AP Physics 1 Summer Assignment

Instructor: Mr. David Silva
dsilva@springfieldschools.com
Room: 223 Jonathan Dayton High School

Greetings AP Students,

Congratulations on your decision to accept the intensive challenge of AP Physics. The pace of this course is fast, spanning the entire 2020-2021 AP Physics Curriculum in approximately nine months. This means much of the work and content will require independent effort and a head start through the summer. AP Physics is catered to students who anticipate studying science in college as it mirrors the first year of college physics. That means that this is a college level course at a college level pace. The summer assignment addresses material that students are expected to know upon entering the class in September.

Complete the following tasks over the summer before the first day of class:

1. Complete the summer packet:
    a. This is an 11 page packet spanning the introductory materials students are expected to know upon entering the course.
    b. You are encouraged to research any content you do not know, but ALL WORK MUST BE SHOWN FOR CREDIT.
    c. Make sure to include units with your answers.
    d. This packet is due the first day of class.
    e. The first unit test will be based on your understanding on this packet and will take place in first few days of school.
2. Obtain a 2+ inch binder, OR a notebook and folder to take notes and keep files (graph paper is recommended). Obtain a scientific calculator (graphing calculators are ideal, I highly recommend the Ti-89)
3. Access the AP Physics 1 college board web page and review "**about the exam**" and the course content and description → (**Google: "AP Physics 1 college board"** or go to the link below): https://apstudent.collegeboard.org/apcourse/ap-physics-1
4. Download and print the AP Physics 1 equation table from College Board website → (**Google: "AP Physics 1 Equation Sheet"** – get it from College Board, or use this link below): https://secure-media.collegeboard.org/digitalServices/pdf/ap/ap-physics-1-equations-table.pdf

Remember that the summer assignment is due the first day of class! **No late assignments will be accepted.** Pace yourself, enjoy the summer, and reach out to my email with any questions! I look forward to working with and meeting all of you in the fall!

Good Luck!
Mr. Silva

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: 1000 **m** = 1 **km** and 3600 **s** = 1 *h*,

★ Cross out terms top/Bottom: SHOW WORK! 6

$$\left(\frac{25\text{ km}}{\text{h}}\right)\left(\frac{1000\text{ m}}{1\text{ km}}\right)\left(\frac{1\text{ h}}{3600\text{ s}}\right)=$$

A. What is the conversion factor to convert km/h to m/s?

B. What is the conversion factor to convert m/s to km/h?

Carry out the following conversions using the factor-label method. Show all your work! ★

1. How many seconds are in a year?

2. Convert 28 km to cm.

3. Convert 45 kg to mg.

4. Convert 85 cm/min to m/s.

5. Convert the speed of light, $3x10^8$ m/s, to km/day.

6. Convert 823 nm to m

7. 8.5 cm^3 to m^3

Solving Equations:

Often problems on the AP exam are done with variables only. Solve for the variable indicated. Don't let the different letters confuse you. Manipulate them algebraically as though they were numbers. You must show work! Include all steps!

1. $K = \frac{1}{2}kx^2$, $x =$ _____

2. $T_p = 2\pi\sqrt{\frac{\ell}{g}}$, $g =$ _____

3. $F_g = G\frac{m_1 m_2}{r^2}$, $r =$ _____

4. $mgh = \frac{1}{2}mv^2$, $v =$ _____

5. $x = x_o + v_o t + \frac{1}{2}at^2$, $t =$ _____

6. $B = \frac{\mu_o I}{2\pi r}$, $r =$ _____

7. $x_m = \frac{m\lambda L}{d}$, $d =$ _____

8. $pV = nRT$, $T =$ _____

9. $\sin\theta_c = \frac{n_1}{n_2}$, $\theta_c =$ _____

10. $qV = \frac{1}{2}mv^2$, $v =$ _____

Geometry

#11. Solve the following geometric problems.

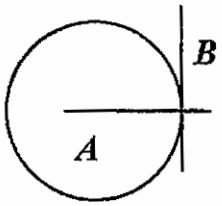
a. Line ***B*** touches the circle at a single point. Line ***A*** extends through the center of the circle.

i. What is line ***B*** in reference to the circle?

_____

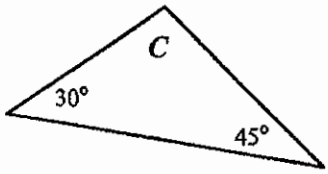
ii. How large is the angle between lines ***A*** and ***B***?

_____



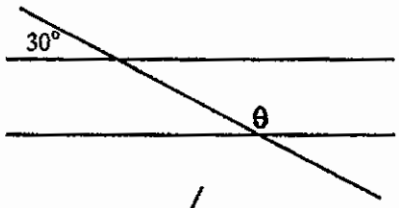
b. What is angle ***C***?

