# AP Physics 1 – Summer Assignment

Welcome to AP Physics 1. This course and the AP exam will be challenging. AP classes are taught as college courses—not just college-*level* courses, but actual college courses. This means that if you're having trouble with something, *you* need to be proactive about learning it, either by coming in for help after school or consulting with your classmates. For this summer assignment, if you need help in any particular area, please view the review video tutorials on my website. Remember—*your* job is to succeed; *my* job is to do everything in my power to *help* you be successful. I will work very hard to prepare lessons and activities to help you be successful and I expect you to work hard too.

***The summer assignment is a review of the math necessary for the AP Physics 1 course through the problems found in this file and an overview of physics through a book reading.*** These topics were part of your experiences in the prerequisite math and science courses. We will use these skills constantly throughout our AP Physics 1 course. You should answer all of the questions and bring them to the **first class** of the school year. You should also take a look at the book mentioned below and try to finish it by the start of the school year.

While completing the assignment, determine how well you can demonstrate these skills; you may want to brush up on them prior to returning to school.

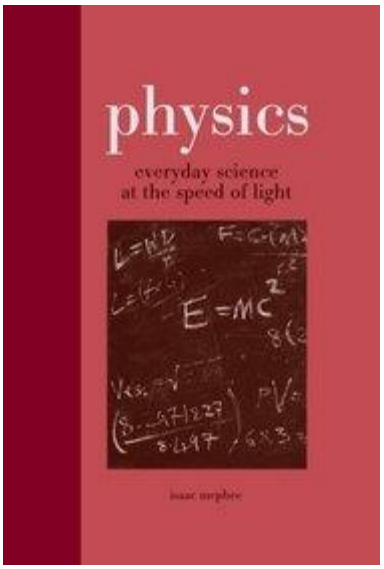
## Recommended Supplies

I recommend the following supplies for AP Physics 1:

- **Scientific calculator**. It does not need to be a graphing calculator, though you are welcome to use a graphing calculator if you already have one.
- **3-ring binder**
- **Looseleaf paper**
- **Pens and pencils**

**Book Reading**

## Physics: Everyday Science At the Speed of Light by Isaac McPhee




*This is a concise and well presented history of physics that also has some very interesting and unusual problems. I think this book will give you a good impression of what physics is about and the curious journey we had in trying to understand the physical world around us. This book introduces the historical figures and ideas that were of particular importance for the development of physics and gives some narrative to the story of how physics changed along with our understanding of the world. More than anything, I think this book provides some great descriptions and explanations of key concepts in physics that should be accessible to anyone.*

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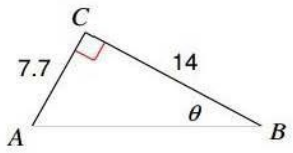
**Math Review**

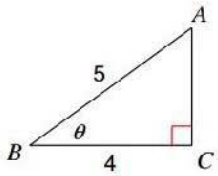
**Part I: Right Triangles**

Directions: Find the measure of the angle or side indicated. Please show all of your work.

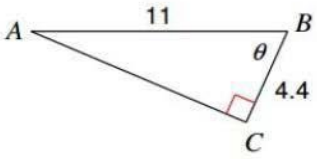
1) Find $\theta$



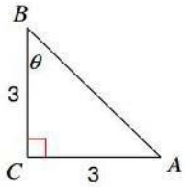

2) Find $\theta$



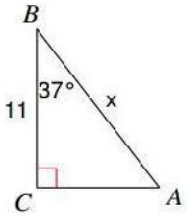

3) Find $\theta$



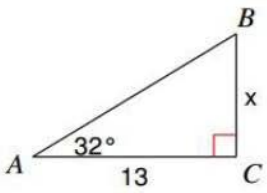

4) Find $\theta$




5) Find $x$




6) Find $x$



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**Part II: Factor-Label Method for Converting Units (Dimensional Analysis)**
A very useful method of converting one unit to an equivalent unit is called the factor-label method of unit conversion. You may be given the speed of an object as 25 **km/h** and wish to express it in **m/s**. To make this conversion, you must change **km** to **m** and **h** to **s** by multiplying by a series of factors so that the units you do not want will cancel out and the units you want will remain. Conversion factors: 1000 **m** = 1 **km** and 3600 **seconds** = 1 **hour**

**Do the following conversions using the factor-label method. Include units in each step and box in your answer. Show all of your work!**

7. How many meters are in 100 feet? (1 ft = 0.3048 m)

8. How many square feet are in 100 $m^2$ ?

9. How many kilograms are in 2000 grams?

10. If there are 745 Watts for every horsepower how many horses would it take to power a single hundred-watt light bulb?

11. If a woodchuck can chuck 2 cubic meters of wood per minute, how many cubic centimeters per second is that equivalent to?

