Lamm
AP Physics

Name:_____

AP Physics Summer Work

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Textbook: Cutnell, John, Kenneth Johnson, David Young, Shane Stadler. *Physics Advanced Edition*. 10th edition. Hoboken, NJ: John Wiley and Sons, 2014.

Your summer assignment is a math review. It covers math skills that you should be mostly comfortable with in order to succeed in AP Physics. Feel free to get help from anyone, including me, or use the internet to remember how to do anything on the handout.

Please do not hesitate to email me with questions. I don't check email

Math review

Make sure to read all directions throughout the packet.

- All work must be completed **on this handout** in the area provided.
- **No calculators**. Final answers can be in fractions and in terms of mathematical constants (π, e, i, etc.).
- Your work must be **legible and linear**, and I must be able to follow it easily. Please no incoherent jumping around the page. If you make a mistake and run out of room, do it over on a separate piece of paper, and then glue or tape it into the space provided. Do not make me hunt for your work or you may not earn credit.
- Mark your final answers by either **circling or boxing** them.
- Your completed summer work is **due the first day of class**. A 10% bonus on the assignment will be given to students who turn in their assignment to the main office of the school by **Monday, August 24.**
- This assignment is meant to ensure you have the skills to succeed, so please don't cheat yourself by copying someone else's work.
- There will be a **quiz** on this material the **first full week of school**. No calculators will be allowed.

Some useful websites in case you get stuck:

http://www.physicsphenomena.com/PhysicsMathReview.htm
https://sites.google.com/site/fregaphysics/physics/math-review
http://www.aplusphysics.com/courses/ap-1/AP1_Physics.html
https://www.khanacademy.org/math
http://www.math.com/

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Significant Figures and Scientific Notation Review

1.) How many significant figures do the following numbers have?

a.) 6.001 Answer:_____

b.) 0.0080 Answer: _____

c.) 206,000 Answer: _____

d.) 27.00 Answer: _____

e.) π Answer: _____

Directions: Find the following. Final answers should be in scientific notation with the correct number of significant figures.

2.) $(5.0 \times 10^{-8})(3.0 \times 10^{2})$

3.) $\left(16 \times 10^{4} + 7 \times 10^{3}\right)$

4.) $6.000 \times 10^{-11} \dfrac{1.00 \times 10^{26}}{2.00 \times 10^{7}}$

5.) $\dfrac{8400}{1.2 \times 10^{7}}$

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Unit Conversions Review

6.) Finish the SI prefix table below. Follow the example of the centi− prefix. You will need to memorize these…especially the k, c and m

Symbol	Name	Numerical Equivalent
n		
μ		
m		
c	centi	10^{-2}
k		
M		
G		

7.) 16.7 kilograms is how many grams?

8.) 560 nm is how many meters?

You may use a calculator for #9–11

9.) 15 days is how many seconds?

10.) 5.75×10^{5} grams is how many pounds (1 kg = 2.2 pounds)? *You may use a calculator for this*

11.) 2.998×10^{8} m/s is how many kilometers per hour? *You may use a calculator for this*

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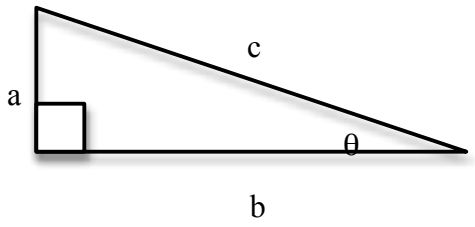
Trigonometry Review

Directions: Use the figure below to answer problems 15−25. Simplify as much as you can.

12.) Find *c* if given *a* and *b*.



13.) If $a = 2.0$ and $c = 7.0$, what is b?

14.) Find *a* if given *c* and θ.

