

## Austin High School Incoming 11<sup>th</sup> Grade OnRamps Physics Summer Assignment 2018

**Welcome to OnRamps Physics!** This is a math-based science course that will often require you to draw from your knowledge of Algebra and Geometry. We want you to be successful in this course, and make certain that you have the background skills necessary to do so. We will be hitting the ground running when we see you in the fall ☺.

**Your Summer Assignment:** Please complete the attached assignment over the summer; we strongly encourage you to work individually, so that the work reflected is your own, and is representative of your skills. The assignment is intended to show you the types of math skills we will use in class, as well as to provide you an opportunity to practice these skills. *It will be collected on your first day of class following your Summer Break*, so be prepared.

If you need a new/clean copy of the assignment, you can find it on my website, under the Summer Assignments tab.

<http://msquacksphysics.weebly.com/>

**What If You Can't Remember How to Solve Problems?** We tried to identify the different sorts of math skills by name (e.g., literal equations) so that you could easily find online resources to assist you. We strongly believe that finding useful resources is a necessary step toward your becoming the independent learner that you'll need to be once you leave Austin High. However, if you hit a wall, and find yourself needing direction, I have provided links to some tutorials on my website (address above). Also, please feel free to contact Ms. Quackenbush over the summer with questions. She will try to check her e-mail frequently, unless she's travelling – and she will be travelling a bit this summer.

Ms Quackenbush's e-mail: [pam.quackenbush@austinisd.org](mailto:pam.quackenbush@austinisd.org)

If there are just one or two skills that you recognize need a little work, don't sweat it. Do your best on the summer assignment; the OnRamps teachers will be providing tutorials during FIT at the start of the year to target the following skills:

- Trigonometry (from Geometry)
- Significant Figures (from Chemistry)
- Unit Conversions (from Chemistry)

**What If You Find the Material *Especially* Difficult?** Our Chemistry teachers tried to steer you towards the right level of Physics for you. If you feel that the material in this review is *especially* difficult for you, you may wish to consider switching to grade level physics. We want you to be comfortable and happy in class, and not feel like you are trying to relearn the math skills we use regularly on top of learning the physics content. The class moves pretty fast, and can be challenging on its own. If you have weak math skills, it may feel like trying to drink water from a fire hose, and who wants that? If you have questions or concerns, please contact your counselor over the summer regarding your placement.

**Don't Procrastinate!** Please don't wait until the last minute to start your summer assignment. Got a little spare time on a weekend? Friends out of town? Knock out a couple problems. It will be less stressful if you space the assignment out over the course of the summer.

**Complete Your Assignment on a Separate Sheet of Paper and SHOW YOUR WORK!** Sorry, we don't want that to come across as yelling, but showing your work is kind of a big deal in this class. We will reinforce this throughout the year, but the sooner you get used to showing your work, the happier we'll all be. For the record, we care less about your getting the right answer than your ability to communicate what you did, and why you did it. Your work should be neat and organized, so that we can easily follow your thought process.

We look forward to meeting you in August! Have a great summer!!

Sincerely,

The OnRamps Physics Teachers

# OnRamps Physics Summer Assignment

Work the following on clean sheet of paper. **SHOW ALL YOUR WORK.**

## ALGEBRA PRACTICE

1. **Literal Equations:** For each of the following formulae, rearrange the equation to isolate the variable given:

(a) Isolate a:  $v_f = v_i + a t$

(f) Isolate v:  $F_c = \frac{mv^2}{r}$

(b) Isolate A:  $R = \frac{\rho L}{A}$

(g) Isolate v:  $KE = \frac{1}{2} mv^2$

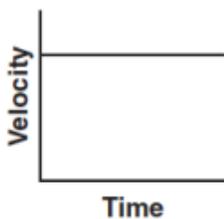
(c) Isolate  $\Delta x$ :  $v_f^2 = v_i^2 + 2 a (\Delta x)$

(h) Isolate k:  $T_s = 2\pi \sqrt{\frac{m}{k}}$

(d) Isolate  $R_{eq}$ :  $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$

(i) Isolate r:  $F = G \frac{m_1 m_2}{r^2}$

2. **Recognizing Functions:** Match the Velocity (v) vs. Time (t) graphs shown below to the equations (1 – 4) that best describe the relationship between these variables:



