

AP Physics C Summer Packet

Your completed work will be due by the end of the first week of school and you will take clear pictures of your work and post to Google Classroom once it is set up in September.

The exercises below are a review of the prerequisite math skills that you need to succeed in AP Physics C. Be sure to read all directions throughout the packet as there are different requirements for each section. All work should be completed in the area below or if additional space is needed please attach clearly labeled additional work at the end of the packet. Unless otherwise specified in the directions, all final answers can be in fraction form or decimal form, and may also be in terms of mathematical constants (like π , e , and so on).

Your work must be legible and easy to follow, and please circle or box all answers to each question unless there is an answer blank provided. Do not copy work from another student for your own integrity and for your own benefit. If you have trouble with something, please look it up. You may use textbooks or the internet as references, but all work must be your own. You may also reach out to me if you have any questions or need any help. My email is merrillk@cinnaminson.com. Please do not wait till school starts in September to work on this, give yourself enough time to complete and be able to submit your work by the end of the first week. I hope you enjoy your summer and come ready for a challenging, yet rewarding year of Physics!

Significant Figures and Scientific Notation Review

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

a.) 6.001 Answer: _____

d.) 27.00 Answer: _____

b.) 0.0080 Answer: _____

e.) π Answer: _____

c.) 206,000 Answer: _____

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

2.) $(5.0 \times 10^{-8})(2.9 \times 10^2)$

3.) $(3.25 \times 10^4 + 7.4 \times 10^3)$

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

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

Unit Conversions Review

6.) Finish the SI prefix table below. Follow the example of the centi- prefix. You will need to know these.

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?

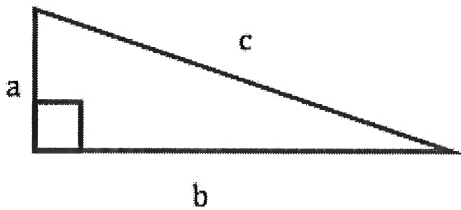
9.) 15 years is how many seconds?

10.) 8.99×10^9 seconds is how many years?

11.) 2.998×10^8 m/s is how many kilometers per hour?

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.) Find a if given b and c .

14.) Find a if given c and θ .

15.) Find b if given a and θ .

16.) Find c if given b and θ .

17.) Find θ if given b and c .

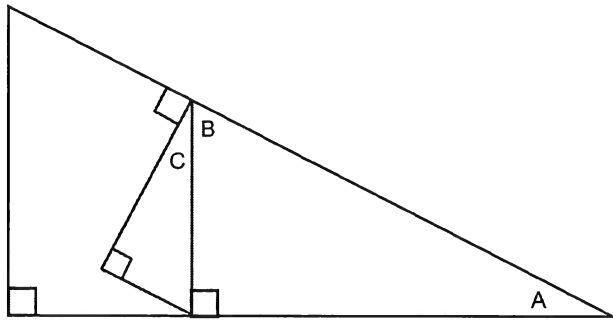
18.) Find θ if given a and b .

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

20.) If $c = 10.0$ and $\theta = 60^\circ$, what is b ?

21.) If $a = 12.0$ and $\theta = 30^\circ$, what is b ?

22.) Using the properties of triangles, prove that $\angle A \cong \angle C$ in the drawing below.



Answer:

23.) For what angles (in degrees) does $\sin \theta \approx \theta$? Describe why mathematically.

24.) Complete the table below without using a calculator.

θ	0°	30°	45°	60°	90°
$\sin \theta$					
$\cos \theta$					
$\tan \theta$					

25.) 360 degrees = _____ radians.

26.) 4.5 revolutions = _____ radians.

27.) Find the length of an arc with a radius of 6.0 m swept across 2.5 radians.

28.) Find the length of an arc with a radius of 10.0 m swept across 100 degrees.

Algebra Review

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

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

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

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

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

30.) $a = v/t$. Solve for t .

31.) $v_f^2 = v_i^2 + 2ad$

A.) Solve for v_i .

B.) Solve for d .

32.) $d_f = d_i + v_0t + \frac{1}{2}at^2$

A.) Solve for v_0 .

B.) Solve for t , if $v_0 = 0$.

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

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

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

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

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

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

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

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.) $m_1v_{i1} + m_2v_{i2} = (m_1 + m_2)v_f$. Solve for v_{i2} .

39.) $m_1v_{i1} + m_2v_{i2} = m_1v_{f1} + m_2v_{f2}$. Solve for v_{f2} if $v_{i1} = 0$.

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.) $F_g = G\frac{m_1m_2}{r^2}$. Solve for r .

43.) $L - L\cos\theta = v^2/2$. 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.) $\frac{1}{2}mv_f^2 + \frac{1}{2}kx^2 = \frac{1}{2}mv_i^2 + mgh$. 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:

1. $z = x/y$
2. $c = ab$
3. $l = m - n$
4. $r = s^2/t^2$

- 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 $a_c = v^2/r$. 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 .

