Physics Honors Name _____

Summer Assignment 2022

Congratulations on your decision to take on the challenge of Physics Honors!

Your completion of the summer homework will allow us to start on the physics subject matter immediately when school begins in the Fall. This math review is to brush up on valuable skills—including calculator skills—and perhaps a means to assess whether you are ready for the rigor of Physics Honors. Physics requires an exceptional proficiency in algebra, trigonometry, and geometry. In addition to the science concepts, physics often seems like a course in applied mathematics! This summer assignment includes mathematical problems that are considered routine in physics. This includes knowing several key metric system conversion factors and how to employ them. **Your completed summer assignment must be mailed to Physics Department, c/o Randall K. Cooper High School with a postmark of not later than June 30, 2022.**

If you are the type of student who waits until the night before a test to begin studying, for whatever reason, you will fail Physics Honors. If you are the type of student who looks up answers online rather than solve them yourself, you will fail Physics Honors. **Do not be that kind of student!** Likewise, do not wait until the day before the due date to begin this summer assignment.

The following are criteria for an acceptable submission of the summer assignment:

- Answers are hand-printed legibly by you, the student, in the designated places on the page.
- Use black #2 pencil (blue ink or black ink is okay) except where noted.
- Print your name legibly at the top of the first page.
- Show your work in the space provided or on the back side of the paper. Don't make the teacher guess how you got your answer.
- Mail the original, hand-written work. Do not mail a photocopy.
- Sign and date the signature block at the bottom of the first page, in ink.
- Have a parent sign and date the signature block at the bottom of the first page, in ink.

It might be a good idea to make a photocopy of the pages first, then work out the problems on the photocopy. Then copy your work neatly onto the original for mailing.

This summer assignment is to be **your own work**. It is not group work, nor is it a partner assignment. By signing below, in ink, you agree that the work you submit is your own work, and that you completed it without the assistance—direct or indirect—of any other person, including persons who did this summer assignment in a previous year. You may use printed or online materials as references. Furthermore, you agree that you did not assist any other student in completing his/her summer assignment, nor will you help any future student in completing his/her summer assignment. **Parent, by signing below, you acknowledge this summer assignment is your student's own work.**

Student Signature: _____ Date: _____

Parent Signature: _____ Date: _____

Math Review

1. The following are calculations from ordinary physics problems. At this time, don't worry about the physical significance of what is being calculated. Express the answer in scientific notation when appropriate and simplify the units (Scientific notation is used when it takes less time to write than the ordinary number does. As an example, 300 is easier to write than 3.00 x10^2, but 3.00 x10^8 is easier to write than 300,000,000). Do your best to cancel units where appropriate and attempt to show the simplified units in the final answer. **Give answers in decimal format**; **do not include fractions, irrational numbers (like π), trig functions, nor radicals in your answers.** Get comfortable with your calculator—you'll be using it often! Express angles in degrees—make sure your calculator is in degrees mode. If you need scrap paper, use the back of the page or a piece of notebook paper.

a.	$T_s = 2\pi\sqrt{\dfrac{2.0\times10^{-2}\ \text{kg}}{4.7\times10^{3}\ \text{kg/s}^2}}$	$T_s =$
b.	$K = \dfrac{1}{2}(7.5\times10^{2}\ \text{kg})(1.13\times10^{4}\ \text{m/s})^2$	$K =$
c.	$F = \left(8.99\times10^{9}\dfrac{\text{N}\cdot\text{m}^2}{\text{C}^2}\right)\dfrac{(7.7\times10^{-9}\text{C})(6.6\times10^{-9}\text{C})}{(0.75\ \text{m})^2}$	$F =$
d.	$\dfrac{1}{R_p} = \dfrac{1}{4.7\times10^{2}\ \Omega} + \dfrac{1}{9.1\times10^{2}\ \Omega}$	$R_p =$
e.	$e = \dfrac{1.9\times10^{3}\ \text{J} - 3.3\times10^{2}\ \text{J}}{1.9\times10^{3}\ \text{J}}$	$e =$
f.	$132\sin 25.0^\circ = 150\cos\theta$	$\theta =$
g.	$K_{max} = (7.63\times10^{-34}\text{J/s})(7.77\times10^{14}\text{s}) - 1.17\times10^{-19}\text{J}$	$K_{max} =$
h.	$\gamma = \dfrac{1}{\sqrt{1-\dfrac{2.75\times10^{8}\ \text{m/s}}{3.00\times10^{8}\ \text{m/s}}}}$	$\gamma =$

2. Often, you'll need to solve problems with variables only. Using algebra and trigonometry as necessary, solve each equation below for the variable indicated, in terms of the other variables. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers. Use the back of the page or a piece of notebook paper for scrap paper if you need to. The first one is done for you.

