MOUNT NOTRE DAME
Empowering Young Women

Physics Summer Assignment
Mount Notre Dame High School

Ladies,

I have put together the work I would like you to practice over the summer. The summer assignment requires a textbook. Please stop by, at your convenience, to pick one up.

The summer work is out of Halliday, Resnick and Walker[1]

Since this is self-study, do your best on the problems but do not go crazy trying to complete all the problems perfectly. This is especially true for problems 8 and 13 from Chapter 2. However please attempt all the problems. We will review them thoroughly at the beginning of the year.

This is a decent amount of work, so please pace yourself throughout the summer and don't try to do this all right before the start of school.

Assignment: The assignment tasks are listed below. The remaining pages of this document are separated into three sections. Section 1 has the selected problems from chapter 1, section 2 has the selected problems from chapter 2, and section 3 contains the vector tasks.

1. Please critically read Chapter 1 and Chapter 2 Sections 2.1 - 2.5.
    - By critically read I mean that you are taking your own notes and writing down questions as your work through the material.
    - Ignore any portions dealing directly with calculus. These sections can be identified by the use of the derivate symbol $\left(\frac{d}{dx}, \frac{d}{dt}\right)$ or the integral symbol $\left(\int dx, \int dt\right)$.
2. Try the selected questions and problems from the end of these chapters. The selected problems are attached as section 1 and section 2.
    - I suspect that almost all of chapter 1 will be review, although the context of the problems is different from your science courses and more like math problems you probably had in Algebra, Geometry and Pre-Calculus.
    - The early sections in Chapter 2 are primarily definitions of terms and the relationship between position, displacement, velocity, speed and acceleration.
3. Please complete section 3 which has an introductory task for vectors.

Have a good summer and I look forward to seeing you all in

the fall. Regards,

Dr. Fletcher

[1] Halliday, D., Resnick, R., & Walker, J. (2014). *Fundamentals of physics*. New York: Wiley.

1 Halliday, Resnick and Walker: Selections from chapter 1

Problems: 1, 6, 8, 13, 17, 20, 22, 26, 53[2]

P1. Earth is approximately a sphere of radius $6.37 \times 10^6\ m$. What are (a) its circumference in kilometers, (b) its surface area in square kilometers, and (c) its volume in cubic kilometers?

[2] All problems are from the eText service provided by VitalBook, under contract to Wiley publishing, for the textbook: *Fundamentals of Physics Extended*, Halliday, David, et. al., 10th Edition. Wiley, 08/2013.

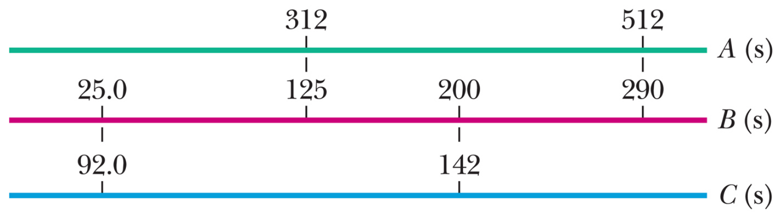
P6. You can easily convert common units and measures electronically, but you still should be able to use a conversion table, such as those in Appendix D. Table 1-6 is part of a conversion table for a system of volume measures once common in Spain; a volume of 1 fanega is equivalent to 55.501 dm^3 (cubic decimeters). To complete the table, what numbers (to three significant figures) should be entered in (a) the cahiz column, (b) the fanega column, (c) the cuartilla column, and (d) the almude column, starting with the top blank? Express 7.00 almudes in (e) medios, (f) cahizes, and (g) cubic centimeters (cm^3).

Table 1-6 Problem 6

	cahiz	fanega	cuartilla	almude	medio
1 cahiz =	1	12	48	144	288
1 fanega =		1	4	12	24
1 cuartilla =			1	3	6
1 almude =				1	2
1 medio =					1

P8. Harvard Bridge, which connects MIT with its fraternities across the Charles River, has a length of 364.4 Smoots plus one ear. The unit of one Smoot is based on the length of Oliver Reed Smoot, Jr., class of 1962, who was carried, or dragged, length by length across the bridge so that other pledge members of the Lambda Chi Alpha fraternity could mark off (with paint) 1-Smoot lengths along the bridge. The marks have been repainted biannually by fraternity pledges since the initial measurement, usually during times of traffic congestion so that the police cannot easily interfere. (Presumably, the police were originally upset because the Smoot is not an SI base unit, but these days they seem to have accepted the unit.) Figure 1-4 shows three parallel paths, measured in Smoots (S), Willies (W), and Zeldas (Z). What is the length of 50.0 Smoots in (a) Willies and (b) Zeldas?

