Seminar 1: Lectures 1-2

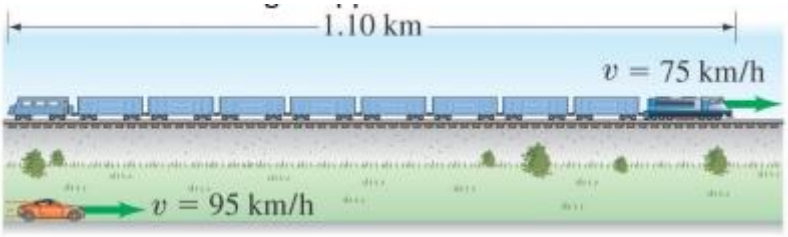
Speed and Velocity:

1. You are driving home from school steadily at 95 km.h^{-1} for 130 km. It then begins to rain and you slow to 65 km.h^{-1}. You arrive home after driving 3 hours and 20 minutes.

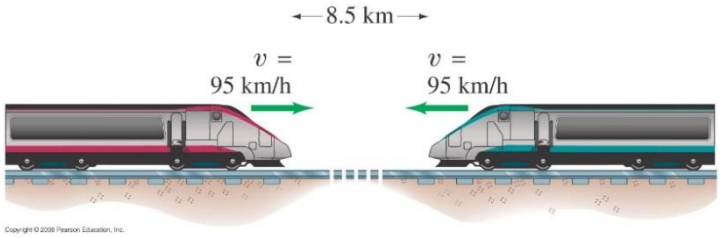
   (a) How far is your hometown from school?

   (b) What was your average speed?

2. An automobile travelling at 95 km.h^{-1} overtakes a 1.10 km long train travelling in the same direction on a track parallel to the road. If the train's speed is 75 km.h^{-1}, how long does it take the car to pass it, and how far will the car have travelled in this time? See the figure below. What the results if the car and train are travelling in opposite directions?



3. Two locomotives approach each other on parallel tracks. Each has a speed of 95 km.h^{-1} with respect to the ground. If they are initially 8.5 km apart, how long will it be before they reach each other? (See the figure below).



Acceleration:

4. A sports car moving at constant speed travels 110 m in 5.0 s. If it then brakes and comes to a stop in 4.0 s, what is the magnitude of its acceleration in ms^{-2}, and in g's (g = 9.80 m.s^{-2})?

Motion at Constant Acceleration:

5. A light plane must reach a speed of 32 m.s^{-1} for takeoff. How long a runway is needed if the (constant) acceleration is 3.0 m.s^{-2}?

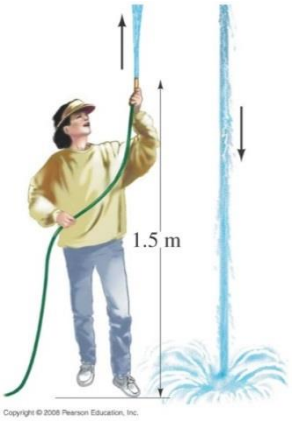
6. An inattentive driver is travelling 18.0 m.s^{-1} when he notices a red light ahead. His car is capable of decelerating at a rate of 3.65 m.s^{-2}. If it takes him 0.200 s to get the brakes on and he is 20.0 m from the intersection when he sees the light, will he be able to stop in time?

Freely-Falling Objects:

7. A stone is dropped from the top of a cliff. It is seen to hit the ground below after 3.75 s. How high is the cliff?

8. A ball player catches a ball 3.2 s after throwing it vertically upward. With what speed did he throw it, and what height did it reach?

9. Suppose you adjust your garden hose nozzle for a hard stream of water. You point the nozzle vertically upward at a height of 1.5 m above the ground (see the figure below). When you quickly turn off the nozzle, you hear the water striking the ground next to you for another 2.0 seconds. What is the water speed as it leaves the nozzle?



Vectors:

10. A delivery truck travels 28 blocks north, 16 blocks east, and 26 blocks south. What is its final displacement from the origin? You can assume that the blocks are equal length.

11. Graphically determine the resultant of the following three vector displacements:
(1) 24 m, 36° north of east; (2) 18 m, 37° east of north; and (3) 26 m, 33° west of south.

12. A skier is accelerating down a 30.0° hill at 1.80 m^{-2} (see the figure below).

    a) What is the vertical component of their acceleration?

    b) How long will it take the skier to reach the bottom of the hill, assuming they start from rest and accelerates uniformly, with the elevation change of 325 m?