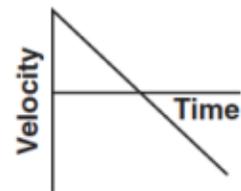
(a)



(b)



(c)



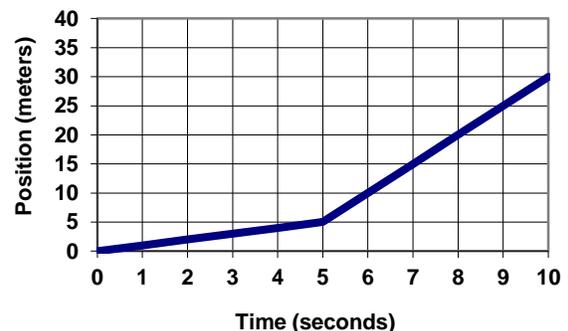
(d)

Equations: (1)  $v = 5 - 4 t$  (2)  $v = 6$  (3)  $v t = 8$  (4)  $v = 2 t^2$

3. **Graphing and Slope :** Use the graph to the right to answer the following questions:

- What is the distance traveled in the first 5 seconds?
- What is the slope of the graph from  $t = 0$  to 5 seconds (don't forget your units)?
- What is the slope of the graph from  $t = 5$  to 10 seconds?
- Write the equation for the position (x) in terms of time (t) for the time interval  $t = 5$  to 10 seconds?

Position vs. Time



4. **Quadratic Equations:** In the following equations, solve for x:

(a)  $2x^2 + 4x + 5 = 3x + 8$

(b)  $5x^2 - 14x + 18 = 0$

5. **Systems of Equations:** Given the systems of equations below, solve for x and y:

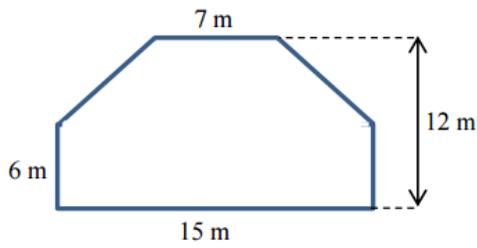
(a)  
 $2x + 3y = 10$   
 $2x - 2y = 0$

(b)  
 $x + y = 15$   
 $3x - 10y = 4$

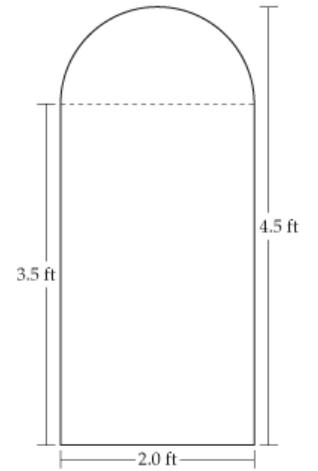
**GEOMETRY PRACTICE**

6. Solve for the unknowns in each of the following:

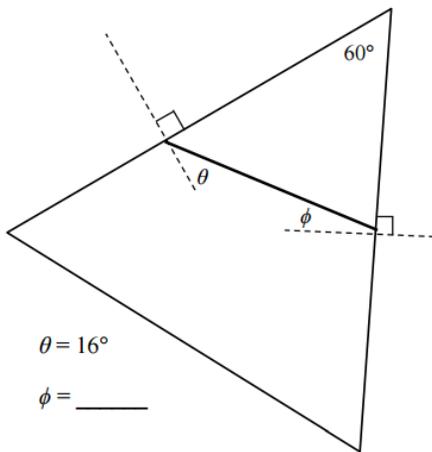
(a) Find the area of this shape:



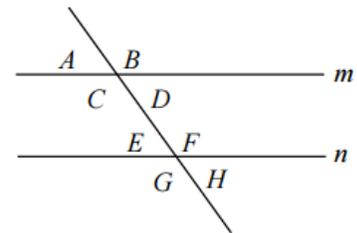
(b) Find the area of this shape:



(c) Solve for the unknown angle,  $\phi$ :

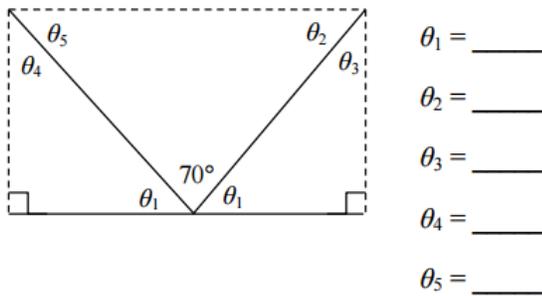


(d) Given  $A = 75^\circ$ , Solve for the unknown angles:

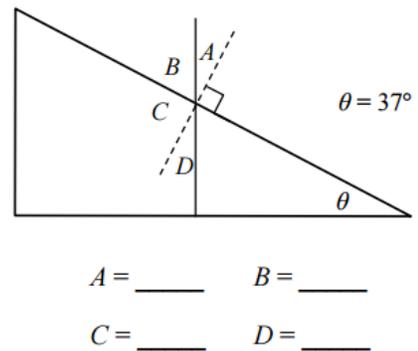


Lines  $m$  and  $n$  are parallel.

(e) Solve for the unknown angles:



(f) Solve for the unknown angles:



**TRIGONOMETRY PRACTICE:** Recall SOH CAH TOA.

7. Complete the following:

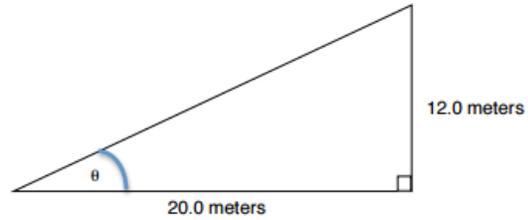
(a)  $\sin \theta =$

(b)  $\cos \theta =$

(c)  $\tan \theta =$

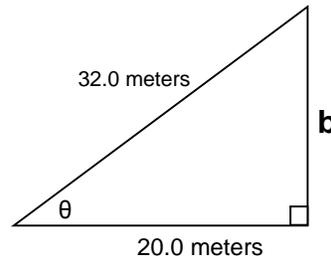
8. Using the triangle to the right, solve for the following:

- (a) What is the length of the hypotenuse?
- (b) What is the tangent of angle  $\theta$ ?
- (c) What is the sine of angle  $\theta$ ?
- (d) What is angle  $\theta$ , in degrees?



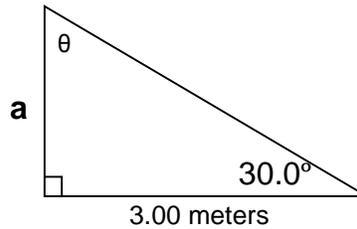
9. Using the following triangle, solve for the following:

- (a) Length of side **b**
- (b)  $\sin \theta$
- (c)  $\theta$

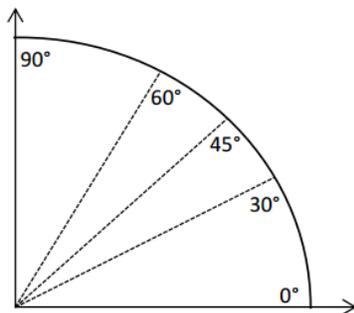


10. Using the triangle to the right, solve for the following:

- (a) Length of side **a**
- (b) Length of hypotenuse
- (c)  $\cos \theta$



11. Common Angles: The following angles are commonly used, and the more familiar you are with them, the better. Complete the table below, and then answer the questions regarding trends for sine and cosine.



$\theta$	$\cos \theta$	$\sin \theta$
$0^\circ$		
$30^\circ$		
$45^\circ$		
$60^\circ$		
$90^\circ$		

- (a) As the angle increases in this first quadrant, what happens to the sine value?
- (b) As the angle increases in this quadrant, what happens to the cosine value?
- (c) For which angle are the sine and cosine values the same?

## **SIGNIFICANT FIGURES:**

12. **What's Significant?** Don't Forget the Rules – look them up if you have to. Answer the following with “always”, “sometimes”, or “never”:

- Non-zero digits are \_\_\_\_\_ significant.
- Zeros between two significant digits are \_\_\_\_\_ significant. (I like to call these “sandwich zeros”)
- Leading zeros, (zeros to the left of the first non-zero digit) are \_\_\_\_\_ significant.
- Trailing zeros, (zeros to the right of the last non-zero digit) are \_\_\_\_\_ significant if they are in a number with a decimal point.

13. Give the correct number of significant figures in the following measurements, AND express each number using scientific notation:

- 7.0890
- 0.00520
- 6200
- 1.20000500
- 100,001

**Addition and Subtraction:** When adding or subtracting significant figures, remember that your calculated value cannot be more precise than the least precise quantity used in the calculation – that least precise quantity has the fewest digits to the right of the decimal point.