P13. Three digital clocks A, B, and C run at different rates and do not have simultaneous readings of zero. Figure 1-6 shows simultaneous readings on pairs of the clocks for four occasions. (At the earliest occasion, for example, B reads 25.0 s and C reads 92.0 s.) If two events are 600 s apart on clock A, how far apart are they on (a) clock B and (b) clock C? (c) When clock A reads 400 s, what does clock B read? (d) When clock C reads 15.0 s, what does clock B read? (Assume negative readings for prezero times.)



P17. Five clocks are being tested in a laboratory. Exactly at noon, as determined by the WWV time signal, on successive days of a week the clocks read as in the following table. Rank the five clocks according to their relative value as good timekeepers, best to worst. Justify your choice.

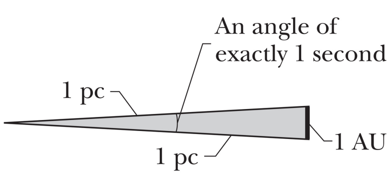
Clock	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
A	12:36:40	12:36:56	12:37:12	12:37:27	12:37:44	12:37:59	12:38:14
B	11:59:59	12:00:02	11:59:57	12:00:07	12:00:02	11:59:56	12:00:03
C	15:50:45	15:51:43	15:52:41	15:53:39	15:54:37	15:55:35	15:56:33
D	12:03:59	12:02:52	12:01:45	12:00:38	11:59:31	11:58:24	11:57:17
E	12:03:59	12:02:49	12:01:54	12:01:52	12:01:32	12:01:22	12:01:12

P20. The record for the largest glass bottle was set in 1992 by a team in Millville, New Jersey — they blew a bottle with a volume of 193 U.S. fluid gallons. (a) How much short of 1.0 million cubic centimeters is that? (b) If the bottle were filled with water at the leisurely rate of 1.8 g/min, how long would the filling take? Water has a density of 1000 kg/m^3.

P22. Gold, which has a density of 19.32 g/cm^3, is the most ductile metal and can be pressed into a thin leaf or drawn out into a long fiber. (a) If a sample of gold, with a mass of 27.63 g, is pressed into a leaf of 1.000 μm thickness, what is the area of the leaf? (b) If, instead, the gold is drawn out into a cylindrical fiber of radius 2.500 μm, what is the length of the fiber?

P26. One cubic centimeter of a typical cumulus cloud contains 50 to 500 water drops, which have a typical radius of 10 μm. For that range, give the lower value and the higher value, respectively, for the following. (a) How many cubic meters of water are in a cylindrical cumulus cloud of height 3.0 km and radius 1.0 km? (b) How many 1-liter pop bottles would that water fill? (c) Water has a density of 1000 kg/m^3. How much mass does the water in the cloud have?

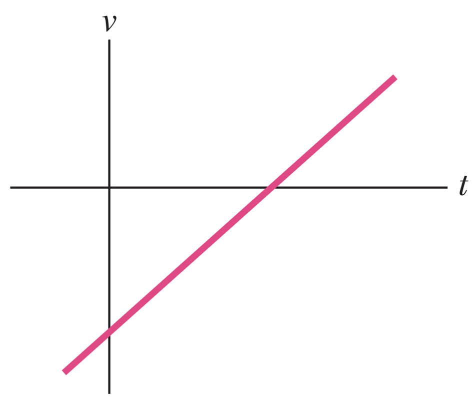
P53. An astronomical unit (AU) is equal to the average distance from Earth to the Sun, about $92.9 \times 10^6\ mi$. A parsec (pc) is the distance at which a length of 1 AU would subtend an angle of exactly 1 second of arc (Fig. 1-8). A light-year (ly) is the distance that light, traveling through a vacuum with a speed of 186 000 mi/s, would cover in 1.0 year. Express the Earth — Sun distance in (a) parsecs and (b) light-years.



