

Objectives for Physics

Chapter 1

1. Be able to state the base units for length, mass, and time in the *Système International d'unités* and to describe their original standards.
2. Be able to use these metric prefixes: milli-, centi-, kilo-. We will eventually need to use most of the prefixes listed in Table 1-3, so be familiar with all of them.
3. Be able to describe the technical meanings of “precision” and “accuracy.”
4. Be able to make measurements of mass, length, and time and report them honestly, *i.e.* to the appropriate degree of precision.

Chapter 2

1. Be able to define a coordinate system including an origin in order to specify the position of an object such as our “Tumble” buggies.
2. Be able to determine the change in position of an object based on a description of its motion.
3. Recognize that “change in position” is also called “displacement.”
4. Be able to determine the distance that an object has moved along one dimension and to distinguish the distance moved from the displacement.
5. Be able to determine the average velocity of an object.
6. Be able to determine the average speed of an object.
7. Given a position vs time plot for an object, be able to figure out
 - (a) the displacement of the object over a specified interval of time,
 - (b) the distance it traveled during the time interval,
 - (c) its average velocity over a specified interval of time.
 - (d) its average speed over a specified interval of time,
 - (e) its instantaneous speed at any specified moment
 - (f) and also its direction of motion, whether positive or negative.
8. On a curved position *vs* time plot, be able to find the instantaneous velocity at any specified time by finding the slope of the tangent to the curve at that point.
9. Be able to convert speeds expressed in km/hr and mph to m/s.
10. Be able to distinguish among average velocity, instantaneous velocity, initial velocity, and final velocity.

11. Be able to distinguish between average speed and average velocity.
12. Be able to define average acceleration in your own words, mathematically, and graphically.
13. Be able to describe to someone else the differences between velocity and acceleration in words, graphs, equations, and motion diagrams.
14. Given an initial velocity vector and a final velocity vector that represent two velocities for some moving object, be able to use vector arithmetic to find $\Delta\mathbf{v}$, the change in velocity experienced by that object.
15. Be able to use the velocity *vs* time plot for an object moving in one dimension
 - (a) to determine the object's average acceleration over a specified interval of time,
 - (b) to find the displacement of the object over some specified interval of time,
 - (c) and to describe the motion of the object in words including its direction of motion.
16. Be able to use an *a vs t* plot to determine
 - (a) the acceleration of an object, and
 - (b) the change in velocity of an object over some specified amount of time.
17. Be able to match *x vs t*, *v vs t*, and *a vs t* plots that describe objects having the same motion.
18. Be able to use the following kinematic relationships to solve problems and to list the conditions under which they are valid.
 - $\bar{\mathbf{v}} = \frac{\Delta\mathbf{x}}{\Delta t}$
 - $\bar{\mathbf{a}} = \frac{\Delta\mathbf{v}}{\Delta t}$
 - $\Delta x = v_0\Delta t + \frac{1}{2}a\Delta t^2$
 - $v_f^2 = 2a\Delta x + v_0^2$
19. Be able to determine when two objects moving along the same line will be at the same position given their initial positions, velocities, and their accelerations.