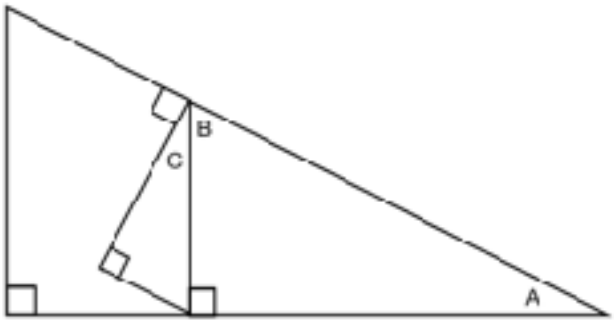
15.) If $a = 12.0$ and $\theta = 30°$, what is b?

16.) Find *c* if $b = 10.0$ and $\theta = 60°$

17.) Find θ if given *b* and *c*.

18.) Find θ if given *a* and *b*.

19.) In the image below, $\angle A \cong \angle C$. Explain why this must always be true, not matter what the angles are. Use what you know about the angles in a triangle and complementary angles.



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20.) For what angles (in degrees) does $\sin\theta \approx \theta$? Explain.

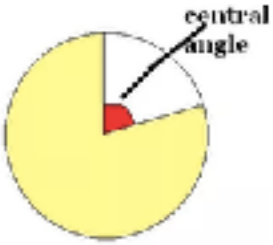
21.) Complete the table below without using a calculator. Leave answers in terms of π.

θ	0°	30°	45°	60°	90°
sin θ					
cos					
tan					

22.) 360 degrees =_____radians.

23.) 4.5 revolutions =_____radians.

24.) Find the length of an arc with a radius of 6.0 m and a central angle of 2π radians.



25.) Find the length of an arc with a radius of 10.0 m and a central angle of 1 radian.

Algebra Review

Quadratic equations: Solve using the simplest means possible. Do not use a calculator; leave your answers as fractions and radicals, if necessary, but simplify as much as possible.

26.) $x^2 + 4x = 45$

27.) $0 = 8 + (1/2)(-10)t^2$

28.) $20 = 50 + 10.0t + (-5)t^2$

Algebra Review

Directions: Solve the following equations for the given variable and conditions. Simplify if needed.

Example: $2x + xy = z$. Solve for *x*.

$$x(2 + y) = z$$

$$\boxed{x = \frac{z}{2 + y}}$$

29.) $v_1 + v_2 = 0$. Solve for v_1.

30.) $a = \frac{v}{t}$. Solve for *t*.

31.) $v_f^{\,2} = v_i^{\,2} + 2ad$

A.) Solve for v_i.

B.) Solve for *d*.

32.) $d_f = d_i + v_o t + \frac{1}{2} a t^2$

A.) Solve for v_o.

B.) Solve for *t*, if $v_o = 0$.

C.) Solve for *t*, if $d_i = d_f$.

33.) $F = m\dfrac{v_f - v_i}{t_f - t_i}$

A.) Solve for v_f, if $t_i = 0$.

B.) Solve for t_f, if $v_f = 0$ and $t_i = 0$.

34.) $a_c = \dfrac{v^2}{r}$. Solve for v.

35.) $mg\sin\theta = \mu mg\cos\theta$. Solve for θ.

36.) $\dfrac{1}{2}mv_f^{\,2} + mgh_f = \dfrac{1}{2}mv_i^{\,2} + mgh_i$

A.) Solve for h_f, if $h_i = 0$ and $v_f = 0$.

B.) Solve for v_f, if $h_f = 0$.

37.) $Ft = mv_f - mv_i$. Solve for v_f.

38.) $m_1v_{i,1} + m_2v_{i,2} = (m_1 + m_2)v_f$. Solve for $v_{i,2}$.

39.) $m_1v_{i,1} + m_2v_{i,2} = m_1v_{f,1} + m_2v_{f,2}$. Solve for $v_{f,2}$ if $v_{i,1} = 0$.

40.) $(F_1 \sin\theta) r_1 + (-F_2 \sin\phi) r_2 = 0$. Solve for r_2.