12. I want to know how far I just traveled on my super sweet 21-speed bike. I know the speed I went (2.5 m/s) and I know that my bike ride was 45 minutes long.

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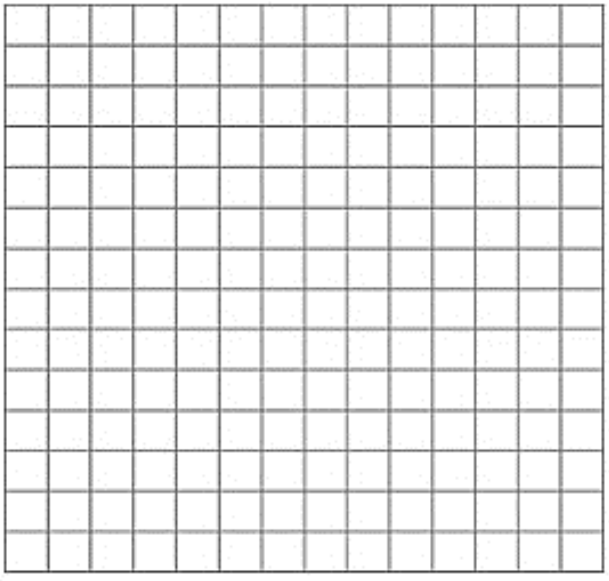
**Part III: Graphing**

You have been asked by your teacher to measure the diameter, radius and circumference of some round objects, such as tin cans, lids, CD's, coins, etc. You have collected the measurements and recorded them in the table below:

| Radius (cm) | Circumference (cm) |
|---|---|
| 1.1 | 3.5 |
| 3.2 | 10.0 |
| 4.8 | 15.1 |
| 8.8 | 27.5 |
| 9.6 | 29.9 |
| 12 | 37.6 |

13. You are to graph the data in the graph below. The radius is the independent variable here and the circumference is the dependent variable. What does this mean for how you graph the data?

14. Label the axis and with the name of the quantity, appropriate scaling of numbers and units. Then plot the points and draw the best straight line through as many points as possible, known as best-fit-curve (DO NOT JUST CONNECT THE DOTS!)



15. Find the slope of the graph. Does it have a name or a physical meaning?

16. Is the slope constant? How do you know this?

17. Does your graph have a y-intercept, if it does, what is it and does it have any significance?

18. Using the fact that the equation for a straight line is $y = mx + b$ write the specific equation for this graph using the appropriate symbols for radius and circumference in place of the and symbols.

**Part IV: Scientific Notation:**

Examples: $200{,}000 = 2 \times 10^{5}$ $0.00000123 = 1.23 \times 10^{-6}$

Express the following numbers in scientific notation:

13. 86,400 s =

14. 0.000564 m =

15. 300,000,000 m/s =

16. 0.0000000000667 =

Convert from scientific notation to normal notation:

17. $9 \times 10^{9}$ =

18. $1 \times 10^{-3}$ m =

19. $1.93 \times 10^{4}$ kg/m$^{3}$ =

20. $4.5 \times 10^{-7}$ m =

**Multiplying Numbers in Scientific Notation**

21. In your own words, explain how you multiply numbers in scientific notation.

22. $(2.5 \times 10^{8}) \times (1.2 \times 10^{1})$

23. $(1.8 \times 10^{3}) \times (7.3 \times 10^{-8})$

24. $(6.0 \times 10^{-2}) \times (6.1 \times 10^{-2})$

25. $(5.5 \times 10^{9}) \times (4.0 \times 10^{11})$

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**Adding Numbers in Scientific Notation**

