram of their hike. Determine how far they are away from their original position. Find their bearing (angle should be between 270 and 360 since they are in quadrant IV)

Section 3: SI Units and Dimensional Analysis

In scientific discourse, we utilize the metric system in part because it is easy to communicate very large and very small quantities simply by changing the prefix attached to the unit. In order to be successful in Hon/DC Physics, you will need to memorize the SI units and be able to move between metric units with ease. You will be provided a table of metric prefixes

S.I. Units are the official units of scientific communication. There are over 50 SI units; however, you will only be responsible for memorizing the following for now:

SI base units^{[12][13]}

Unit name	Unit symbol	Quantity name	Quantity symbol
metre	m	length	<i>l</i> (a lowercase L), <i>x</i> , <i>r</i>
kilogram ^[note 1]	kg	mass	<i>m</i>
second	s	time	<i>t</i>
ampere	A	electric current	<i>I</i> (an uppercase i)
kelvin	K	thermodynamic temperature	<i>T</i>
candela	cd	luminous intensity	<i>I_v</i> (an uppercase i with lowercase non-italicized v subscript)
mole	mol	amount of substance	<i>n</i>

The ability to move between metric prefixes with ease is essential to your success in physics. You will have a list of prefixes similar to this to use for quizzes and tests, but you need to know how to convert between units .

Standard prefixes for the SI units of measure

Multiples	Name		deca-	hecto-	kilo-	mega-	giga-	tera-	peta-	exa-	zetta-	yotta-
	Symbol		da	h	k	M	G	T	P	E	Z	Y
	Factor	10 ⁰	10 ¹	10 ²	10 ³	10 ⁶	10 ⁹	10 ¹²	10 ¹⁵	10 ¹⁸	10 ²¹	10 ²⁴
Fractions	Name		deci-	centi-	milli-	micro-	nano-	pico-	femto-	atto-	zepto-	yocto-
	Symbol		d	c	m	μ	n	p	f	a	z	y
	Factor	10 ⁰	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁶	10 ⁻⁹	10 ⁻¹²	10 ⁻¹⁵	10 ⁻¹⁸	10 ⁻²¹	10 ⁻²⁴

SI Units and Dimensional Analysis Problem Set

Perform the following conversions (be sure to show your dimensional analysis work)

1.) 14.3 mm = ____ dm	
2.) 8,671 ML = ____ GL	
3.) 4.61 x 10 ⁻⁷ m = ____ nm	
4.) 14.61 kA = ____ μA	
5.) 2.41 x 10 ¹⁵ nmol = ____ kmol	

Section 4: Scientific Notation

Scientific Notation is a way to communicate very large and very small numbers quickly and efficiently. While you will always be allowed to use your calculator on quizzes and tests, it is a good idea to understand the basic concepts of arithmetic when using scientific notation so that you have a general idea of the value of the solution before plugging it into a calculator.

Adding or Subtracting with Scientific Notation

- When adding or subtracting with scientific notation, the exponents (the power of 10) must be equal.
- When attempting to change the exponent, you must move the decimal on the coefficient at the same time.
 - To increase ($10^1 \square 10^2$, $10^{-3} \square 10^{-2}$, etc...) the exponent, move the decimal left.
 - To decrease ($10^2 \square 10^1$, $10^{-2} \square 10^{-3}$, etc...) the exponent, move the decimal right.
 - Example: $3.00 \times 10^3 + 5.55 \times 10^4 = ???$
 $3.00 \times 10^3 = 0.300 \times 10^4$
 $0.300 \times 10^4 + 5.55 \times 10^4 = 5.85 \times 10^4$

Multiplying or Dividing with Scientific Notation

- When multiplying or dividing with scientific notation, the coefficients are multiplied/divided as normal and the exponents are added (if multiplying) or subtracted (if dividing)
 - Example: $3.00 \times 10^8 \div 4.00 \times 10^{-6}$
 - $3.00/4.00 = 0.750$ & $8 - (-6) = 14$
 - $0.750 \times 10^{14} \square 7.50 \times 10^{13}$

Scientific Notation Problem Set

Rewrite the following in proper scientific notation.

1.) 94.61×10^{-4}

2.) 0.00792×10^6

3.) 0.0612×10^{-2}

4.) 1006.4×10^8

Perform the following operations and express the answers in scientific notation.

5.) $(1.20 \times 10^5) + (5.35 \times 10^6)$

6.) $(6.91 \times 10^{-2}) + (2.4 \times 10^{-3})$

$$7.) (9.70 \times 10^6) + (8.34 \times 10^5)$$

$$8.) (3.67 \times 10^2) - (1.61 \times 10^1)$$

$$9.) (8.41 \times 10^{-5}) - (7.94 \times 10^{-6})$$

$$10.) (1.33 \times 10^5) - (4.97 \times 10^4)$$

Perform the following operations and express the answers in scientific notation.

$$11.) (4.3 \times 10^8) \times (2.0 \times 10^6)$$

$$12.) (6.0 \times 10^3) \times (1.5 \times 10^{-2})$$

$$13.) (1.5 \times 10^{-2}) \times (8.0 \times 10^{-1})$$

$$14.) \frac{9.51 \times 10^{-15}}{6.626 \times 10^{-34}}$$

$$15.) \frac{3.76 \times 10^8}{4.11 \times 10^{10}}$$

$$16.) \quad \frac{(9.11 \times 10^3)(6.43 \times 10^5)}{9.91 \times 10^6}$$

$$17.) \quad \frac{(4.31 \times 10^3 + 8.11 \times 10^2)(2.11 \times 10^{-3} - 1.44 \times 10^{-4})}{1.33 \times 10^2}$$

Section 5: Basic Algebraic Manipulation

In physics you will encounter a number of equations that you will need to be able to manipulate in order to find solutions and solve problems. Not much to say here. Good Luck!

Basic Algebraic Manipulation Problem Set

Solve the following formulas for every variable.

1.) $c = \lambda v$

- $\lambda =$

- $v =$

2.) $v_f = v_i + a(t_f - t_i)$

- $v_i =$

- $a =$

- $t_f =$

- $t_i =$

3.) $T = 2\pi\sqrt{\frac{m}{k}}$

- $m =$

- $k =$

4.) $F_e = k\frac{q_1q_2}{r^2}$

- $k =$

- $q_1 =$

- $q_2 =$

- $r =$

5.) $\frac{1}{f} = \frac{1}{D_i} + \frac{1}{D_o}$

- $f =$

- $D_i =$

- $D_o =$

6.) $\beta = \sqrt{1 - \frac{v^2}{c^2}}$

- $v =$

- $c =$

7.) $\tau = (F)(L)\cos\theta$

- $F =$

- $L =$

- $\theta =$