



# Kinematics Problems

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Part A

1. The speed of light is 300,000,000 m/s. The speed of sound is 344 m/s. A flash of lightning occurs in a storm 10,000 m away. How many seconds does it take for us to see the lightning and hear the thunder? [hint: find the times for both and note that the acceleration in both cases is zero! Just use the speed equation]



2. A MagLev train travelling at 40 km/h accelerates at  $-2.3 \text{ m/s}^2$  for 2.7 seconds. How far has it travelled in that time? What is its final velocity?



3. A truck starts at rest and accelerates at  $2.0 \text{ m/s}^2$ .

- How fast is it going after 6.0 s?
- How far has it gone in 6.0 s?
- What is the average velocity over the first 12.0 s?
- How far has it gone by the time it reaches a speed of  $20.0 \text{ m/s}$ ?



4. A really cool disc shaped spacecraft travelling at a velocity of  $+1210 \text{ m/s}$  begins uniformly accelerating at  $-23 \text{ m/s}^2$ . If the acceleration lasts for 8.68 s, what is the final velocity of the craft?



5. An electric skateboard accelerates at  $2.0 \text{ m/s}^2$  for a distance of 20 m. If the original velocity of the skateboard was  $3.0 \text{ m/s}$ , what is the final velocity?



6. Graham is driving his race-car travelling at  $50 \text{ m/s}$  when the brakes are applied. The car decelerates at  $2.0 \text{ m/s}^2$ . How long does it take the race-car to travel a distance of 55 m during the braking?



7. If 100 m sprinters accelerate from rest for 3.5 s at  $2.8 \text{ m/s}^2$ , how far have they run at this point? How long will it take them to complete the 100 m sprint, assuming they maintain their speed the rest of the way? (Two step problem)



8. A dragster accelerates from rest for a distance of 450 m at  $14 \text{ m/s}^2$ . A parachute is then used to slow it down to a stop. If the parachute gives the dragster an acceleration of  $-7.0 \text{ m/s}^2$ , how far has the dragster travelled before stopping?



9. Maddison is performing a simple physics experiment. She drops a large rock from a bridge into a river. If the time required to drop is 3.2 s, determine the velocity that the rock has just as it hits the water? How high was the bridge? [ $a = 9.8 \text{ m/s}^2$ ]



10. A cat is dropped from a bridge (and will land safely in a net far below). How far does it drop in the eighth second? **Note:** this is the distance travelled between the 7<sup>th</sup> and 8<sup>th</sup> second. [  $a = 9.8 \text{ m/s}^2$  ]
11. A student launches a potato canon from ground level, straight into the air.
- The potato takes 3.67 seconds to reach the maximum height. Calculate the initial speed of the potato.
  - Calculate the speed of the potato at  $t = 1.4$  seconds and 4.7 seconds.
  - Calculate the time it takes the potato to reach the ground after it is launched.



## Part B

12. A bizarre parcel service uses a balloon to deliver packages. A balloon is ascending (rising) at a rate of 9.0 m/s and has reached a height of 80 m above the ground when it releases a package. How long does the package take to reach the ground? (  $a = 9.8 \text{ m/s}^2$  [down] *Hint:* if you jump out of a car going 100 km/h how fast are you initially travelling before you hit the pavement? Use this example to think about the initial speed of the package as it leaves the balloon)
13. Super Turtle is moving with constant acceleration covers the distance between two points 60 m apart in 6.0 s. Its velocity as it passes the second point is 15 m/s.
- What is the speed at the first point?
  - What is the constant acceleration?
  - How far behind the first point was the Super Turtle at rest?



## Part C

14. A police car stopped at a set of lights has a speeder pass it at 25 m/s/s. If the police car can accelerate (from rest) at 3.6 m/s/s,
- How long does it take to catch the speeder?
  - How far would the police car have to go before it catches the speeder?
  - What would its speed be when it caught up with the car? Is this speed reasonable?
15. Super woman is hovering above the ground when a person free-falling goes by her at a terminal velocity (constant maximum speed) of 140 km/h. Unfortunately, the parachute does not open. Fortunately, Superwoman is around. If it takes her 1.9 s to realize the person is in a lot of trouble, what must her acceleration be if she is to catch the parachutist just before she hits the ground 1000 m below.