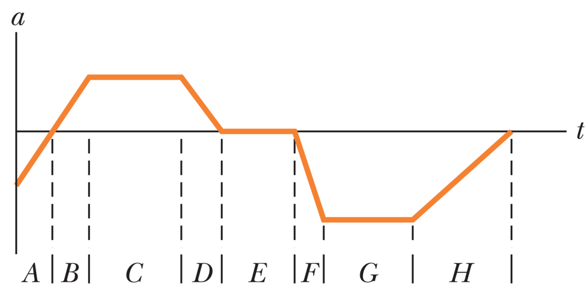
2 Halliday, Resnick and Walker: Selections from chapter 2

Questions: 1, 2, 3, 5, 10, 11; Problems: 1, 6, 8, 9, 13, 16, 21

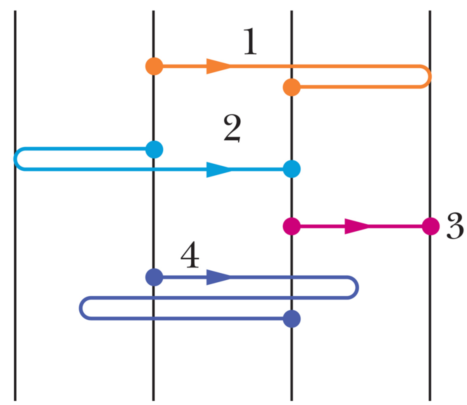
Q1. The figure shows the velocity of a particle moving on an x axis. What are (a) the initial and (b) the final directions of travel? (c) Does the particle stop momentarily? (d) Is the acceleration positive or negative? (e) Is it constant or varying?



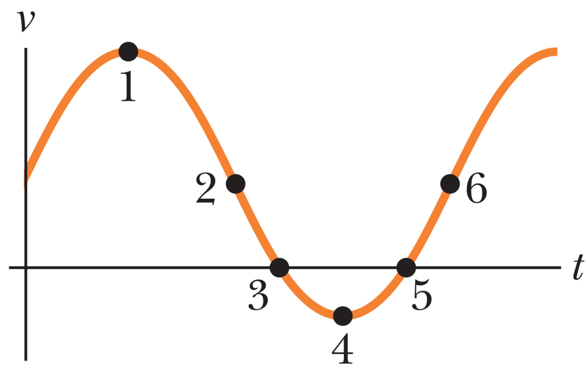
Q2. The figure shows the acceleration, a(t), of a Chihuahua as it chases a German shepherd along an axis. In which of the time periods indicated does the Chihuahua move at constant speed?



Q3. The figure shows four paths along which objects move from a starting point to a final point, all in the same time interval. The paths pass over a grid of equally spaced straight lines. Rank the paths according to (a) the average velocity of the objects and (b) the average speed of the objects, greatest first.

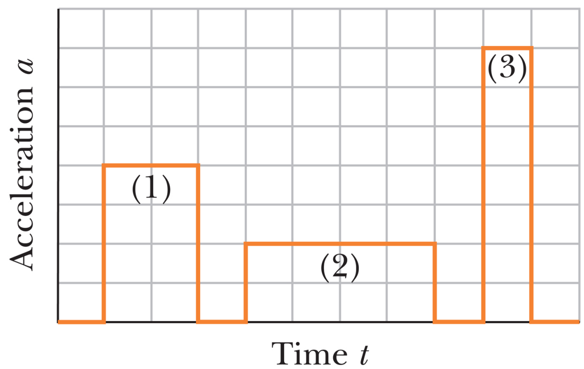


Q5. The figure shows the velocity of a particle moving along an axis. Point 1 is at the highest point on the curve; point 4 is at the lowest point; and points 2 and 6 are at the same height. What is the direction of travel at (a) time t = 0 and (b) point 4? (c) At which of the six numbered points does the particle reverse its direction of travel? (d) Rank the six points according to the magnitude of the acceleration, greatest first.



Q10. Suppose that a passenger intent on lunch during his first ride in a hot-air balloon accidently drops an apple over the side during the balloon's liftoff. At the moment of the apple's release, the balloon is accelerating upward with a magnitude of 4.0 m/s^2 and has an upward velocity of magnitude 2 m/s. What are the (a) magnitude and (b) direction of the acceleration of the apple just after it is released? (c) Just then, is the apple moving upward or downward, or is it stationary? (d) What is the magnitude of its velocity just then? (e) In the next few moments, does the speed of the apple increase, decrease, or remain constant?