a.	$v^2 = v_o^2 + 2a(x - x_o)$	$a = \frac{v^2 - v_o^2}{2(x - x_o)}$
b.	$U = \frac{1}{2}kx^2$	$x =$
c.	$T_p = 2\pi\sqrt{\frac{L}{g}}$	$g =$
d.	$F_g = G\frac{m_1 m_2}{r^2}, \quad r > 0$	$r =$
e.	$mgh = \frac{1}{2}mv^2, \quad v > 0$	$v =$
f.	$x = x_o + v_o t + \frac{1}{2}at^2$ Hint: Use quadratic formula.	$t =$
g.	$B = \frac{\mu_o}{2\pi}\frac{I}{r}$	$r =$
h.	$x_m = \frac{m\lambda L}{d}$	$d =$
i.	$PV = nRT$	$T =$
j.	$\sin\theta_c = \frac{n_1}{n_2}$	$\theta_c =$
k.	$qV = \frac{1}{2}mv^2$	$v =$
l.	$\frac{1}{f} = \frac{1}{s_o} + \frac{1}{s_i}$	$s_i =$

3. Science uses the ***SI*** system (Système international d'unités). Base units for our Physics Honors class are kilogram, meter, and second. (In Chemistry class you might have used grams and centimeters.) The equations in physics depend on unit agreement. So, you must convert to ***SI*** in most problems to arrive at the correct answer. For example, conversions of the following types will become second nature to you.

kilometers (*km*) to meters (*m*)	nanometers (*nm*) to meters (*m*)
grams (*g*) to kilograms (*kg*)	liters (*L*) to cubic meters (m^3)
centimeters (*cm*) to meters (*m*)	micrometers (μm) to meters (*m*)
millimeters (*mm*) to meters (*m*)	hours (*h*) to seconds (*s*)
revolutions (rev) to degrees (°)	revolutions (rev) to radians

Other conversions will be taught as they become necessary.

What if you don't know the conversion factors? Find them. But don't use Google or any other similar tool to do the conversion for you. Use the back of the paper or a piece of notebook paper to show your work. Express your answers in scientific notation if appropriate.

a. 4008 g = _____ kg

b. 1.2 km = _____ m

c. 823 nm = _____ m

d. 298 K = _____ °C

e. 0.77 m = _____ cm

f. 8.8×10^{-8} m = _____ mm

g. 1.2 atm = _____ Pa

h. 25.0 μm = _____ m

i. 2.65 mm = _____ m

j. 8.23 m = _____ km

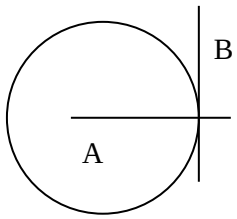
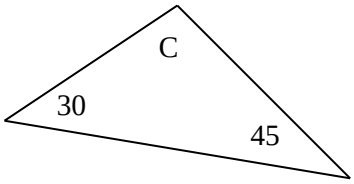
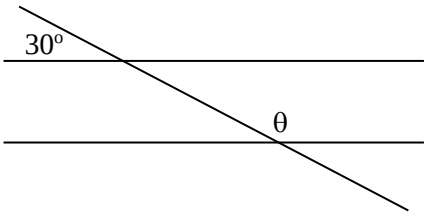
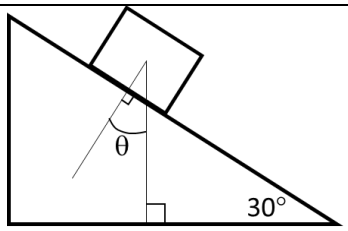
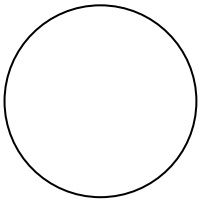
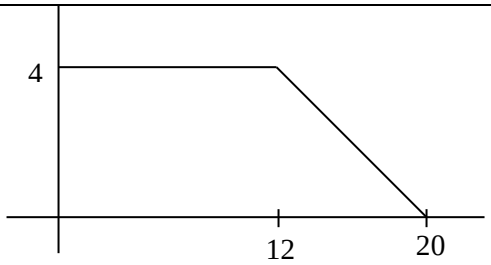
k. 5.4 L = _____ m^3