_____



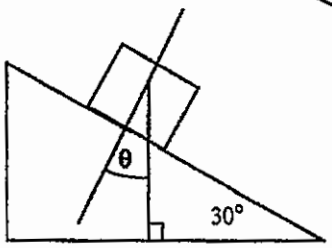
c. What is angle θ ?

_____



d. How large is ***θ***?

_____



You can assume this is a right triangle

#12. a. The radius of a circle is 5.5 *cm*,

i. What is the circumference in meters?

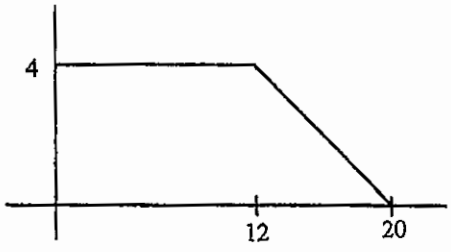
_____

ii. What is its area in square meters?

_____

b. What is the area under the curve at the right?

_____



AP Physics 1
Summer Assignment

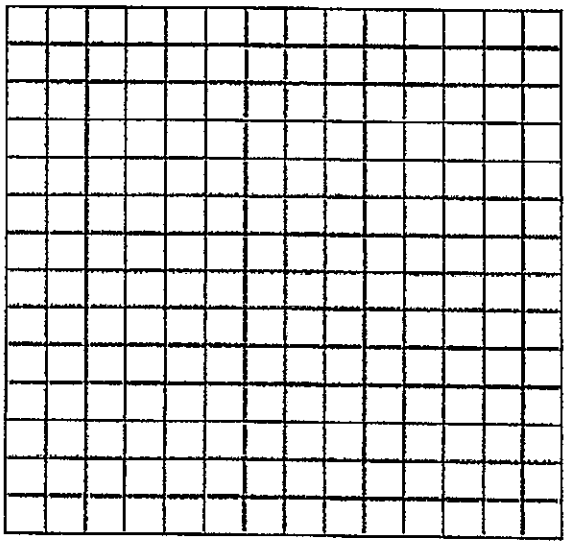
· Graphing

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.

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. 9×10^9 =

18. 1×10^{-3} m =

19. 1.93×10^4 kg/m^3 =

20. 4.5×10^{-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. $(1.8 \times 10^3)(7.3 \times 10^{-8})$

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

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

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) 0.25×10^{3} (B) 2.5×10^{2} (C) 25×10^{1} (D) 250

Algebraic Relationships

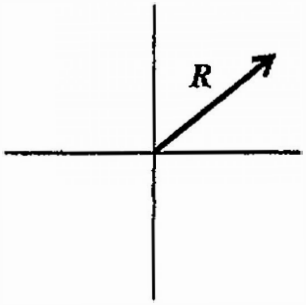
Consider the following: $z = x/y$ $c = ab$ $l = m\sqrt{n}$ $r = s^2/t^2$

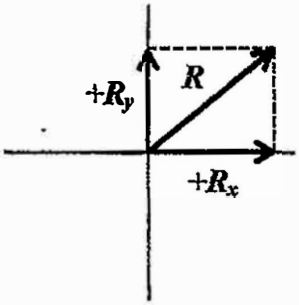
33. As *x* increases and *y* stays constant, *z* _____.
34. As *y* increases and *x* stays constant, *z* _____.
35. As *x* increases and *z* stays constant, *y* _____.
36. As *a* increases and *c* stays constant, *b* _____.
37. As *c* increases and *b* stays constant, *a* _____.
38. As *b* increases 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 _____

Component Vectors

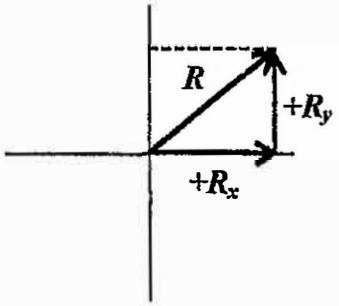
A resultant vector is a vector resulting from the sum of two or more other vectors. Mathematically the resultant has the same magnitude and direction as the total of the vectors that compose the resultant. Could a vector be described by two or more other vectors? Would they have the same total result?

This is the reverse of finding the resultant. You are given the resultant and must find the component vectors on the coordinate axis that describe the resultant.





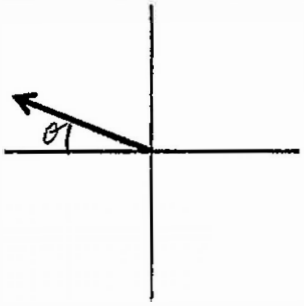
or



Any vector can be described by an *x* axis vector and a *y* axis vector which summed together mean the exact same thing. The advantage is you can then use plus and minus signs for direction instead of the angle.

Break down the vectors into their components as shown above. <u>CALULATE THE MISSING SIDES!</u>

a.



