- Sample Problem 3—Practice Problem

  Let upward be positive. Substitute the values into the final velocity equation.

  $\vec{v}_f = \vec{v}_i + \vec{a}_{av}\Delta t = 20 \text{ m/s} + (-9.8 \text{ m/s}^2 \times 1.5 \text{ s})$

  $\vec{v}_i = +5.3 \text{ m/s}$

  The question asks for speed, not velocity, so you need to indicate only the magnitude. After 1.5 s, the speed of the marble was 5.3 m/s.

- Sample Problem 4—Practice Problem

  Let upward be positive. Rearrange the final velocity equation to solve for initial velocity. Substitute the values into the initial velocity equation.

  $\vec{v}_f = \vec{v}_i + \vec{a}_{av}\Delta t$

  $\vec{v}_i = \vec{v}_f - \vec{a}_{av}\Delta t = 125 \text{ m/s} - (19 \text{ m/s}^2 \times 4.5 \text{ s})$

  $\vec{v}_i = +39 \text{ m/s}$

  The rocket's velocity before the second stage fired was +39 m/s or 39 m/s [up].

- Provide students with a copy of *BLM 13.1-2 Vertical Projectiles* to provide a more in-depth discussion of the graph in Figure 5 on page 378 of the Student Book.

Technology Connections
Have students use computer graphing software to produce grahs for their answers to the **Check Your Understanding** questions. For most graphs of this nature, students will need to choose a scatter plot rather than a line graph for the program to handle the data correctly.

3 Consolidate and Extend

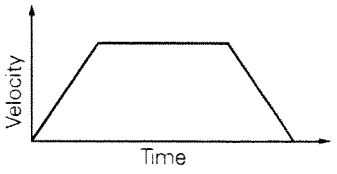
- Have students complete *WS 13.1-3 Using the Average Acceleration Equation* to practice solving acceleration problems.
- Have students complete the **Check Your Understanding** questions.

CHECK YOUR UNDERSTANDING—SUGGESTED ANSWERS — PAGE 379

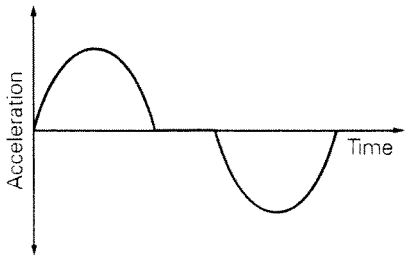
1. Sample answer: Acceleration is the change in velocity over time.
2. **(a)** Assuming up is positive, the velocity has a sharp increase, then is constant, then has a sharp decrease to zero. The acceleration has a sharp increase, then drops to zero, then has a sharp decrease to a negative acceleration, and then returns to zero.

   (b)

   Velocity vs. Time for an Elevator Trip

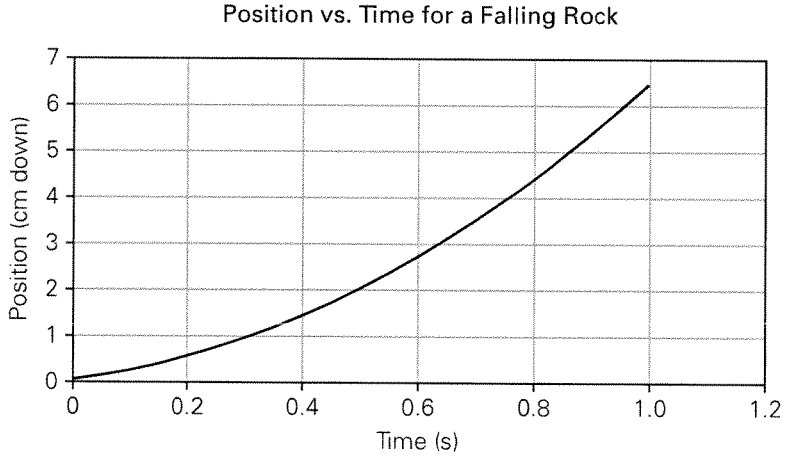
   

   Acceleration vs. Time for an Elevator Trip

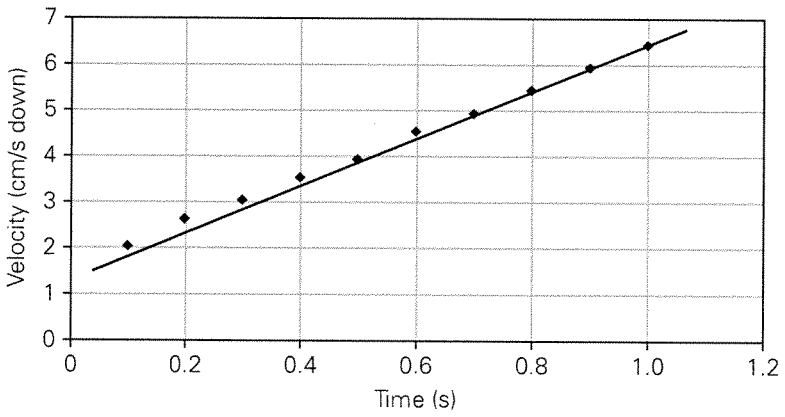
3. A
4. The velocity increases. The acceleration is always 9.8 m/s^2 downward.
5. 4.7 m/s^2 [SW]
6. −14 m/s^2 [W]; East is positive, and the change in velocity was instantaneous.
7. 5.3 m/s^2
8. 3.3 s

9. (a)



(b) It increases over time. **(c)** The velocity steadily increases. **(d)** (See the table below.) **(e)** There is one less average velocity value than the number of time or position values because the average velocity is calculated for the time interval (e.g., from 0 to 1 s) whereas the position is given for an instant in time (e.g., at the 1 s point). There are 11 instants in time, but there are only 10 time intervals.

(f)



(g) 4.9 m/s^2 **(h)** The first velocity value does not equal 0 cm/s because it is the average velocity for the first time interval (the time from the start (0 s to 0.1 s) rather than the instantaneous velocity at the start. **(i)** (See the table below.)

Time (s)	Position (cm down)	Average velocity (cm/s down)	Average acceleration (cm/s^2 down)
0	0	—	—
0.1	0.20	2	20
0.2	0.51	2.6	13
0.3	0.90	3.0	10
0.4	1.38	3.5	8.6
0.5	1.97	3.9	7.9

Time (s)	Position (cm down)	Average velocity (cm/s down)	Average acceleration (cm/s^2 down)
0.6	2.67	4.5	7.4
0.7	3.46	4.9	7.0
0.8	4.33	5.4	6.8
0.9	5.33	5.9	6.6
1.0	6.41	6.4	6.4