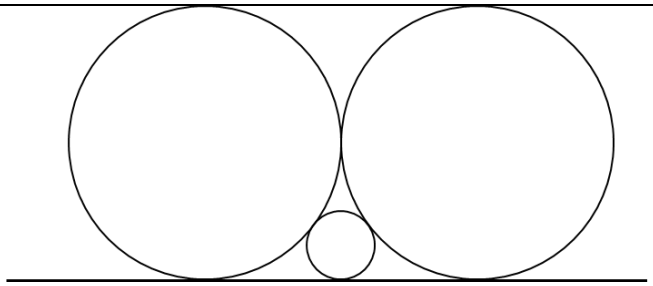
l. 40.0 cm = _____ m

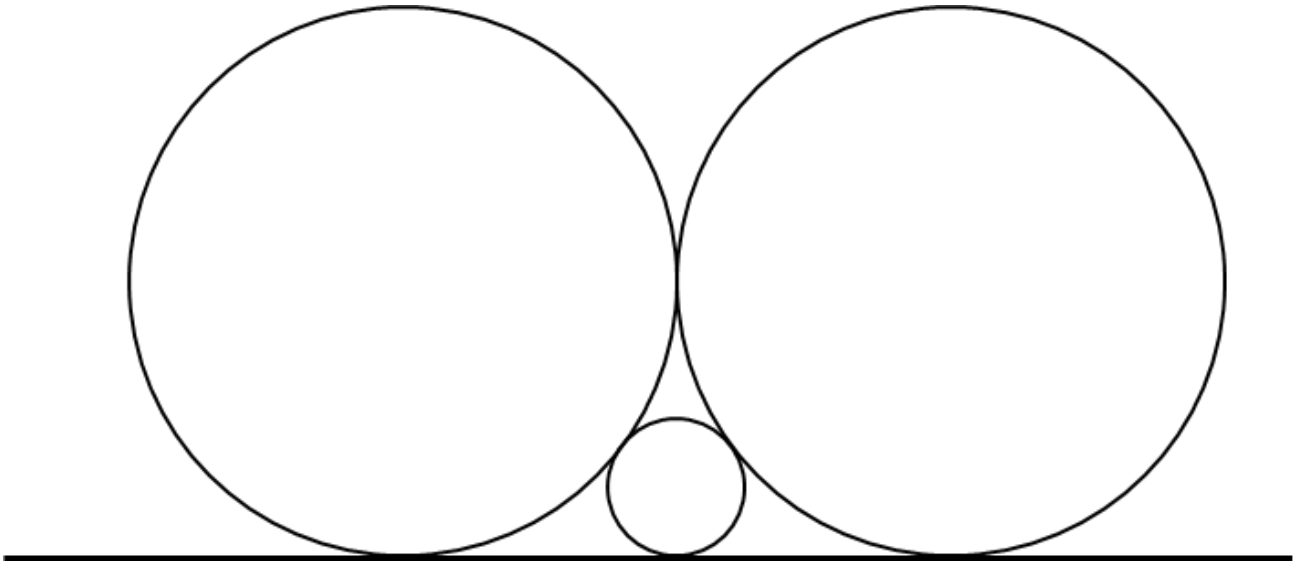
m. 6.23×10^{-7} m = _____ nm

n. 1.5×10^{11} m = _____ km

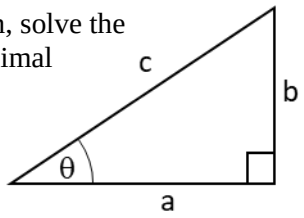
4. Solve the following geometric problems.

a.	Line ***B*** touches the circle at a single point. Line ***A*** extends through the center of the circle and touches the circle at the same point as ***B*** does.	
	i. Complete the sentence: Line B is _____ 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.	What is angle θ?	
e.	The radius of the circle is 7.70 cm; What is the circumference in <u>meters</u>? _____ What is its area in <u>square meters</u>? _____	
f.	What is the enclosed area in the figure at the right?	

g.	Two <u>unit</u> circles are tangent to each other and to a horizontal line. A third, smaller circle is tangent to each of the unit circles and to the same horizontal line as shown. <u>Analytically</u> determine the radius of the third circle. Show your calculations below, along with rationale. (A tough one! A straightedge might come in handy for drawing lines. Don't forget the Pythagorean Theorem.)	



5. Using the generic triangle to the right, trigonometry, and the Pythagorean Theorem, solve the following. ***Your calculator must be in degree mode.*** Express your answer as a decimal value, including units. Don't be too concerned about significant figures.



i. $\theta = 45^o$ and c = 32 m a = _____ b = _____

ii. $\theta = 37^o$ and a = 15 m/s b = _____ c = _____

iii. b = 17.8 m and $\theta = 53^o$ a = _____ c = _____

iv. a = 250 m and b = 180 m θ = _____ c = _____

v. a = 25 cm and c = 32 cm b = _____ θ = _____

vi. b = 65 cm and c = 104 cm a = _____ θ = _____