Assignment 2.04 - The Kinematic Equations

1. You are in a plane that is taking off. It starts from a stop and accelerates at a rate of 5 m/s^2 until it leaves the ground 675 meters away.

   (a) What is the velocity that the plane is traveling with when it leaves the ground?

   (b) How long does it take the plane to travel the distance of the runway?

2. A cart is rolling down an inclined plane, and accelerates from rest at a constant rate of 0.5 m/s^2.

   (a) How far will the cart travel in 0.75 seconds?

   (b) What is the final velocity of the cart after 0.75 seconds?

3. A major league pitcher can cause a baseball to go from 0 m/s to 42 m/s over the distance of 1.2 meters.

   (a) Calculate the acceleration of the baseball.

   (b) How long does it take the pitcher to throw the ball (from when he starts to throw until the ball leaves his hand)?

4. The Space Shuttle Discovery begins its final launch from Cape Canaveral, Florida. At t=0s, the main engines start, and Discovery climbs toward the sky. 10 minutes later, Discovery is traveling 7.823 x 10^3 m/s.

   (a) What is Discovery's average acceleration?

   (b) How far does Discovery travel during this time?

5. Kirk and McCoy step off the edge of a 50-m high cliff on an alien planet. If gravity causes them to accelerate at 2.3 m/s^2,

   (a) What is their speed when they hit the water below?

   (b) How long are they falling toward the water?

6. A man is pushing a baby stroller on a hill when he is distracted by a text message. Starting from rest, the baby stroller begins to roll down the hill, accelerating at 0.1 m/s^2. If the man can run at a speed of 12 m/s, what is the longest amount of time he can spend reading his text message and still catch the stroller?