PHYSICS IN MOTION
gpb.org/physics-motion

Unit 2C

Acceleration and Kinematic Equations

Practice Problems

Name:

Date:

Work each of the following problems. SHOW ALL WORK.

1. A sports car accelerates from rest to 26.8 m/s (roughly 60 mi/h) in 5.1 seconds. What is the acceleration of the car?

2. A child goes down a slide, starting from rest. If the length of the slide is 2 m and it takes the child 3 seconds to go down the slide, what is the child's acceleration?

3. How far does a sled travel in 5 seconds while accelerating from 4 m/s to 10 m/s?

4. A fighter jet is catapulted off an aircraft carrier from rest to 75 m/s. If the aircraft carrier deck is 100 m long, what is the acceleration of the jet?

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5. A driver notices an upcoming speed limit change from 45 mi/h (20 m/s) to 25 mi/h (11 m/s). If she estimates the speed limit will change in 50 m, what acceleration is needed to reach the new speed limit before it begins?

6. One minute after takeoff, a rocket carrying the space shuttle into outer space reaches a speed of 447 m/s. What was the average acceleration of the rocket during that initial minute?

7. A sprinter accelerates from rest to a velocity of 12 m/s in the first 6 seconds of the 100-meter dash.
   a. How far does the sprinter travel during the first 6 seconds?

   b. How much farther does the sprinter have to travel to reach the finish line?

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c. If the sprinter travels at a constant velocity of 12 m/s for the last 64 m, how long will it take to reach the finish line?

8. The school zone in front of your school has a posted speed limit of 25 mi/h, which is about 11 m/s. Let's examine the stopping of a car in several different situations.

    a. The crossing guard holds up her stop sign, and the driver is paying attention well. The car moves at a constant velocity of 11 m/s for 2.3 seconds while the driver reacts, then slows down at a constant rate of -4.5 m/s^2. What is the stopping distance for the car in this situation?

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b. A child appears to be running into the street ahead. It takes 2.3 seconds for the driver to react and begin to brake, but this time at a rate of -7.5 m/s². What is the stopping distance for the car in this situation?

c. The driver is looking at her phone and has a total reaction time of 4.6 seconds as the car is moving at a constant speed of 11 m/s. If the driver slams on her brakes and slows down at a rate of -8.2 m/s², what is the stopping distance for the car in this situation?