Q11. The figure shows that a particle moving along an x axis undergoes three periods of acceleration. Without written computation, rank the acceleration periods according to the increases they produce in the particle's velocity, greatest first.



P1. While driving a car at 90 km/h, how far do you move while your eyes shut for 0.50 s during a hard sneeze?

P6. The 1992 world speed record for a bicycle (human-powered vehicle) was set by Chris Huber. His time through the measured 200 m stretch was a sizzling 6.509 s, at which he commented, “Cogito ergo zoom!” (I think, therefore I go fast!). In 2001, Sam Whittingham beat Huber’s record by 19.0 km/h. What was Whittingham’s time through the 200 m?

P8. Panic escape. Figure 2-24 shows a general situation in which a stream of people attempt to escape through an exit door that turns out to be locked. The people move toward the door at speed $v_s = 3.5\ m/s$, are each $d = 0.25\ m$ in depth, and are separated by $L = 1.75\ m$. The arrangement in Fig. 2-24 occurs at time $t_0 = 0\ s$.

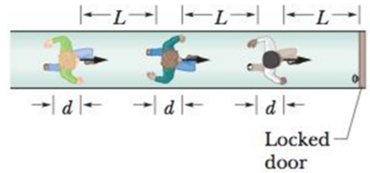


Figure 2-24 Problem 8.

(a) At what average rate does the layer of people at the door increase?

(b) At what time does the layer's depth reach 5.0 m?

P9. In 1 km races, runner 1 on track 1 (with time 2 min, 27.95 s) appears to be faster than runner 2 on track 2 (2 min, 28.15 s). However, length L_2 of track 2 might be slightly greater than length L_1 of track 1. How large can L_2 - L_1 be for us still to conclude that runner 1 is faster?

P13. You drive on Interstate 10 from San Antonio to Houston, half the *time* at 55 km/h and the other half at 90 km/h. On the way back you travel half the *distance* at 55 km/h and the other half at 90 km/h. What is your average speed (a) from San Antonio to Houston, (b) from Houston back to San Antonio, and (c) for the entire trip? (d) What is your average velocity for the entire trip? (e) Sketch x versus t for (a), assuming the motion is all in the positive x direction. Indicate how the average velocity can be found on the sketch.

P16. The position function x(t) of a particle moving along an x-axis is $x = 4.0 - 6.0t^2$, with x in meters and t in seconds. (a) At what time does the particle momentarily stop. (b) Where does the particle momentarily stop? (c) At what negative time does the particle pass through the origin? (d) At what positive time does the particle pass through the origin? (e) Graph x versus t for the range -5 s to +5 s. (f) To shift the curve rightward on the graph, should we include the term +20t or the term -20t in x(t)? (g) Does that inclusion increase or decrease the value of x at which the particle momentarily stops?

P21. From $t = 0$ to $t = 5.00\ min$, a man stands still, and from $t = 5.00\ min$ to $t = 10.0\ min$, he walks briskly in a straight line at a constant speed of 2.20 m/s. What are (a) his average velocity v_{avg} and (b) his average acceleration a_{avg} in the time interval 2.00 min to 8.00 min? What are (c) v_{avg} and (d) a_{avg} in the time interval 3.00 min to 9.00 min? (e) Sketch x versus t and v versus t, and indicate how the answers to (a) through (d) can be obtained from the graphs.

3 Vectors

You might have been introduced to vectors already. This concept is extensively used in physics. We will learn vectors very early in the year and use them for the entire year. Understanding vectors are critical to your success in physics. We will spend considerable time on this topic, including learning how to do some simple Calculus operations with vectors.

To prepare, please look at the links below.

The first link is a good, descriptive introduction to vectors. Do not worry if terminology is unfamiliar—this is what we will be learning during the year!

- http://www.youtube.com/watch?v=EUrMI0DIh40

The second link is another descriptive introduction to vectors with more of a science class perspective.

- https://www.youtube.com/watch?v=_QC42w0npwQ

There will be a short assessment before our first lab, which covers vectors.