

Class/Student Practice
Simple Kinematics

1. A ball is rolling from rest down a hill at 2.5m/s^2 for 5 seconds.

a. How fast is the ball rolling at the 5 second mark?

$$v_f = v_i + at \Rightarrow v_f = 0 + 2.5(5) = \boxed{12.5\text{m/s}}$$

b. How far did the ball roll at the 5 second mark?

$$x_f = x_i + v_i t + \frac{1}{2}at^2$$

$$0 + 0 + \frac{1}{2}(2.5)(5)^2 = \boxed{31\text{m}}$$

2. A ball is rolling up a hill at 15m/s while slowing down at 2.5m/s^2 .

a. How fast is the ball rolling at the 5 second mark?

$$v_f = v_i + at \quad 15 + (-2.5)(5) = \boxed{2.5\text{m/s}}$$

b. How far did the ball roll at the 5 second mark?

$$x_f = x_i + v_i t + \frac{1}{2}at^2 \quad x_f = 0 + 15(5) + \frac{1}{2}(-2.5)(5)^2$$

c. How fast is the ball going at the 7 second mark?

$$v_f = v_i + at \quad 15 + 7(-2.5) = \boxed{-2.5\text{m/s}}$$

d. How far has the ball gone at the 7 second mark?

$$x_f = x_i + v_i t + \frac{1}{2}at^2 \quad x_f = 105 + (-61.25)$$

$$0 + 15(7) + \frac{1}{2}(-2.5)(7)^2 \quad \boxed{x_f = 43.75}$$

e. What is happening at the 7 second mark that isn't happening at the 5 second mark?

on way down $-v$ $+a$ speeding up
on way down.

3. A car traveling at 4m/s slows to 0.5m/s in 10 meters.

a. What is the acceleration of the car?

$$v_f^2 - v_i^2 = 2ad \quad \frac{v_f^2 - v_i^2}{2d} = a \quad \frac{0.5^2 - 4^2}{2(10)} = \boxed{-0.78\text{m/s}^2}$$

b. How much time does it take?

$$v_f = v_i + at \quad \frac{v_f - v_i}{a} = t \quad \frac{0.5 - 4}{-0.78} = \boxed{4.6\text{s}}$$

4. A block sliding at 7m/s on a frictionless surface for 3 seconds?

a. What is the acceleration?

0 - no change in speed

b. How far will the block travel in the 3 seconds?

$$x_f = x_i + v_i t + \frac{1}{2}at^2$$

$$= 0 + 7 \cdot 3 = \boxed{21\text{m}}$$