AP Physics 1

AP Physics is a wonderful opportunity to grow as a critical thinker, problem solver and great communicator. Don't believe the rumors- it is not impossibly hard. It does require hard work, but so does anything that is worthwhile. You would never expect to win a race if you didn't train. Similarly, you can't expect to do well if you don't train academically. This course is immensely rewarding and exciting, but you do have to take notes, study, and read the book (!). I guarantee that if you do what is asked of you that you will look back to this class with huge sense of satisfaction! I know I can't wait to get started…

Let's learn some Physics!!!

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Welcome to the world of Physics and I am glad that you are taking AP Physics 1 and this course will use inquiry-based instructional strategies that focus on experimentation to develop students' conceptual understanding of physics principles. The students begin studying a topic by making observations and discovering patterns of natural phenomena. The next steps involve developing, testing, and applying models. Throughout the course, the students construct and use multiple representations of physical processes, solve multistep problems, design investigations, and reflect on knowledge acquired. (Algebra and Trigonometry will be used throughout the year)

Summer Assignment is due the first day of class. There are multiple parts to this and they are math review and web based (online) portion to Introductory Physics since part of it is website based, don't wait until the last minute to work on this assignment.

I - Math Review

There will be a math test during the first week of school. Be familiar with the following practice problems (and the attached answers).

MKS units and the metric system

MKS (meter-kilogram-second) units are fundamental metric units. The more common prefixes used in the metric system, and the powers of ten associated with them, are given in the table below. You should know all of these off by heart.

prefix	*abbreviation*	*power of ten*
Mega	M	10^6
kilo	k	10^3
centi	c	10^{-2}
milli	m	10^{-3}
micro	μ	10^{-6}
nano	n	10^{-9}

Unit analysis and conversion

You will often need to convert a value from one unit to another, converting from centimeters to meters, for example. Be extra careful if you have units which are squared, cubed, or have some other exponent, for example V = 1 cm x 5 cm x 10 cm = 50 cm^3. The volume of 1000 cm^3 in m^3, is

$V = 1000\ cm^3 \times (1\ m / 100\ cm)^3 = 1000\ cm^3 \times (1\ m^3 / 1000000\ cm^3) = 0.001\ m^3$.

Significant figures

When you punch in 200/19.32 in your calculator, your calculator gives you the number 10.35196687. You have to round this off, because most of the figures the calculator gives you are not *significant*, i.e. are *meaningless*. Assume given quantities are accurate to 3 significant figures so round your answers in problems to 3 significant figures.

Trigonometry

Pythagorean theorem: $a^2 + b^2 = c^2$

$\sin\theta = opp/hyp$ $\cos\theta = adj/hyp$ $\tan\theta = opp/adj$

The quadratic formula

Get to know how to solve a quadratic equation using your calculator and or memorize the quadratic formula. You will be expected to solve quadratics on tests so prepare accordingly.

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Proportions

Proportions relate to two or more variables in an equation. If two variables are proportional then the ratio of the variable is a constant. For example when you move at constant speed the distance you travel is directly proportional to the time. That is for a trip at constant speed you travel 200 miles in 4 hours, 400 miles in 8 hours. The ratio of distance to time is constant or $\frac{d_1}{t_1} = \frac{d_2}{t_2}$ and $d_2 = \frac{d_1}{t_1} \times t_2$

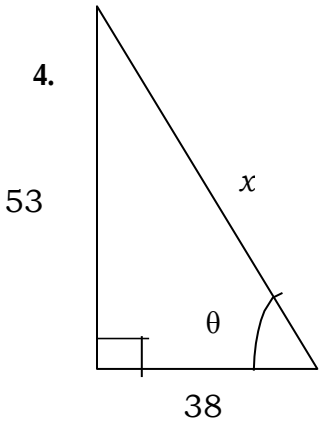
If a is proportional to b^2 then proportion is $\frac{a_1}{b_1^2} = \frac{a_2}{b_2^2}$ and $a_1 = \frac{a_2}{b_2^2} \times b_1^2$.

For questions 1-3 Solve for the unknown.

1. $10 = \sqrt{5^2 + 3x^2}$ 2. $50 = 100 - 10x$ 3. $1.5 \sin 20° = 1.2 \sin \theta$

For questions 4-6 Calculate the unknowns, θ and x, using Pythagorean theorem and SOHCAHTOA.

4.



