

W1.04A**Acceleration—Counting problems**

Note—all accelerations are uniform

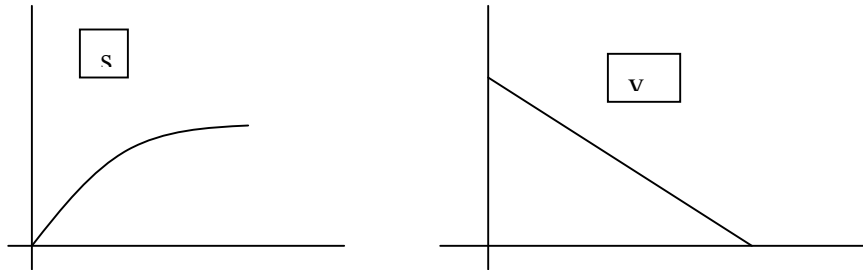
(9-19-05)

1. A car begins at rest and accelerates to a speed of 20 m/s in 5 seconds.
 - a. What is its acceleration?
 - b. How far does it travel while accelerating?
 - c. If its acceleration continued, how long would it take to reach 30 m/s?
2. A bus is seen moving at 30 m/s as the driver applies the brakes and begins to slow down uniformly at -2 m/s/s.
 - a. How long would it take to slow to 12 m/s?
 - b. How far would the bus travel while slowing to 12 m/s?
 - c. How far would the bus travel if the acceleration continued until the bus came to a stop?
 - d. Draw an s vs. t and a v vs. t graph of the motion while the bus slows to rest.
3. A spaceship is moving forward at 100 m/s when it begins to fire its retro rockets (retro rockets push the ship backwards). It continues to fire those rockets until its velocity is 60 m/s in reverse 8 seconds later.
 - a. What was the acceleration of the rocket?
 - b. How far forward did it travel before coming (instantaneously) to rest?
 - c. How far backward did it travel after that?
 - d. What is the rocket's average speed during the entire 8 seconds?
 - e. Can you see a one-step method of calculating the overall displacement of the rocket? If so, do the calculation.
 - f. When the rocket is instantaneously at rest, is its acceleration 0? Why or why not?
4. Annie is running s vs. t at a constant speed of 6 m/s when she passes Nick standing on the side of the track. If Nick has a maximum acceleration of 2 m/s/s and a maximum speed of 8 m/s, how long would it take him to catch Annie if she maintains her speed at 6 m/s and Nick starts running immediately when Annie passes? (Try to estimate this answer if you can't calculate it directly—hint: break the problem into segments)
5. Graph the motion in the above problem on a v vs. t plot showing both people.
6. Two trains are approaching each other on a single track. When they are 3500 meters (3.5 kilometers) apart, they both apply their brakes trying to avoid a collision. The first train (train A) is traveling at 30 m/s and brakes at 0.25 m/s/s, and the second train (train B) is traveling at 40 m/s and brakes at 0.50 m/s/s. Do the trains collide? Demonstrate (mathematically) why or why not.

W1.04A Acceleration—Counting problems KEY

1. a. 4 m/s/s b. 50 meters c. 7.5 seconds
2. a. 9 seconds b. 189 meters c. 225 meters d.
3. a. -20 m/s/s b. 250 meters c. 90 meters d. $+20$ m/s e. $+160$ meters f. no
4. 8 seconds
- 5.
6. No—they stop 100 meters apart.

2.d.



5.