41.) $-kx + m(-g) = 0$. Solve for m.

42.) $F_g = G\frac{m_1 m_2}{r^2}$. Solve for r.

43.) $L - L\cos\theta = \frac{v^2}{2}$ Solve for L.

44.) $\frac{mv^2}{R} = G\frac{Mm}{R^2}$. Solve for v.

45.) $T = 2\pi\sqrt{\frac{L}{g}}$. Solve for g.

46.) $\frac{1}{2}mv_f^2 + \frac{1}{2}kx^2 = \frac{1}{2}mv_i^2 + mgh_i$. Solve for x if $v_f = 0$.

47.) $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$. Solve for R_T.

Miscellaneous

Directions: Simplify without using a calculator. Remember to show all of your work.

48.) $\frac{1}{4} + \frac{1}{6}$

49.) $\frac{1}{3} + \frac{1}{18}$

50.) Consider $z = \frac{x}{y}$, $c = ab$, $l = m - n$, or $r = \frac{s^2}{t^2}$.

a.) As x increases and y stays constant, z _____.

b.) As y increases and x stays constant, z _____.

c.) As x increases and z stays constant, y _____.

d.) As a increases and c stays constant, b _____.

e.) As c increases and b stays constant, a _____.

f.) As b increases and a stays constant, c _____.

g.) As n increases and m stays constant, l _____.

h.) As l increases and n stays constant, m _____.

i.) If s is tripled and t stays constant, r is multiplied by _____.

j.) If t is doubled and s stays constant, r is multiplied by _____.

Systems of equations

Conceptual Question:

51.) How many equations are needed to solve…

a.) for 1 unknown variable? _____

b.) for 2 unknown variables? _____

c.) for 3 unknown variables? _____

Use the equations in each problem to solve for the specified variable in the given terms. Simplify.

52.) $F_f = \mu F_N$ and $F_N = mg\cos\theta$. Solve for μ in terms of F_f, m, g, and θ.

53.) $F_1 + F_2 = F_T$ and $F_1 \cdot d_1 = F_2 \cdot d_2$. Solve for F_1 in terms of F_T, d_1, and d_2.

54.) $F_c = ma_c$ and $a_c = \frac{v^2}{r}$. Solve for r in terms of F_c, m, and v.

55.) $T = 2\pi\sqrt{\frac{L}{g}}$ and $T = \frac{1}{f}$. Solve for L in terms of π, g, and f.

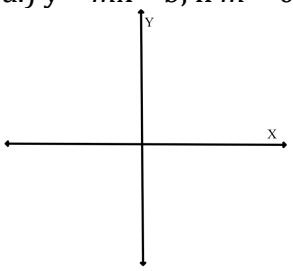
Graphing Equations

56.) If $r = c - x*t$ was graphed on an r vs. t graph, what would the following be?

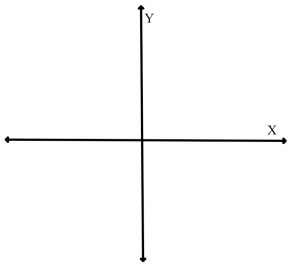
Slope: _____ y-intercept: _____

57.) On the y vs. x graphs below, sketch the relationships given.

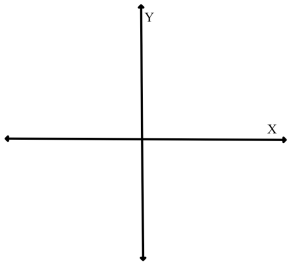
a.) y = mx + b, if $m > 0$ and $b = 0$.



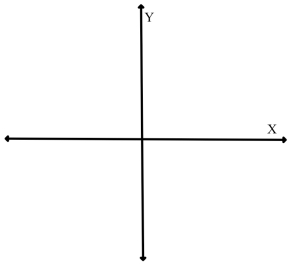
b.) y = mx + b, if $m < 0$ and $b > 0$.