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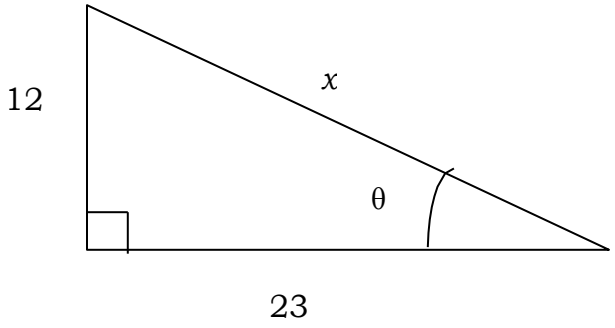

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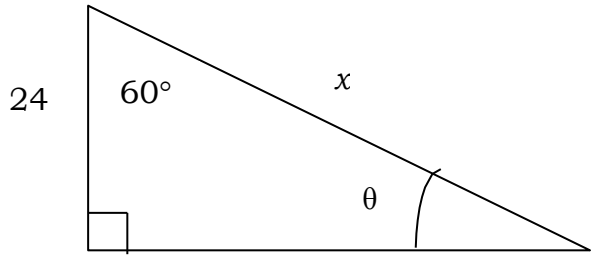


7. Solve the following system of equations for x and y.

$$3x + 5y = 30$$
$$2x + 3y = 19$$

8. A platinum resistance thermometer has a resistance, R, that changes with temperature as follows: $R(T) = R_0(1 + AT + BT^2)$ where $R_0 = 100$, T = temperature in °C, and A, B are constant coefficients.

If R(100)=172, and R(200)=241, determine the value for coefficient B.

A) -1.50×10^{-6} B) 1.50×10^{-6} C) -7.35×10^{-3} D) 7.35×10^{-3}

For questions 9-11 use the conversion table below.

Length			**Volume**		
meter	=	3.281 feet	liter	=	1.000×10^{-3} m^3
		1.093611 yards			1000 cm^3
mile	=	1.609 kilometers			1.0567 quarts
inch	=	2.54000 centimeters			
Mass			**Time**		
kilogram	=	2.248 pounds	hour	=	3600 seconds

9. Convert 871 milligrams to pounds 10. Convert 40 km/hr into ft/s

11. 5.29 g/cm^3 to pounds per ft^3

12. The distance a cart moves down a track (from rest) is proportional to the time squared. How far would a cart move down a track (from rest) in two seconds if it moves (from rest) a distance of 20 cm in one second? A) 5 cm B) 10 cm C) 20 cm D) 40 cm E) 80 cm

13. Sam takes a picture of himself standing 3.0 meters from his camera and finds the size of his image to be 6.0 cm. In another photograph of himself he finds his image to be 2 cm tall. What is his distance from the same camera in the second picture? Image size is inversely proportional to the object distance.

A) 1.0 m B) 2.0 m C) 6.0 m D) 9.0 m E) 18 m

14. If you have a pendulum that is 0.25 m long, it will have a period of 1.0 second. What length of pendulum is needed in a Grandfather clock in order to get a period of 2.0 seconds? Period is proportional to the square root of the length of the pendulum.

A) 0.20 cm B) 2.0 cm C) 20 cm D) 100 cm E) 200 cm

For questions 15-17 Use the data given in the table below.

A	B	1/A	A^2	$\sqrt{A}$
1.0	4.00	1.00	1.0	1.0
2.0	2.00	0.50	4.0	1.4
3.0	1.33	0.33	9.0	1.7
4.0	1.00	0.25	16	2.0

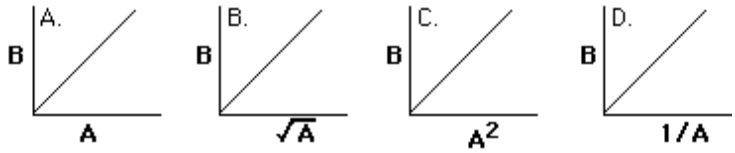
15. Which of the following is true? (Hint: which two columns are directly proportional?)

A) $\mathbf{B} \propto 1/\mathbf{A}$ B) $\mathbf{B} \propto \mathbf{A}^2$ C) $\mathbf{B} \propto \mathbf{A}^{0.5}$ D) $\mathbf{B} \propto \mathbf{A}$

16. What value would **B** have if **A** had the value 5.0?

A) 0.20 B) 0.50 C) 0.80 D) 20 E) 50

17. Which of the following plots is correct?



Solve for the following quadratics. Give both solutions.

18. $x^2 - 3x - 4 = 0$

19. $2x^2 - 6x - 25 = 0$

20. $3x^2 + 4x - 19 = 0$

Answers to Math Review

1) + or – 5	2) x = 5	3) theta = 25.3	4) x = 65 theta = 54
5) x = 26 theta=28	6) x = 48 theta = 30	7) x =5 y=3	8) A
9) 1.96 x 10^{-3} lbs	10) 36 ft/sec	11) 337 lb/ft^3	12) E
13) D	14) D	15) A	16) C
17) D	18) 4,-1	19) 5.34; -2.34	20) 1.94;-3.27

Part II: Web Assignment:

This is a great web site so feel free to wander around in it. www.physicsclassroom.com
Click on: Physics tutorial
Click on: 1-D Kinematics
Click on: Lesson 1b. Scalars and Vectors
Read through this section and answer the following.

