

### CP 1D Motion Practice Problems

**Distance and Displacement Problems:** Draw out the path of the motions. Graph paper is very helpful.

1. Michelle walks 100m toward the west, then turns and walks back the way she came 20m. What is her distance? What is her displacement?
2. An Olympic runner competing in the 1600m circles the track exactly 4 times during a race. What is his distance? What is his displacement?
3. A shopper walks forward 20m, turns right and walks 5m, turns left and walks in the original direction 10m, then turns left again for 5m. What is her distance? What is her displacement?
4. Some hikers travel 2 km north, turn toward the west and travel 4km, turn toward the south and travel 6 km, then finally travel east for 4 km. What is their distance? What is their displacement?
5. A skating rink is perfectly circular and it has a radius of 12m. A skater circles the rink on the outer edges near the wall. When the skater is half way around the circle what is her distance and what is her displacement?

**Answers:** 1) 120m, 80m West. 2) 1600m, 0m. 3) 40m, 30m forward (positive). 4) 16m, 4km South. 5) 37m, 24m perpendicular to the positive direction

### Speed and Velocity Practice Problems

1. A runner does a 10K (10 kilometers) in one hour. What is his speed in k/h? m/s?
2. A ball rolls 8m in 2 sec. What is the ball's speed?
3. A cyclist travels 4km in 15min. What is her speed in m/s?
4. A runner circles the track *exactly* 2 times for distance of 800m. It takes 4.0min. What is her average speed in m/s? What is her average velocity?
5. A mom pushes a stroller up and down the mall with an average speed of .6m/s. How far will she go in 30 min?
6. If the mom in problem #5 stops to sit on a bench located 20m to the east of her starting place, what was her average velocity during her 30min walk?
7. A car averaged 20m/s on a road trip to a city 400km away. How long did the trip take?
8. A tortoise can crawl 1.0m in 6 sec. What is his speed?
9. A hare (rabbit) can run 2.5 m/s. If he runs for 36 sec, how far did he run?
10. The tortoise and the hare were racing a distance of 100m. The hare stopped to take a nap 10m from the finish line and ended up losing the race. How long was his nap?

**Answers:** 1) 10k/h, 2.8m/s 2) 4m/s 3) 4.4m/s 4) 3.3m/s, 0m/s 5) 1080m (1.08km) 6) .011 m/s East 7) 20,000sec (5.5 hr) 8) .167m/s 9) 90m 10) at least 9min 20sec.

### 1D Acceleration Practice Problems

1. A car's velocity changes from 32 m/s to 96 m/s in an 8.0-s period. What is its acceleration?
2. Rocket-powered sleds are used to test the responses of humans to acceleration. Starting from *rest*, one sled can reach a speed of 244 m/s in 1.80 s. What is its acceleration?
3. A car with a velocity of 22 m/s is accelerated uniformly at the rate of  $1.5 \text{ m/s}^2$  for 6.0 s. What is its final velocity?
4. A supersonic jet flying at 150 m/s is accelerated uniformly at the rate of  $22 \text{ m/s}^2$  for 20.0 s. What is its final velocity?
5. Determine the displacement of a plane that is uniformly accelerated from 66 m/s to 88 m/s in 12 s.
6. How far does a plane fly in 15 s while its velocity is changing from 145 m/s to 75 m/s at a uniform rate of acceleration?
7. A skater is moving at 1.6m/s and then accelerates at  $.4\text{m/s}^2$  for 4 sec. How far did he travel during that motion?
8. A car is moving 12 m/s and coasts up a hill with a uniform acceleration of  $-1.0 \text{ m/s}^2$ . How far has it traveled after 6.0 s?
9. A plane travels 500 m while being accelerated uniformly from *rest* at the rate of  $5.0 \text{ m/s}^2$ . What final velocity does it attain?
10. A race car can be slowed with a constant acceleration of  $-11 \text{ m/s}^2$ . If the car is going 55 m/s, how many meters will it take to *stop*?

Answers: 1)  $8 \text{ m/s}^2$  2)  $136 \text{ m/s}^2$  3) 31 m/s 4) 590m/s 5)  $924 \text{ m/s}$  6) 1650m 7) 9.6m 8) 54m 9) 71m/s 10) 138m

### **Free Fall/Acceleration due to gravity**

1. A stone falls freely from *rest* for 8.0 s. Calculate the stone's velocity after 8.0 s.
2. How far does the stone in problem #1 fall in 8.0 sec?
3. A student drops a rock from a bridge to the water 12.0 m below. With what speed does the rock strike the water?
4. A weather balloon is floating at a 200m above Earth when it releases a pack of instruments. How long does the pack fall?
5. An astronaut drops a feather from 1.2 m above the surface of the moon. If the acceleration of gravity on the moon is  $-1.60 \text{ m/s}^2$ , how long does it take the feather to hit the surface?
6. How fast will the feather in problem #5 be moving when it hits the moon's surface?
7. During a baseball game, a batter hits a high pop-up. If the ball remains in the air for 6.0 s, how high does it rise?

Answers: 1) 78m/s 2) 314m 3) 15m/s 4) 6.4 sec 5) 1.2 sec 6) 2m/s 7) 44m