

Freefall

(Take $g = -9.8 \text{ m/s}^2$ unless otherwise stated.)

1. A ball is dropped from rest.
 - a. What is its velocity after 1.0 s?
 - b. A ball is dropped from rest. How far does it fall in 1.0 s?
2. A physics student drops a textbook from rest. If it takes 2.1 s to hit the ground, from what height did it fall?
3. A ball is dropped from a height of 20.0 m. What is its final velocity when it reaches the ground?
4. A flowerpot falls from a windowsill 36.0 m above the sidewalk.
 - a. What is its velocity when it strikes the ground?
 - b. How long does it take to reach the ground?
5. A ball is thrown upward at 20.0 m/s. What is its velocity after 3.0 s?
6. A ball is thrown upward at 15.0 m/s. How much time does it take to reach its maximum height?
7. A tennis ball is thrown straight upward. If it rises to a maximum height of 99.0 m, what was its initial velocity?
8. An object is thrown upward with 40.0 m/s from the top of a 50.0 m building. What maximum height above the ground does it reach?
9. A bullet is shot vertically upward. If the bullet's total time in the air is 10.0 s, what was its initial velocity?
10. A ball is thrown upward at 30.0 m/s.
 - (a) How high is it after 2.0 s?
 - (b) What is its velocity at that instant?
11. A ball is thrown upward at 20.0 m/s from a 10.0 m balcony. What is its displacement after 3.0 s?
12. A ball is thrown upward at 25.0 m/s from the top of a 15.0 m building.
 - (a) Calculate the speed of the ball when it strikes the ground.
 - (b) State whether the final velocity is upward or downward.
 - (c) Calculate the time it takes for the ball to reach the ground.
13. A ball is thrown upward at 36.0 m/s. How long before it returns to the ground?
14. An object is thrown straight downward at 10.0 m/s. What is its velocity after 3.0 s?

15. A brick is thrown straight downward at 25.0 m/s from the roof of a building. If it strikes the ground in 2.0 s , how tall is the building?
16. A toy rocket is launched straight upward with an acceleration of 10.0 m/s^2 for 3.0 s . After its fuel is used up, it continues upward under the influence of gravity. How high does the rocket go?
17. A ball is thrown upward at 20.0 m/s from a balcony 60.0 m above the ground.
- (a) Determine the speed of the ball when it passes a height of 80.0 m .
 - (b) Explain why the ball passes this point twice.
 - (c) Find the time at which the ball first passes 80.0 m (on the way up).
 - (d) Use the same formula to find the time when it passes 80.0 m again (on the way down).
18. A ball is thrown upward at 25.0 m/s from ground level.
- (a) Calculate the speed of the ball when it is at a height of 20.0 m .
 - (b) Determine the time when the ball passes 20.0 m on the way up.
 - (c) Find the time when the ball passes 20.0 m on the way down.
 - (d) How much total time does the ball spend above 20.0 m ?