State whether the following are vectors or scalars.
16 mi/hr _____ 4 m east_____ 47 kg _____ 18 sec _____
8 m/sec^2, up _____ 19 km/hr, south _____

Click on: Distance and Displacement (Still in Lesson 1) Read through Describing motion in words – Distance and Displacement and click on
Quick Quiz: What is the coach's resulting displacement and distance of travel?
a) Find the distance traveled from point A to B to C_____Football
b) Find the distance traveled from B to C to D_____Coach
c) Find the displacement from A to B to C _____
d) Find the displacement from B to C to D _____

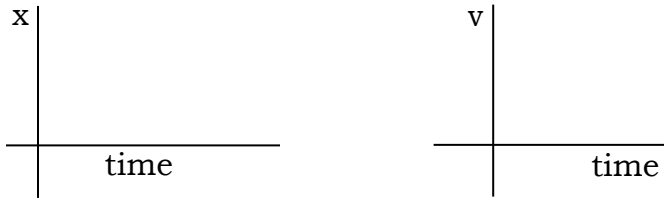
Click on: Speed and Velocity (Still in Lesson 1) Read through Speed and Velocity
Click on Quick Quiz: Football coach
a) Find the average speed from A to B to C _____
b) Find the average velocity from A to B to C _____

Click on: Acceleration (Still in Lesson 1) Read through Acceleration
Click on: The first ***ANIMATION*** box. You should see a red, green and a blue car.
Answer the 3 questions under the animation.

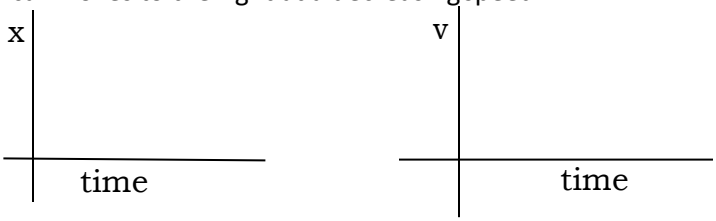
1. _____
2. _____
3. _____

Click on: Position-time Graphs (located beneath animation) Read through The meaning of shape of a p-t graph Click on: The meaning of slope of a p-t graph (at the bottom of the page) Read through The meaning of slope of a p-t graph
Draw a position-time graph and a velocity time graph for each of the following cases:
1) A car moves to the right at a constant velocity

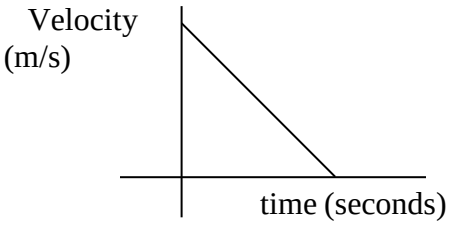
2) A car moves to the right at an increasing speed



3) A car moves to the right at a decreasing speed



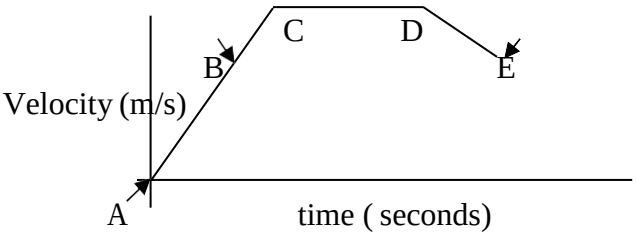
Click on: Go to Lesson 4 Describing Motion with Velocity vs. Time Graphs
Read through The meaning of shape of a v-t graph
Describe the motion of the graph below. Include a statement about its position, velocity and acceleration.



Click on: The meaning of slope on a v-t graph
Read through The meaning of slope of a v-t graph Use the graph in ***Check your understanding*** to answer the questions.
During what time interval is the rocket

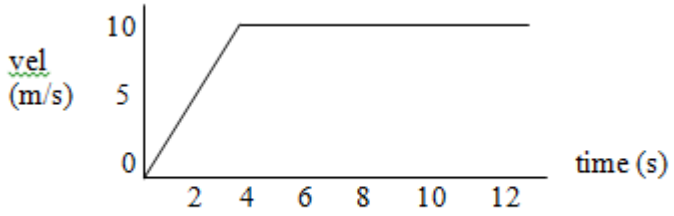
a) moving away from its starting position? _____
b) accelerating positively? _____
c) not moving? _____
d) changing direction? _____
e) accelerating with the greatest magnitude? _____
f) slowing down? _____

Click on: Relating the shape to the motion. Read through Relating the shape to the motion. Describe what is happening in the graph below. Be sure to include a statement about position, velocity and acceleration.