**Multiplication and Division:** When multiplying or dividing significant figures, remember that the number of significant figures in your final calculated value will be the same as the quantity with the fewest number of significant figures.

14. Use the rules above to complete the following operations; express your answer using the correct number of *significant figures* – it may be necessary to convert quantities so that they have the same units.

- $0.0025 \text{ cm} + 1.24 \text{ cm} + 0.45 \text{ cm} =$
- $2.367 \text{ mm} \times 1.52 \text{ mm} =$
- $2.67 \times 10^{-3} \text{ kg} - 9.5 \times 10^{-4} \text{ kg} + 47.3 \text{ kg} =$
- $7 \times 10^5 \text{ kg} / 2.4 \times 10^7 \text{ L} =$
- $0.006 \text{ m} + 0.03 \text{ cm} =$

**METRIC SYSTEM:** The international science community uses the

15. What is the factor denoted by the following metric prefixes (note, you must REMEMBER the ones in bold)?

nano- (n)	_____ $10^{-9}$ _____	1 nanometer is <u><math>1 \times 10^{-9}</math></u> meters
<b>micro-</b> ( <b><math>\mu</math></b> )	_____	15 microcoulombs is _____ coulombs
<b>milli-</b> ( <b>m</b> )	_____	2015 milliamperes is _____ amperes
<b>centi-</b> ( <b>c</b> )	_____	5200 $\text{cm}^3$ is _____ $\text{m}^3$
<b>kilo-</b> ( <b>k</b> )	_____	15 kilocalories is _____ calories
<b>mega-</b> ( <b>M</b> )	_____	15 megawatts is _____ watts
giga- (G)	_____	22 gigabytes is _____ bytes

16. List an appropriate SI base unit (with a prefix as needed) for measuring the following:

- The time it takes to play a CD on a stereo
- The mass of a car
- The length of a soccer field
- The mass of a slice of pizza
- Your mass
- The distance you traveled from home to school
- Your height

**SCIENTIFIC NOTATION:** When reporting numbers in proper scientific notation, the base number  $n$  must be  $\geq 1$  and  $< 10$ , multiplied by a power of 10.

17. When numbers reported in scientific notation are multiplied together, you add the exponents and multiply the bases. When numbers are divided, you \_\_\_\_\_ the exponents, and \_\_\_\_\_ the bases. When an exponent is raised to another exponent, you \_\_\_\_\_ the exponents, and \_\_\_\_\_ the base. The base number reports only digits that are significant.

18. Use these rules to simplify the following numbers and report your answers in *proper* scientific notation:

(a)  $(3.2 \times 10^7)(2.0 \times 10^5) =$

(d)  $\frac{5.0 \times 10^{-6}}{1.0 \times 10^{12}} =$

(b)  $(5.0 \times 10^{-5})(7.0 \times 10^8) =$

(e)  $(5.0 \times 10^4)^3 =$

(c)  $\frac{4.0 \times 10^8}{2.0 \times 10^{-4}} =$

(f)  $\frac{2.0 \times 10^2}{(1.0 \times 10^3)^2} =$

19. Report the following numbers in scientific notation:

- (a) 1001
- (b) 53
- (c) 6,926,300,000
- (d) 0.00361
- (e) 0.1358
- (f) -20.

**UNIT CONVERSIONS:** (Sometimes called “dimensional analysis” or “DA” – but there’s more to DA than just unit conversion)

20. Convert the following:

- (a) The density of lead is  $11.34 \text{ g/cm}^3$ . Convert this to  $\text{kg/m}^3$ .
- (b) How many seconds are in a year?
- (c) A light-year is the distance that light travels in a year. If the speed of light is  $3.00 \times 10^8 \text{ m/s}$ , how far is a light year in km?
- (d) An acre-foot is a measurement of volume. It is equal to an acre times one foot. What is this in  $\text{ft}^3$ ? One acre =  $4840 \text{ yds}^2$ .
- (e) Every year, approximately 25,000,000 kg of hair is cut in the U.S. Each kg of hair contains about 0.0002 kg of zinc, and each kg of zinc is worth about 4 dollars. How many dollars worth of zinc is contained in the hair cut in the U.S. annually?