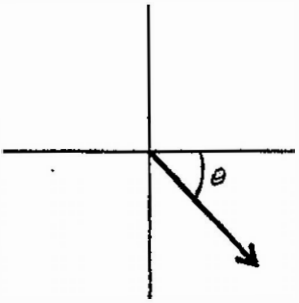
Θ = 25°

R= 2m/s

R_x = _____

R_y= _____

c.



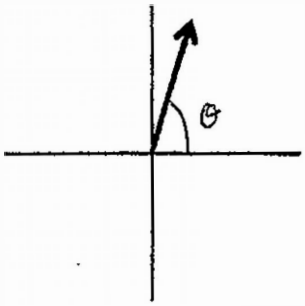
Θ = 50°

R= 4m

R_x = _____

R_y= _____

b.



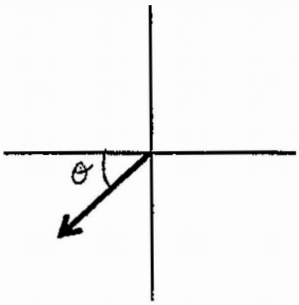
Θ = 80°

R= 5m/s

R_x = _____

R_y= _____

d.



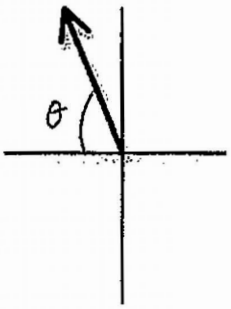
Θ = 45°

R= 10cm

R_x = _____

R_y= _____

e.



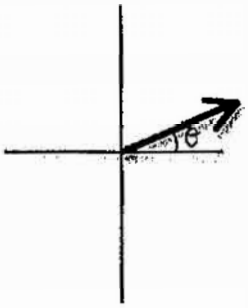
Θ = 75°

R= 1.5inches

R_x = _____

R_y= _____

f.



Θ = 15°

R= 0.5km

R_x = _____

R_y= _____

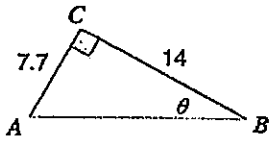
Obviously, the <u>quadrant</u> that a vector is in <u>determines</u> the (sign) <u>of the *x* and *y* component vectors.</u>

AP Physics 1
Summer Assignment

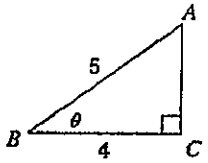
Right Triangles

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

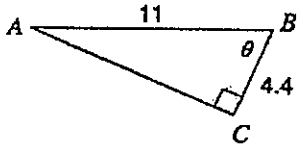
1) Find θ



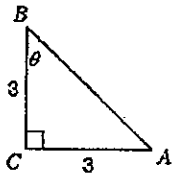
2) Find θ



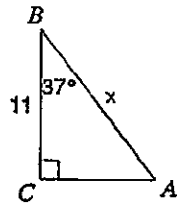
3) Find θ



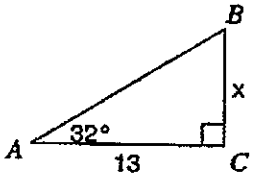
4) Find θ



5) Find x

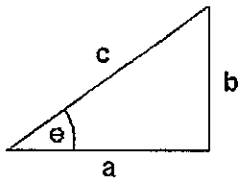


6) Find x



Trigonometry

Using the generic triangle to the right, Right Triangle Trigonometry and Pythagorean Theorem solve the following. ***Your calculator must be in degree mode.***



g. $\theta = 55°$ and $c = 32\ m$, solve for a and b.

_____

h. $\theta = 45°$ and $a = 15\ m/s$, solve for b and c.

_____

i. $b = 17.8\ m$ and $\theta = 65°$, solve for a and c.

_____

j. $a = 250\ m$ and $b = 180\ m$, solve for θ and c.

_____

k. $a = 25\ cm$ and $c = 32\ cm$, solve for b and θ.

_____

l. $b = 104\ cm$ and $c = 65\ cm$, solve for a and θ. * What is the error here? How can you fix it?

_____

Experimental Design: (write these answers on a separate piece of paper and attach)

1. What is the difference between an experiment and a case study?

2. What is a hypothesis?

3. Differentiate "independent variable" from "dependent variable," give examples of each:

4. What are extraneous variables? Give examples:

5. What is the difference between "correlation" and "causation?"

(write these steps on a separate piece of paper and attach)

Design an experiment testing how height would affect the speed of a bowling rolling down a hill. Don't do the experiment, just design it and follow this sequence:

Introduction (Hypothesis):

Procedure (# the steps):

Data Collection & Analysis (how you will collect and interpret data):

Results (what are the possible results?):

Conclusion (overview the experiment):