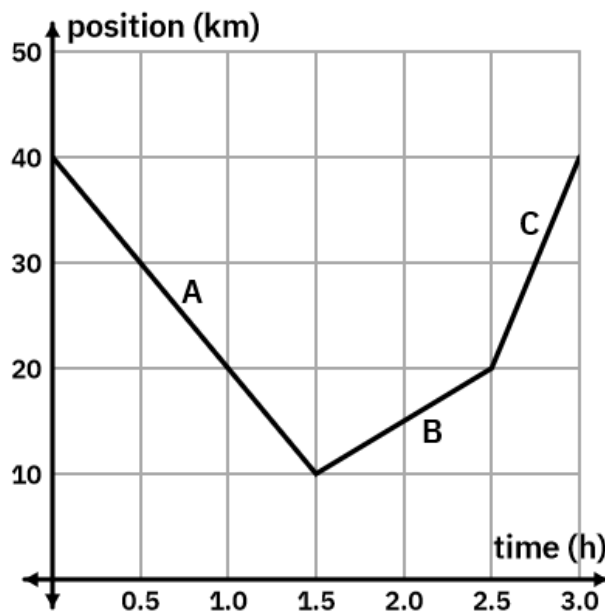


Kinematics Worksheet 3

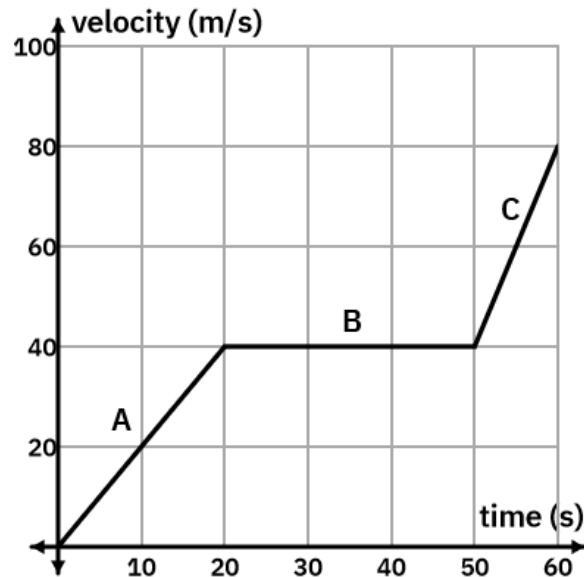
1. Electrons move through a certain electric circuit at an average speed of 1.1×10^{-2} m/s. How long (in minutes) does it take an electron to traverse 1.5 m of wire in the filament of a light bulb?
2. A cheetah is hunting. Its prey runs for 3.0 s at a constant velocity of +9.0 m/s. Starting from rest, what constant acceleration must the cheetah maintain in order to run the same distance as its prey runs in the same time?
3. An Olympic-class sprinter starts a race with an acceleration of 4.50 m/s^2 .
 - (a) What is her speed 2.40 s later?
 - (b) Sketch a position-time graph for the sprinter.
4. A well-thrown ball is caught in a well-padded mitt. If the acceleration of the ball is $-2.10 \times 10^4 \text{ m/s}^2$, and 1.85×10^{-3} s elapses from the time the ball first touches the mitt until it stops, what was the initial velocity of the ball?
5. A bullet in a gun is accelerated from the firing chamber to the end of the barrel at an average rate of $6.20 \times 10^5 \text{ m/s}^2$ for 8.10×10^{-4} s. What is its muzzle velocity, that is, its final velocity?
6. A jet is taking off from the deck of an aircraft carrier. Starting from rest, the jet is catapulted with a constant acceleration of $+31 \text{ m/s}^2$ along a straight line and reaches a velocity of +62 m/s. Find the displacement of the jet.
7. A ball is dropped from a building and takes 6.8 s to hit the ground.
 - (a) What is the height of the building?
 - (b) What is the velocity of the ball when it hits the ground?
8. A bullet is shot straight up in to the air from ground level at a velocity of 234 m/s.
 - (a) How high does the bullet go?
 - (b) What is the velocity of the bullet when it hits the ground?
 - (c) How long is the bullet in the air?
9. A dynamite blast at a quarry launches a chunk of rock straight upward, and 2.0 s later it is rising at a speed of 15 m/s. Assuming air resistance has no effect on the rock, calculate its speed at launch.
10. A ball is thrown vertically upward, which is the positive direction. A little later it returns to its point of release. The ball is in the air for a total time of 8.0 s. What is its initial velocity? Neglect air resistance.
11. An astronaut on a distant planet wants to determine its acceleration due to gravity. The astronaut throws a rock straight up with a velocity of +15 m/s and measures a time of 20.0 s before the rock returns to his hand. What is the acceleration (magnitude and direction) due to gravity on this planet?

12. A hot-air balloon is rising upward with a constant speed of 2.50 m/s. When the balloon is 3.00 m above the ground, the balloonist accidentally drops a compass over the side of the balloon. How much time elapses before the compass hits the ground?
13. A woman on a bridge 75.0 m high sees a raft floating at a constant speed on the river below. Trying to hit the raft, she drops a stone from rest when the raft has 7.00 m more to travel before passing under the bridge. The stone hits the water 4.00 m in front of the raft. Find the speed of the raft.
14. Two identical pellet guns are fired simultaneously from the edge of a cliff. These guns impart an initial speed of 30.0 m/s to each pellet. Gun A is fired straight upward, with the pellet going up and then falling back down, eventually hitting the ground beneath the cliff. Gun B is fired straight downward. In the absence of air resistance, how long after pellet B hits the ground does pellet A hit the ground?
15. A cement block accidentally falls from rest from the ledge of a 53.0 m high building. When the block is 14.0 m above the ground, a man, 2.00 m tall, looks up and notices that the block is directly above him. How much time, at most, does the man have to get out of the way?
16. A ball is thrown straight upward. At 4.00 m above its launch point, the ball's speed is one-half its launch speed. What maximum height above its launch point does the ball attain?
17. A bus makes a trip according to the following position-time graph.



- (a) What is the average velocity (magnitude and direction) of the bus during each of the segments A, B, and C? Express your answers in km/h.
- (b) What is the average velocity for the entire trip?

18. A snowmobile moves according to the following velocity-time graph.



- (a) What is the snowmobile's average acceleration during each of the segments A, B, and C?
 - (b) What is the snowmobile's average acceleration over the whole trip?
 - (c) What is the displacement of the snowmobile over the whole trip?
19. At the beginning of a basketball game, a referee tosses the ball straight up with a speed of 4.6 m/s. A player cannot touch the ball until after it reaches its maximum height and begins to fall down. What is the minimum time that a player must wait before touching the ball?
20. Two cars cover the same distance in a straight line. Car A covers the distance at a constant velocity. Car B starts from rest and maintains a constant acceleration. Both cars cover a distance of 460 m in 210 s. Assume that they are moving in the +x direction. Determine
- (a) the constant velocity of car A.
 - (b) the final velocity of car B.
 - (c) the acceleration of car B.