Click on: Determining the slope on a v-t graph Read through Determining slope on a v-t graph
Click on: Determining the area on a v-t graph. Read through Determining area on a v-t graph. Use the graph below to answer the questions.

a) Find the velocity at 2 seconds. _____
b) Find the position of the object at 4 seconds. _____
c) Find the acceleration of the object at 6 seconds _____
d) When is the object accelerating? _____
e) When is the object not moving? _____
f) Find the displacement of the object at 6 seconds. _____



All work is due on the first day of class.

Any questions- Email through School loop at atandon@cuhsd.org

Conceptual Preview

QUESTIONS FOR YOU TO THINK ABOUT and *then* RESEARCH…

Do your best to answer the following questions after examining the provided videos and links. These concepts are important ideas we will discuss throughout the year.

Kinematics

1. A gun is fired parallel to the ground. At the same instant, a bullet of equal size and mass next to the muzzle is released and drops to the ground. Which hits the ground first and why?

http://www.youtube.com/watch?v=oBdalzRJR5g
http://phet.colorado.edu/en/simulation/projectile-motion

Newton's Laws

2. Why can you exert a greater force on the pedals of a bicycle if you pull up on the handlebars?

http://ed.ted.com/lessons/joshua-manley-newton-s-3-laws-with-a-bicycle

http://phet.colorado.edu/en/simulation/ramp-forces-and-motion

Work and Energy

3. Consider a fly that is hovering on the inside of your car as you are traveling down the Interstate. Does it have more or less kinetic energy than the car?

http://ed.ted.com/lessons/how-does-work-work-peter-bohacek

http://phet.colorado.edu/en/simulation/energy-skate-park

Momentum and Impulse

4. Describe why a watermelon will be obliterated when you drop it in a parking lot but will remain intact when dropped from the same height into a pool.

http://www.youtube.com/watch?v=Hx9TwM4Pmhc

http://phet.colorado.edu/en/simulation/collision-lab

Circular Motion and Gravitation

5. Either for fun or for physics (sometimes you can't tell these apart…) you are swinging a rock attached to a string over your head. Suddenly the string breaks. Describe the new motion of the rock by drawing a picture.

http://www.youtube.com/watch?v=zN6kCa6xi9k

http://phet.colorado.edu/en/simulation/balancing-act

Waves and Sound

6. If you blow across the top of a Coke bottle, a specific note is produced. Add a little water to the bottle and the pitch changes. Add more water and it changes even more… why?

http://www.youtube.com/watch?v=qyi5SvPlMXc&list=PLED25F943F8D6081C&index=73

http://phet.colorado.edu/en/simulation/wave-on-a-string

Electricity

7. Why can birds sit on high powered electrical wires and not be electrocuted?

http://ed.ted.com/lessons/electric-vocabulary

http://phet.colorado.edu/en/simulation/balloons

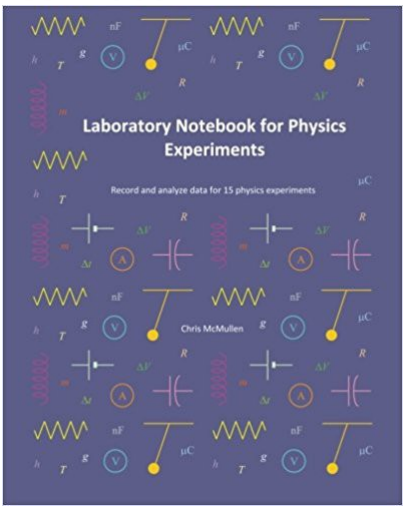
http://phet.colorado.edu/en/simulation/electric-hockey

Supplies-

Apart from having a binder for the class, please have a scientific calculator as well. You are strongly recommended to buy the lab notebook shown below to record all your experiments in it. It is available on Amazon for $ 7.99. The advantage of this notebook over others is that the sections are already organized in the form of a lab write up format. You are free to buy from elsewhere if you get it for a cheaper price.

Laboratory Notebook For Physics Experiments: Record And Analyze Data For 15 Physics Experiments

by Chris McMullen (Author)
5.0 out of 5 stars 1 customer review
Look inside



ISBN-13: 978-1438284439
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Paperback

$7.04 - $7.99

This laboratory notebook is designed to provide structure and organization to the recording of data and/or preparation of lab reports for students and instructors of physics labs. Sections include prelab exercises, lecture notes, objectives, illustration of experimental setup, procedures, data tables, computations, tabulation of results, analysis, conclusions, sources of error, references, notes, and attachments. The notes and attachment sections provide room for additional sections or continuation of previous sections as well as an area to attach graphs, spreadsheet printouts, or other documents. Each section designates lined space for written work or blank space for calculations or illustrations. Compared to traditional blank notebooks/journals or starting from scratch with a word processor, this physics laboratory notebook provides a built-in structure for more organized reports. A class using these notebooks will submit reports in a much more uniform format.