

Kinematics Review

1. What is the difference between average velocity and instantaneous velocity?
2. What is the difference between velocity and speed?
3. What is the definition of acceleration?
4. A high-powered racing car accelerates from rest at a rate of 7.0 m/s^2 . How fast will it be moving after 10.0 s? Express your answer in m/s and km/h.
5. Avery, a frustrated physics student, drops a physics textbook off the top of the CN tower. If the tower is $5.3 \times 10^2 \text{ m}$ high, how long will the book take to reach the ground, assuming there is negligible air resistance?
6. If an electron inside a TV tube accelerates in a space of 5.0 cm from rest to 10.0% of the speed of light, what is its acceleration? (the speed of light is $3.00 \times 10^8 \text{ m/s}$)
7. Snoopy is taking off in his World War I biplane. He coasts down the runway at a speed of 40.0 m/s, then accelerates for 5.2 s at a rate of 4.90 m/s^2 . How fast is the plane moving after the 5.2 s?
8. A car accelerates from rest at 6.00 m/s^2 . How far does it move between 10.0 s and 15.0 s?
9. A skier accelerates steadily down a hill from 3.50 m/s to 11.40 m/s in 4.20 s.
 - a. What distance is travelled?
 - b. What is the average speed for the trip?
10. A child on a toboggan slides down a snowy hill, accelerating uniformly at 2.8 m/s^2 . When the toboggan passes the first observer, it is travelling with a speed of 1.4 m/s. How fast will it be moving when it passes a second observer who is 2.5 m downhill from the first observer?
11. A space vehicle is orbiting the earth at a speed of $7.58 \times 10^3 \text{ m/s}$. In preparation for a return to earth, it fires retro-rockets which provide an acceleration in the opposite direction of 78.4 m/s^2 . Ignoring any change in altitude that might occur, how long will it take the vehicle to slow down to $1.52 \times 10^3 \text{ m/s}$?
12. A truck is moving along at 80 km/h when it hits a gravel patch, which causes it to accelerate in the opposite direction at 1.4 m/s^2 . How far will the truck travel before it slows down to 20.0 km/h?
13. A woman biker is driving along the highway at 80.0 km/h, in a 60 km/h speed zone. She sees a police car ahead, so she brakes so her bike accelerates in the opposite direction at 2.22 m/s^2 . How far along the road will she travel before she is at the legal speed limit?

14. Spiderman is crawling up a building at a rate of 0.50 m/s . Seeing Spiderwoman 56 m ahead of him, he accelerates at a rate of 2.3 m/s^2 .
- How fast will he be moving when he reaches Spiderwoman?
 - How much time will it take to reach Spiderwoman?
 - When he reaches Spiderwoman, Spiderman discovers that she is a Black Widow and, as you may know, Black Widows eat their mates! If he is 200.00 m from the road below, how long will it take him to fall to the safety of the road.
15. A stone is dropped from the top of a tall building. How long will the stone take to pass a window that is 2.0 m high if the top of the window is 20.0 m below the point from which the stone is dropped?
16. An arrow shot straight up into the air at 50.0 m/s accelerates downward at 9.8 m/s^2 until it reaches a speed of zero at its peak. Draw a velocity vs. time graph of this motion.

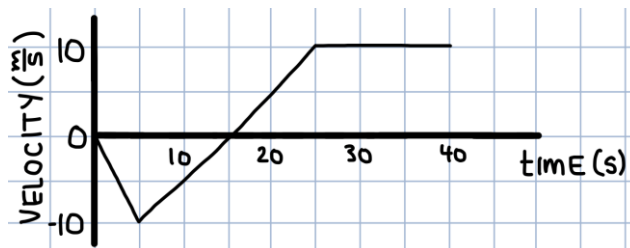
17. Use the following position vs. time graph to answer the following:

- What is the total displacement of the car between 90 and 150 s ?
- When is the car moving in the positive direction?
- What is the velocity of the car between 0 and 30 s ?
- What is the instantaneous velocity of the car at 60 s ?
- What is the average speed of the car between 0 and 150 s ?



18. Use the following velocity vs. time graph to answer the following:

- When is the car moving in the positive direction?
- When does the car have a positive acceleration?
- Describe the motion of the car from 25 to 40 s .
- What is the total displacement of the car over the 40 s ?
- What is the total distance travelled by the car over the 40 s ?
- What is the average velocity of the car over the 40 s ?



19. A glider on an air track is made to accelerate uniformly by tilting the track at a slight angle. The distance travelled by the glider was measured at the end of each 0.10 s interval and the following data was gathered:

distance d (cm)	0	0.025	0.100	0.225	0.400	0.625
time t (s)	0	0.100	0.200	0.300	0.400	0.500

- Plot a graph with distance, d , on the y-axis and time, t , on the x-axis.
- Plot a second graph with d on the y-axis and t^2 on the x-axis.
- Calculate the slope of your second graph to figure out the acceleration of the glider on the air track.