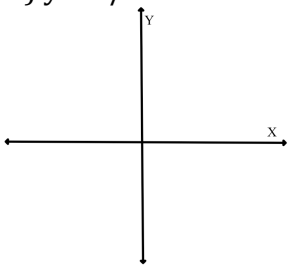
c.) $y = x^2$



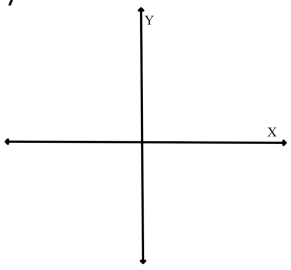
d.) $y = \sqrt{x}$



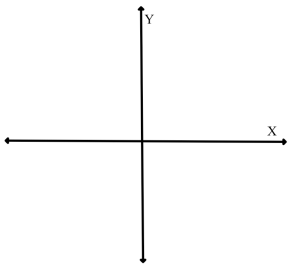
e.) $y = 1/x$



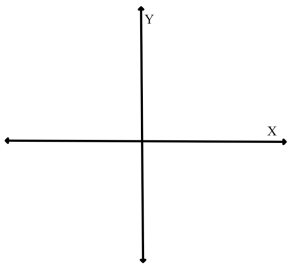
f.) $y = 1/x^2$



g.) $y = \sqrt{\frac{1}{x}}$



h.) y = sin(x)



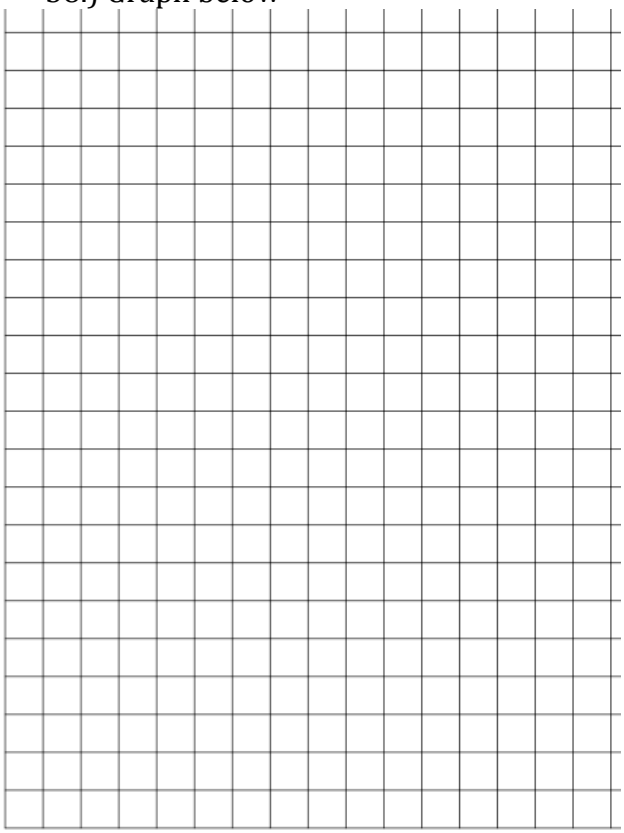
Marbles in Cylinder Lab

You received a graduated cylinder with three identical marbles and an unknown amount of water already in it. You placed extra identical marbles in the cylinder and obtained the data below. Use the data to graph a best-fit line showing the relationship between the water level and the number of marbles. The y-intercept should be visible on the graph. Label your axes and include units.

From the graph, determine a mathematical formula for the water level for any number of marbles. Lastly, give an explanation of your formula in words. Make sure to give an explanation of the slope and y-intercept of your formula.

Number of Marbles in Water	Water level (mL)
3	58
4	61
5	63
6	65
7	68

58.) Graph below



59.) Formula: _____

60.) Explanation of the formula in words: (Include the meaning of the slope and y-intercept.)