**Constant Acceleration Practice Problems**

1. Sketch the velocity-time graphs for the following motions.
   1. a city bus that is moving with a constant velocity
   2. a wheelbarrow that is speeding up at a uniform rate of acceleration while moving in the positive direction
   3. a tiger that is speeding up at a uniform rate of acceleration while moving in the negative direction
   4. an iguana that is slowing down at a uniform rate of acceleration while moving in the positive direction
   5. a camel that is slowing down at a uniform rate of acceleration while moving in the negative direction



1. The strobe photographs to the right show a disk moving from left to right under different conditions. The time interval between images is constant.

Assuming that the direction to the right is positive, identify the following types of motion in each photograph.

* 1. the acceleration is positive
  2. the acceleration is negative
  3. the velocity is constant

1. If a car is traveling eastward, can its acceleration be westward? Explain, and use examples.
2. A car traveling at +7.0 m/s accelerates at the rate of +0.80 m/s² for an interval of 2.0 s. Find final velocity. *(+8.6 m/s)*
3. An ice cream truck travelling at 33 m/s due east comes to a halt when a child runs in the street. The truck decelerates at a rate of 11 m/s2. If the child is 12 m from the truck initially, will the truck have enough distance to stop? *(No, it takes 49.5 m to stop)*
4. With the plane standing on the runway, the pilot brings the engines to full thrust before releasing the brakes. The aircraft accelerates at 2.9 m/s2 and reaches a takeoff speed of 58 m/s.
   1. Calculate the time from rest to takeoff. *(20 s)*
   2. Determine the displacement of the plane. *(580 m)*
5. A penny is dropped from the top of the Sears Tower in Chicago. Classic. Considering that the height of the building is 427 m, and ignoring air resistance, calculate the speed of the penny when the penny strikes the ground. *(91.5 m/s)*
6. A car moving westward along a straight, level road increases its velocity uniformly from +16 m/s to +32 m/s in 10.0 s.
   1. What is the car’s acceleration? *(+1.6 m/s²)*
   2. What is the average velocity? *(+24 m/s)*
   3. How far did it move during while accelerating? *(240 m)*
7. A car accelerates uniformly from rest to a speed of 65 km/h (18 m/s) in 12 s. Find the distance the car travels during this time. *(108 m)*
8. A plane lands with a velocity of +120 m/s and accelerates at a maximum rate of -6.0 m/s².
   1. From the instant the plane touches the runway, what is the minimum time needed before it can come to rest? *(20 s)*
   2. Can this plane land on a naval aircraft carrier where the runway is 0.80 km long? *(No, needs at least 1.2 km to land)*
9. Suppose a car is travelling at 12.0 m/s, and the driver sees a traffic light turn red. After 0.510 s has elapsed (the driver’s reaction time), the driver applies the brakes, and the car decelerates at 6.20 m/s2. What is the stopping distance, as measured from the point where the driver first sees the red light? *(17.7 m)*
10. A locomotive accelerating at 1.6 m/s2 passes through a 20.0 m wide crossing in a time of 2.4 s. After the locomotive leaves the crossing, how much time is required until its speed reaches 32 m/s? *(13.6 s)*
11. An elevator is moving upward 1.20 m/s when it experiences an acceleration of 0.31 m/s² downward, over a distance of 0.75 m. What will its final velocity be? *(0.99 m/s)*
12. A ball is thrown vertically upward.
    1. What happens to the ball’s velocity while the ball is in the air?
    2. What is its velocity when it reaches its maximum altitude?
    3. What is its acceleration when it reaches its maximum altitude?
    4. What is its acceleration just before it hits the ground?
    5. Does its acceleration increase, decrease, or remain constant?
13. A small fish is dropped by a pelican that is rising steadily at 0.50 m/s.
    1. After 2.5 s, what is the velocity of the fish? *(-24 m/s)*
    2. How far below the pelican is the fish after 2.5 s? *(31 m)*
14. A parachutist descending at a speed of 10.0 m/s loses a shoe at an altitude of 50.0 m.
    1. When does the shoe reach the ground? *(2.33 s)*
    2. What is the velocity of the shoe just before it hits the ground? *(-32.9 m/s)*
15. A mountain climber stands at the top of a 50.0 m cliff hanging over a calm pool of water. The climber throws two stones vertically 1.0 s apart and observes that they cause a single splash when they hit the water. The first stone has an initial velocity of +2.0 m/s.
    1. How long after release of the first stone will the two stones hit the water? *(3.40s)*
    2. What is the initial velocity of the second stone when it is thrown? *(-9.2 m/s)*
    3. What will the velocity of each stone be at the instant both stones hit the water?

*(-31 m/s; -33 m/s)*

1. A model rocket is launched straight upward with an initial speed of 50.0 m/s. It accelerates with a constant upward acceleration of 2.00 m/s² until its engines stop at an altitude of 150 m.
   1. What is the maximum height reached by the rocket? *(310 m)*
   2. When does the rocket reach maximum height? *(8.5 s)*
   3. How long is the rocket in the air? *(16.4 s)*
2. A boy runs away from his father at a constant speed of 5 m/s. The father allows the boy a head start of 15 meters before starting to run towards his son. If he wants to catch his son after he has run a total distance (from his initial, at rest position) of 40 meters, at what constant speed must he run to catch him? *(8 m/s)*