

Free Fall

Conceptual Questions

1. If an object is accelerating, the velocity of the object (CHANGES, STAYS THE SAME)
2. An object is thrown upwards. The velocity of the object at its highest point is _____.
3. If the object had a zero velocity, would the object be moving? (YES, NO)
4. A ball is thrown straight up in the air.
 - (a) Is the velocity changing before it is at its highest point? (YES, NO)
 - (b) Is the velocity changing after it is at its highest point? (YES, NO)
 - (c) Is the velocity changing at its highest point? (YES, NO)
 - (d) Is the object accelerating at its highest point? (YES, NO).
5. You stand on a table and throw a ball up at a speed of 10.0 m/s. Your friend is lying on the floor and catches the ball. Just before your friend catches the ball, the ball is moving (THE SAME SPEED, FASTER THAN, SLOWER THAN) you threw it.

Problems

1. To celebrate a victory, a pitcher throws her glove straight upward with an initial speed of 6.0 m/s.
 - (a) How long does it take for the glove to return to the pitcher?
 - (b) How long does it take for the glove to reach its maximum height?
2. On a hot summer day several swimmers decide to dive from a railroad bridge into the river below. The swimmers step off the bridge and hit the water approximately 1.5 s later.
 - (a) How high is the bridge?
 - (b) How fast are the swimmers moving when they hit the water?
3. An astronaut on the Moon drops a rock straight downward from a height of 0.95 m. The acceleration of gravity on the Moon is 1.62 m/s^2 .
 - (a) What is the speed of the rock when it lands?
 - (b) How long does the rock take to hit the ground?
4. A football is kicked straight up at a speed of 30.0 m/s. How high does the ball go? Assume the height of the ball is measured from the point where it leaves the kickers foot.
5. Consider a rifle fired straight down from a high-altitude balloon. The muzzle velocity is 100.0 m/s and air resistance can be neglected. Calculate the velocity of the bullet after one second.
6. How fast must a ball be thrown straight upward that it remains in the air for 10.0 seconds?

7. Ball A is thrown upwards at 40 m/s off the edge of building 20 m high. Ball B is dropped off the edge of the building. Ball C is thrown downwards at 20 m/s off the edge of the building. Which ball hits the ground at the fastest speed? Show your work.
8. A ball is thrown upward with a velocity of 20.0 m/s. How long after leaving the thrower's hand will the ball have a velocity of
 - (a) 10 m/s upwards?
 - (b) 10 m/s downwards?
9. A ball is thrown vertically upward from a point near the corner of the roof of a tall building. It just misses the corner on the way down and passes a point 50 m below its starting point 5 s after it leaves the thrower's hand.
 - (a) What was the initial velocity of the ball?
 - (b) How high did it rise above its starting point?
10. When a kid drops a rock off the edge of a cliff, it takes 4.0 s to reach the ground below. When he throws the rock down, it strikes the ground in 3.0 s. What initial velocity did he give the rock?