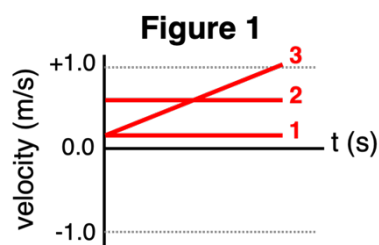


Velocity versus Time Graphs

Velocity refers to how fast an object is moving (known as **speed**) AND in what direction. A plus (+) or minus (-) sign is often used to indicate direction. An object with a velocity of -34 m/s is moving with a speed of 34 m/s in the - direction. A group of students are investigating how velocity vs. time graphs can be used to describe motion. Using a motion detector, they move in a variety of ways and observe the corresponding plots of velocity vs. time on a computer monitor.

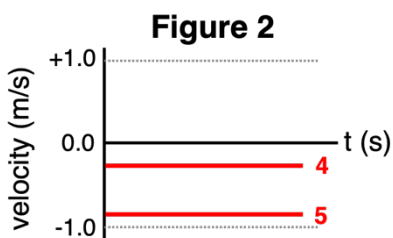
Experiment 1:

The students move away from the detector in three separate trials. In trial 1, they move slowly at a constant speed. In trial 2, they move fast at a constant speed. In trial 3, they continually change their speed from slow (initially) to fast (finally). The plots for the three trials are shown in **Figure 1**.



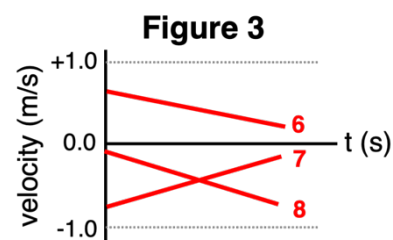
Experiment 2:

The students conduct two constant speed trials. In trial 4, they move towards the detector slowly. In trial 5, they move towards the detector, but with a faster speed than in trial 4. The plots for the two trials are shown in **Figure 2**.



Experiment 3:

The students conduct three changing speed trials. In trial 6, they walk away from the detector from fast to slow. In trial 7, they walk towards the detector from fast to slow. In trial 8, they walk towards the detector from slow to fast. The plots for the three trials are shown in **Figure 3**.



Experiment 4:

The students constructed a ramp and rolled a cart along the ramp. The cart was given a push from the bottom of the ramp. The cart decreased its speed as it rolled up the ramp, it turned around, and it increased its speed as it rolled down the ramp. They performed Trial 9 with the motion detector at the top of the ramp. In trial 10, the motion detector was at the bottom of the ramp. See **Figure 4**.

