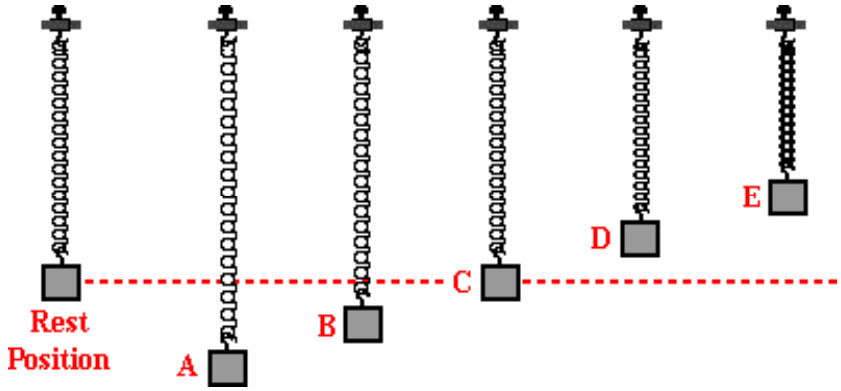
Mass on a Spring

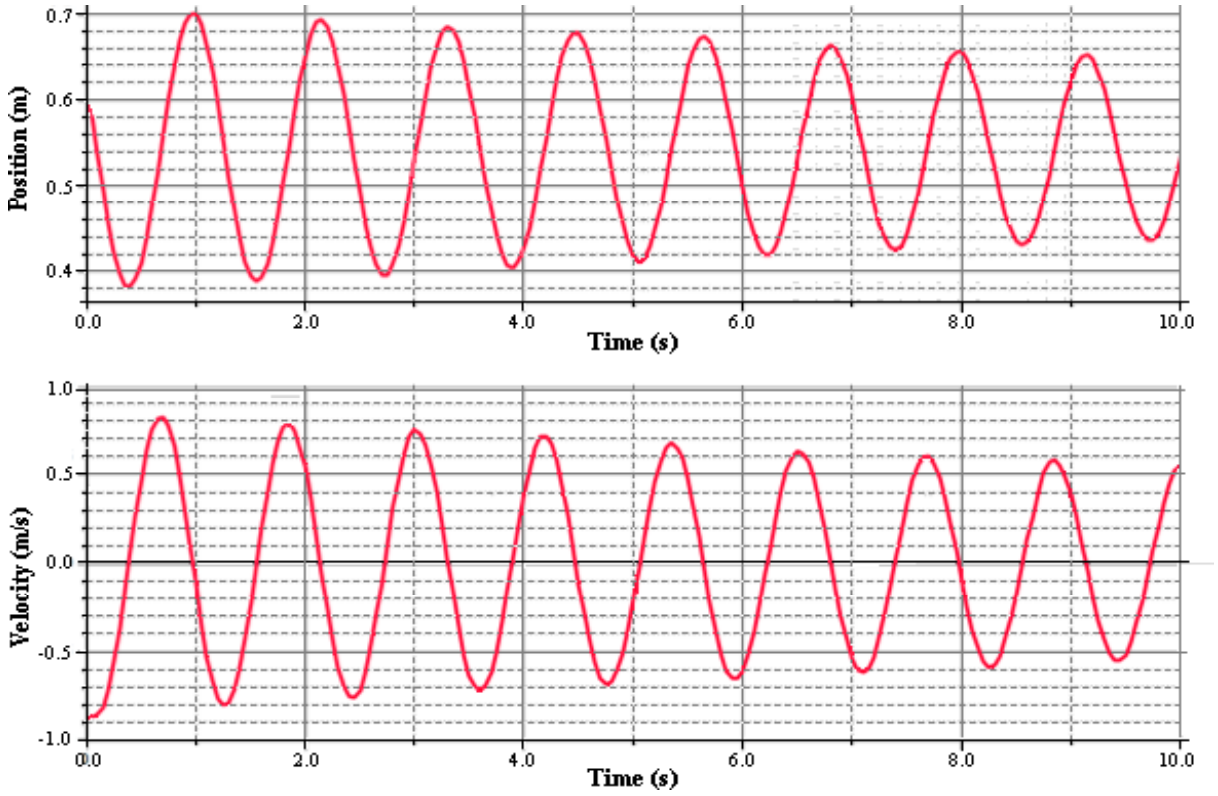
When a mass is suspended on a spring, the mass hangs at its **rest position**. If the mass is pulled below its rest position and released, it begins to vibrate up and down. It moves from position A to B to C (the original rest position) to D to E, and then back down to A. See **Figure 1**. The motion repeats itself in cyclic fashion over and over again.

Figure 1: Up and Down Motion of a Mass on a Spring



The vertical position is not the only property of the mass that changes over time. The velocity of the mass also changes. **Velocity** describes how fast an object moves and in what direction it moves. A + and - sign is used to indicate the directional aspect of velocity. A + sign indicates an upward direction of motion and a - sign indicates a downward direction of motion. If a motion dectector is placed below the vibrating mass, it will detect the vertical position (height above the detector) and velocity as a function of time. The resulting graphical display is shown in **Figure 2**.

Figure 2: Plots of Position and Velocity as a Function of Time



Questions

1. At which one of the following times is the mass located at a highest vertical position?
   a. 1.0 seconds
   b. 3.0 seconds
   c. 3.9 seconds
   d. 5.9 seconds

2. At which of the following times is the mass moving with a velocity of 0.40 m/s?
   a. 0.5 seconds
   b. 2.7 seconds
   c. 8.1 seconds
   d. 9.0 seconds

3. At which one of the following times is the mass located at position E?
   a. 1.0 seconds
   b. 3.0 seconds
   c. 3.9 seconds
   d. 5.9 seconds

4. According to **Figure 2**, at which of the following times is the mass located below its rest position and moving in the downward direction?
   a. 2.0 seconds
   b. 4.0 seconds
   c. 6.0 seconds
   d. 7.0 seconds

5. A vibrating mass is often described as having a *period*. The period is the time that it takes the mass to complete one full up and down cycle of vibration. According to **Figure 2**, what is the period of this mass?
   a. Approximately 0.6 seconds
   b. Approximately 1.2 seconds
   c. Approximately 1.8 seconds
   d. Approximately 10.0 seconds