Physics Summer Assignment

Please complete the attached assignment over the summer. I 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 your first week of class following Summer Break, so be prepared.

What if you can't remember how to solve problems?

I tried to identify the different sorts of math skills by name (e.g. literal equations, dimensional analysis) so that you can easily find online resources to assist you.

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 as we will review all these major concepts throughout the year.

Work the Following on Clean Paper, Numbered, and Neat. 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: $v_f = v_i + a\,t$

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

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

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

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

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

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

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

2. What is the independent variable in an experiment?

3. What is the dependent variable in an experiment?

4. What are constant variables, why do you need constant variables in an experiment?

5. What is the difference between a positive and negative control?

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

6. What is the distance traveled in the first 5 seconds?

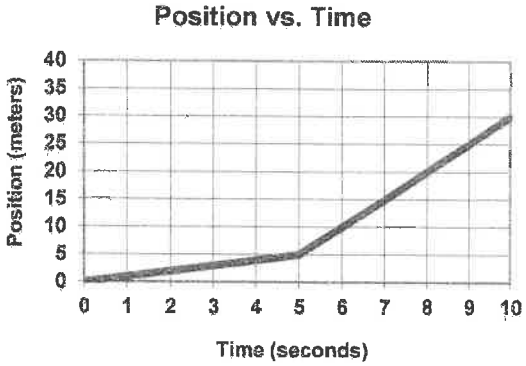
7. What is the slope of the graph from t = 0 to 5 seconds (don't forget your units)?

8. What is the slope of the graph from t = 5 to 10 seconds?

9. Write the equation for the position (x) in terms of time (t) for the time interval t = 5 to 10 seconds?

10. Describe the overall trend of the graph.

11. What position of the object at 8 seconds?



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:
    (a) 7.0890
    (b) 0.00520
    (c) 6200
    (d) 1.20000500
    (e) 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 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.

    (a) 0.0025 cm + 1.24 cm + 0.45 cm =
    (b) 2.367 mm × 1.52 mm =
    (c) 2.67×10^{-3} kg – 9.5×10^{-4} kg + 47.3 kg =
    (d) 7×10^{5} kg /2.4×10^{7} L =
    (e) 0.006 m + 0.03 cm =

International System of Units (SI Units): The international science community uses SI units, which is an extension of the metric system. We'll be using these units as well, and you should be familiar with the base units and the following prefixes.

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 1×10^{-9} meters
micro- (μ)	_____	15 microcoulombs is _____ coulombs
milli- (m)	_____	2015 milliamperes is _____ amperes
centi- (c)	_____	5200 cm^3 is _____ m^3
kilo- (k)	_____	15 kilocalories is _____ calories
mega- (M)	_____	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:
    (a) The time it takes to play a CD on a stereo
    (b) The mass of a car
    (c) The length of a soccer field
    (d) The mass of a slice of pizza
    (e) Your mass
    (f) The distance you traveled from home to school
    (g) Your height

SCIENTIFIC NOTATION: When reporting numbers in proper scientific notation, the base number n must be ≥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) $(3.2 \times 10^{7})(2.0 \times 10^{5}) =$

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

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

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

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

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

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 g/cm^3. Convert this to 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 3.00×10^{8} 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 ft^3? One acre = 4840 yards^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?