26. In your own words, explain how you add numbers in scientific notation.

27. $(2.5 \times 10^{8}) + (1.2 \times 10^{8})$

28. $(1.8 \times 10^{3}) + (7.3 \times 10^{2})$

29. $(6.0 \times 10^{-2}) + (6.1 \times 10^{-2})$

30. $(5.5 \times 10^{9}) + (4.0 \times 10^{11})$

31. Why do scientists use scientific notation?

32. Which of the following is written in proper scientific notation?

(A) $0.25 \times 10^{3}$ (B) $2.5 \times 10^{2}$ (C) $25 \times 10^{1}$ (D) 250

**PART V: Algebraic Relationships**

Consider the following: $z = x/y$ $c = ab$ $l = m\sqrt{n}$ $r = s^2/t^2$

33. As *x* increases and *y* stays constant, *z* _____.
34. As *y* increases and *x* stays constant, *z* _____.
35. As *x* increases and *z* stays constant, *y* _____.
36. As *a* increases and *c* stays constant, *b* _____.
37. As *c* increases and *b* stays constant, *a* _____.
38. As *b* increases and *a* stays constant, *c* _____.
39. As *n* increases and *m* stays constant, *l* _____.
40. As *l* increases and *n* stays constant, *m* _____.
41. If *s* is tripled and *t* stays constant, *r* is multiplied by _____.
42. If *t* is doubled and *s* stays constant, *r* is multiplied by _____.

**PART VI: SOLVING EQUATIONS**

Often problems on the AP exam are done with variables only. Below are various physics formulas. Don't worry about what the variables mean for now; we will learn that later. Just solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers. Remember, there is a video tutorial on the website if you need some help.

Directions: Use algebra to solve for the indicated variable. Please show all work.

43. $\Delta V = IR$, solve for I

44. $v_f = v_o + at$, solve for a

45. $mgh = \frac{1}{2} mv^2$, solve for v

46. $\Delta x = v_o t$, solve for t

47. $v_f^2 = v_o^2 + 2a(x_f - x_0)$, solve for a

**48.** $T = 2\pi\sqrt{\frac{l}{g}}$ **solve for g**

49. $U_s = \frac{1}{2} kx^2$, solve for x

**PART VII: Significant Figures**

For each number given below, identify how many significant digits are in the number.

50. 0.56 _____

51. 5,984 _____

52. 5.9873 _____

53. 100,000 _____

54. 0.098 _____

55. 5 _____

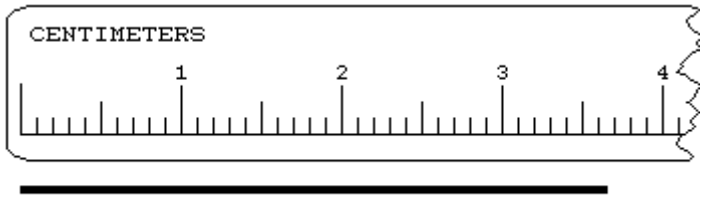
56. 5.0 _____

57. 5.08 _____

58. 1870 _____

59. 1.400 _____

60. Measure the line with the ruler shown below




a) Your Measurement:_____

b) How many significant digits are there? _____

c) How do you know how many significant digits are necessary here?

61. In math operations involving significant figures, the answer is reported in such a way that it reflects the reliability of the least precise operation. In your own words, what are the "rules" for:

a) multiplication & division of significant figures:

b) addition & subtraction of significant figures:

Directions: Solve each problem. Show all steps of your process and circle your answer. Be sure your answer has the correct amount of significant figures.

62. 1.3 m x 71.5 m =

63. 4.2 ft + 8.15 ft =

64. 38.520 L – 11.4 L =

**65. Test Yourself….**An engineering student is trying to calculate the permeation rate of water across a polymer membrane of a fuel cell. The student's measurements are provided in the table below. Determine how many significant figures each measurement has.

| Student's Data | Student's Measurements | # of Significant Figures |
|---|---|---|
| the mass of water that crossed the membrane | 3.7520 g | |
| the area of the membrane used | 1.00 $cm^2$ | |
| elapsed | 3600 seconds | |

66. Explain why all of the measurements are given in different numbers of significant figures.

67. In order to calculate the permeation rate of water across the polymer membrane, she must divide the mass of the water collected by the area of the membrane and then divide that by the elapsed time. So in other words:

**Permeation rate = the mass of the collected methanol/ area of the membrane /elapsed time**

a) How many significant digits should her answer be?_____

b) Explain how you figured out the answer to part a.

68. What is the connection between the number of significant digits provided in a problem and the way in which these quantities were initially measured?