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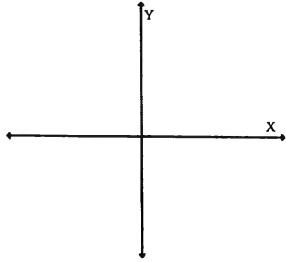
Graphing Equations

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

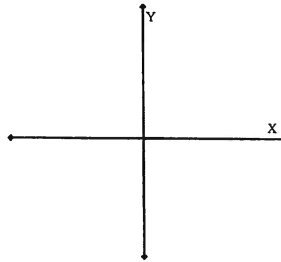
Slope: _____ y-intercept: _____

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

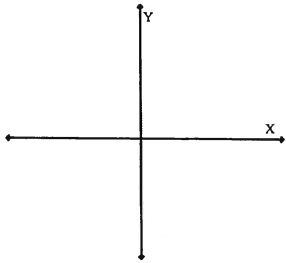
a.) $y = mx + b$, if $m > 0$ and $b = 0$.



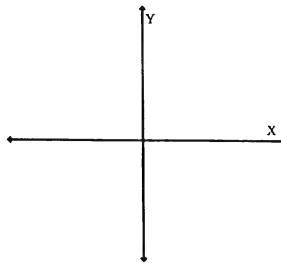
b.) $y = mx + b$, if $m < 0$ and $b > 0$.



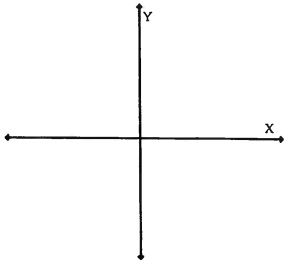
c.) $y = x^2$



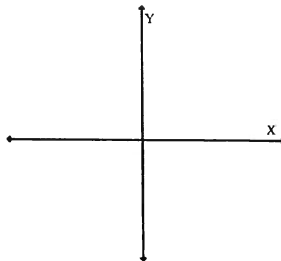
d.) $y = \sqrt{x}$



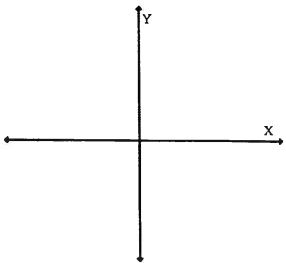
e.) $y = 1/x$



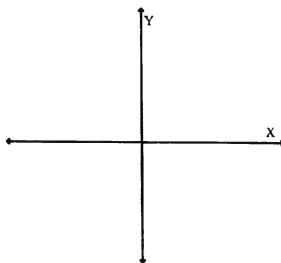
f.) $y = 1/x^2$



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



h.) $y = \sin(x)$



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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.

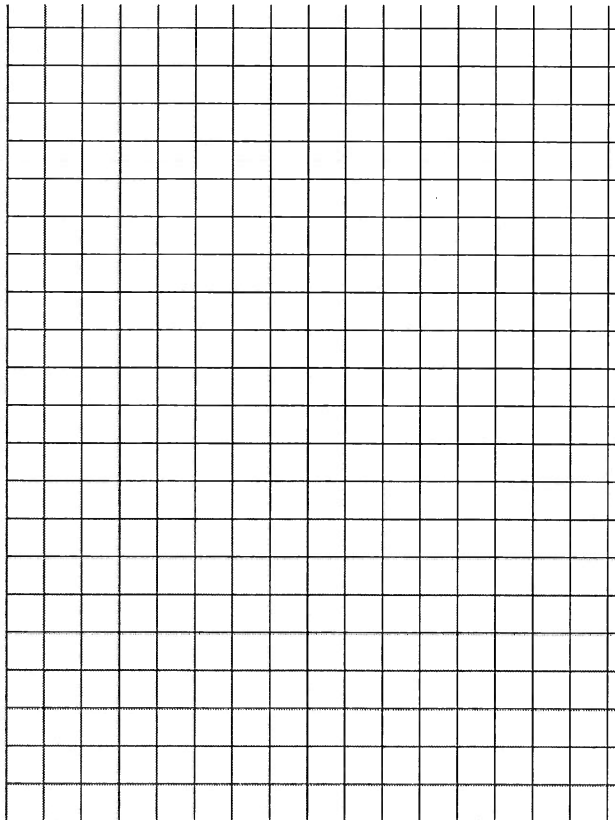
From the graph, determine a mathematical formula for the water level for any number of marbles. Lastly, give an explanation of your formula in words. Make sure to give an explanation of the slope and y-intercept of your formula.

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.)



Last Problem: Consider a soap bar dropped into a bathtub. Assume that the soap bar is less dense than water. Draw the Free Body Diagrams at the following times a) Soap is held above the tub by a person b) soap is released but not in the water c) Soap is touching the water but not inside yet d) Half the soap is in the water e) Soap is fully in the water moving further into the water f) soap stops moving but is still completely in the water g) Soap is headed back to the top of the water but still fully submerged h) soap is oating on top of the water and completely stopped.