

## Speed, Velocity, and Acceleration Problems

KEY

Use your OWN PAPER, and show ALL work. Show the formula used, the setup, and the answer with the correct units.

1. Pete is driving down 7<sup>th</sup> street. He drives 150 meters in 18 seconds. Assuming he does not speed up or slow down, what is his speed in meters per second?

$$s = \frac{d}{t} \qquad s = \frac{150m}{18s} = 8.3 \text{ m/s}$$

2. A person jogs 4.0 km in 32 minutes, then 2.0 km in 22 minutes, and finally 1.0 km in 16 minutes. What is the jogger's average speed in km per minute?

$$s = \frac{d}{t} \qquad s = \frac{4km + 2km + 1km}{32min + 22min + 16min} = \frac{7km}{70min} = 0.1 \text{ km/min}$$

3. A train travels 120 km in 2 hours and 30 minutes. What is its average speed? (2hrs 30min = 150 min)

$$s = \frac{d}{t} \qquad s = \frac{120km}{150min} = 0.8 \text{ km/min}$$

4. A plane's average speed between two cities is 600 km/hr. If the trip takes 2.5 hrs. how far does the plane fly?

$$s = \frac{d}{t} \qquad 600 \text{ km/hr} = \frac{d}{2.5hr}$$

$$d = (600 \text{ km/hr})(2.5hr) = 1,500 \text{ km}$$

5. George walks to a friend's house. He walks 750 meters North, then realizes he walked too far. He turns around and walks 250 meters South. The entire walk takes him 13 seconds. What is his speed per second?

$$s = \frac{d}{t} \qquad s = \frac{750m + 250m}{13 \text{ sec}} = \frac{1000m}{13 \text{ sec}} = 76.9 \text{ m/s}$$

6. In problem #5, what was George's **velocity** in meters per second? (hint: draw a picture to find his displacement)

Velocity would be average speed with direction.

7. A roller coaster's velocity at the top of a hill is 10 m/s. Two seconds later it reaches the bottom of the hill with a velocity of 26 m/s. What was the acceleration of the coaster?

$$a = \frac{v_2 - v_1}{t} \qquad a = \frac{26 \text{ m/s} - 10 \text{ m/s}}{2 \text{ s}} = \frac{16 \text{ m/s}}{2 \text{ s}} = 8 \text{ m/s}^2$$

8. A roller coaster is moving at 25 m/s at the bottom of a hill. Three seconds later it reaches the top of the hill moving at 10 m/s. What was the acceleration of the coaster?

$$a = \frac{v_2 - v_1}{t}$$

$$a = \frac{10 \text{ m/s} - 25 \text{ m/s}}{3 \text{ sec}} = \frac{-15 \text{ m/s}}{3 \text{ sec}} = -5 \text{ m/s}^2$$

9. A car traveling at 15 m/s starts to decelerate steadily. It comes to a complete stop in 10 seconds. What is its acceleration?

$$a = \frac{v_2 - v_1}{t}$$

$$a = \frac{15 \text{ m/s} - 0 \text{ m/s}}{10 \text{ sec}} = \frac{15 \text{ m/s}}{10 \text{ sec}} = 1.5 \text{ m/s}^2$$

10. A child drops a ball from a window. The ball strikes the ground in 3.0 seconds. What is the velocity of the ball the instant before it hits the ground?

$$v_2 = a(t) - v_1$$

$$v_2 = 9.8 \text{ m/s}^2 (3.0 \text{ sec}) + 0 \text{ m/s} \\ = 29.4 \text{ m/s}$$

11. A boy throws a ball straight up into the air. It reaches the highest point of its flight after 4 seconds. How fast was the ball going when it left the boy's hand?

$$v_2 = a(t) - v_1$$

$$v_2 = 9.8 \text{ m/s}^2 (4.0 \text{ sec}) + 0 \text{ m/s} \\ = 39.2 \text{ m/s}$$

12. A train moves from rest to a speed of 25 m/s in 30.0 seconds. What is its acceleration?

$$a = \frac{v_2 - v_1}{t}$$

$$a = \frac{25 \text{ m/s} - 0 \text{ m/s}}{30.0 \text{ sec}} = 0.83 \text{ m/s}^2$$

13. If a train going 60 m/s hits the brakes, and it takes the train 1 minute 25 seconds to stop, what is the train's acceleration?

$$a = \frac{v_2 - v_1}{t}$$

$$a = \frac{0 \text{ m/s} - 60 \text{ m/s}}{85 \text{ sec}} = -0.71 \text{ m/s}^2$$

14. How long will it take a car to go from a complete stop to 44 km/hr if they are accelerating at 5 km/hr<sup>2</sup>?

$$t = \frac{v_2 - v_1}{a}$$

$$t = \frac{44 \text{ km/hr} - 0 \text{ km/hr}}{5 \text{ km/hr}^2} = 8.8 \text{ hr}$$

15. How long will it take a car to accelerate from 15.2 m/s to 23.5 m/s if the car has an average acceleration of 3.2 m/s<sup>2</sup>?

$$t = \frac{v_2 - v_1}{a}$$

$$t = \frac{23.5 \text{ m/s} - 15.2 \text{ m/s}}{3.2 \text{ m/s}^2} = \frac{8.3 \text{ m/s}}{3.2 \text{ m/s}^2} = 2.6 \text{ sec.}$$