

Worksheet 3 - Kinematics Equations

1.
 - a) A snowmobile on a frozen pond is moving at 15.0 m/s when the driver decides to pass a slow-moving sled. If the driver accelerates to a speed of 19.5 m/s in a time of 4.00 seconds then what was the acceleration?
 - b) What distance will be covered by the snowmobile in the time that it takes to accelerate? Use the values from part (a).
 - c) A wagon is initially rolling UP a hill at a velocity of 4.6 m/s. The wagon is accelerated down the hill at 0.64 m/s^2 until its final velocity is 2.3 m/s DOWN the hill. Calculate the displacement from the initial position.
 - d) Your friend is on a quad is moving at 14.0 m/s when you breeze by on your bike. Your friend accelerates at 2.0 m/s^2 for 3.0 seconds. How far does she travel during this time?
 - e) An oil tanker, initially traveling *west* at 18 km/h is accelerated uniformly until it is traveling *east* at 21.6 km/h. The acceleration is 0.20 m/s^2 towards the *east*. Compute the total *displacement* from the tanker's initial position.
 - f) A corvette can accelerate during high speeds at about 2.0 m/s^2 . At this rate how long does it take the car to accelerate from 80 km/h to 160 km/h?
 - g) A snowmobile with an initial speed of 5.6 m/s travels 24.0 m in 2.0 s. What final speed does it attain? Express your answer first in m/s and then in km/hr.
 - h) A motorcycle with an initial speed of 2.2 m/s accelerates at 3.6 m/s^2 and covers a distance of 12.0 m. What is its final speed?
 - i) A hockey puck initially travelling to the right at 34 m/s is slowed down by rough ice at a rate of 2.0 m/s/s . It moves for 7.2 s before finally coming to rest. How far did it travel?
2. A car moves at 12 m/s for 30.0 seconds. It then accelerates at 1.5 m/s^2 for 8.00 seconds. Finally, it continues on at this top speed for another 12.0 seconds. Calculate the net displacement during the whole time interval.
3. A police cruiser is travelling at 20.0 m/s when the officer spies a speeder. The cruiser accelerates at 3.0 m/s^2 for 5.0 seconds, at which time the speeder pulls over and starts thinking up excuses to try and get out of getting a ticket. The cruiser then slows to a stop at 5.0 m/s^2 . How far does it go in the entire time?
4. A sprinter who is running a 250 m race accelerates from rest at 7.5 m/s^2 for 1.2 s and maintains this speed for the remainder of the race. What is her time for the race?

5. Superman is flying at an initial velocity of 33.5 m/s [N] when he decides to slow to 10.0 m/s [N] in a time of 8.05 s . He then continues at this velocity for 12.4 s before accelerating at 2.35 m/s^2 [N] until he reaches a final velocity of 23.8 m/s [N].
 - a) Calculate Superman's displacement in this time. (Hint: This motion has three unique parts)
 - b) Calculate Superman's average velocity for his entire flight.
6. A model rocket blasts off with a constant acceleration of 12.3 m/s^2 until its fuel runs out 10.2 s later. It then enters free fall for the remainder of its flight.
 - a) Calculate the maximum height above the ground reached by the model rocket.
 - b) Calculate the total time the rocket is in the air. (Careful: There are two different accelerations on the way up, but only one on the way down. This creates three parts to the motion.)
7. A rocket sled accelerates from rest for a distance of 645 m at 16.0 m/s^2 . A parachute is then used to slow it down to a stop. If the parachute gives the sled an acceleration of -18.2 m/s^2 and there is 500.0 m of sled track remaining after the shoot opens, will the sled stop before running off the track? Show why or why not?
8. On a 150 m straight sprint, a cyclist accelerates from rest for 4.5 s at 3.8 m/s^2 . How long will it take her to complete the 150 m track, assuming she maintains her speed for the remaining part of the track?
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10. A ski-doo moving at 12 m/s [W] accelerates at 6.0 m/s^2 [W]. How long will it take to experience a displacement of 63 m [W]?
11. Two cars accelerated uniformly from a stationary start on a straight racing track, Car A at 2.5 m/s^2 , and Car B at 2.0 m/s^2 .
 - (A) At what time were the cars separated by 25 m ?
 - (B) What was the speed of car A at the instant that the speed of car B was 14 m/s ?
12. A police car stopped at a set of lights has a speeder pass it at 100.0 km/h . If the police car can accelerate at 3.6 m/s^2 ,
 - (A) how long does it take to catch the speeder?
 - (B) how far would the police car have to go before it catches the speeder?
 - (C) what would be its speed when it caught up with the speeder? Is this speed reasonable?