

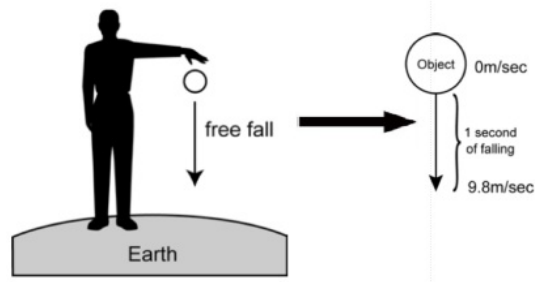


PHYSICS 3204
Worksheet 1: Free Fall

Student Name: _____

The equations of kinematics for uniform acceleration also apply to the special case of an object that is accelerating near the earth's surface. Acceleration due to gravity is known to be 9.8 meters/second/second or 9.8 m/sec^2 and is represented by g . Three conditions must be met before we can use this acceleration:

- (1) the object must be in free fall
- (2) the object must have negligible air resistance
- (3) the object must be close to the surface of Earth.



There are a few unique features to solving freefall problems.

- a) acceleration is always constant at $g = -9.80 \text{ m/s}^2$ (the negative is very important)
- b) at the top of its flight, an object has $v = 0$. (since it must stop before starting to come down again)
- c) keeping your sign conventions for direction is very important...all velocity directed down must be negative, and all velocity directed up must be positive.

PART A: MULTIPLE CHOICE

1. An object is thrown downwards from the top of a tall bridge with an initial velocity of 12 m/s. What is the speed of the object when it has fallen 9.5 m?
 - (A) 12 m/s
 - (B) 14 m/s
 - (C) 16 m/s
 - (D) 18 m/s
2. An object is thrown vertically upwards with an initial velocity of 6.8 m/s. How far does it travel in 0.60 s?
 - (A) 1.1 m
 - (B) 2.3 m
 - (C) 4.1 m
 - (D) 5.8 m
3. A rock is thrown upwards from the second story window of an apartment building with an initial velocity of 6.80 m/s. What is the speed of the rock as it falls past the first story window located 3.25 m directly below the starting position?
 - (A) 4.18 m/s
 - (B) 7.98 m/s
 - (C) 8.40 m/s
 - (D) 10.5 m/s
4. A ball is tossed straight up with an initial velocity of 5.0 m/s. What is the speed of the ball at its maximum height?
 - (A) 0.0m/s
 - (B) 5.0 m/s
 - (C) 9.8 m/s
 - (D) 14.8 m/s

5. An iPod rests on a 1.2 m high table. How much time does it take to fall to the floor?
- (A) 0.24 s
 (B) 0.49 s
 (C) 1.9 s
 (D) 3.7 s
6. An object is thrown vertically upwards from the Earth. While it is rising, what is true about its velocity and acceleration?
- (A) Velocity is upward and its acceleration is downward
 (B) Velocity is upward and its acceleration is upward
 (C) Velocity is downwards and its acceleration is downward
 (D) Velocity is downward and its acceleration is upward
7. A ball thrown vertically upward reaches a maximum height of 30.0 m above the surface of Earth. At its maximum height, the speed of the ball is
- (A) 0.0 m/s
 (B) 3.1 m/s
 (C) 9.8 m/s
 (D) 24 m/s
8. A rock is dropped from a cliff. It takes 5.88 s for the rock to reach the bottom of the cliff. What is the height of the cliff?
- (A) 28.8 m
 (B) 57.6 m
 (C) 169 m
 (D) 339 m
9. A girl uses a slingshot to fire a stone straight upwards at 24 m/s. What is the stone's velocity 3.0 s later?
- (A) 5.4 m/s [down]
 (B) 5.4 m/s [up]
 (C) 53.4 m/s [up]
 (D) 53.4 m/s [down]
10. A tourist throws a rock at 8.0 m/s [down] from the top of the CN tower. What is the rock's displacement at 6.0 s?
- (A) 2.2×10^2 m
 (B) -2.2×10^2 m
 (C) 1.2×10^2 m
 (D) -1.2×10^2 m
11. A ball is thrown upwards at 49 m/s. How much time elapses before it reaches its maximum height?
- ✓ (A) 5s
 (B) 10s
 (C) 49s
 (D) 98s
12. A stone is thrown straight downward from a 15 m high bridge. If it hits the water at 22 m/s, what was its initial velocity?
- ✓ (A) 11 m/s [down]
 (B) 14 m/s [down]
 (C) 28 m/s [down]
 (D) 330 m/s [down]

PART B: WRITTEN RESPONSE

Solve the followings using g of 9.80 m/s/s on Earth.



1. A steel ball falls from a height of 15.0m above the ground. How fast will it be travelling when it strikes the ground? **17.1 m/s**
2. An apple falls from a tree, if the time of the fall was 0.50s , from what height did the apple fall? **1.2m**
3. A book falls from a shelf that is 1.75m above the floor. How long will it take the book to reach the floor? **0.598 s**
4. If you drop a coin from a height of 9.50m above the ground, how fast will it be travelling when it reached the ground? **13.6 m/s**
5. An object is dropped from the roof of a building. If the object takes 2.5 s to reach the ground, what was the velocity of the object when it reached the ground? **25 m/s**

6. A rock is thrown vertically downward from a bridge over a river. If the rock was released when it was 11.2m above the water, and it took 0.550 s for the rock to reach the water, what was the velocity of the rock when it was released? **11.7 m/s**

7. An egg is thrown vertically downward from a window. If the egg was released with a velocity of 10.0 m/s and strikes the ground at a velocity of 25.0 m/s, how long did it take the egg to reach the ground? **1.53 s**

8. A rock is thrown vertically downward. If the rock was released with a velocity of 5.0 m/s and it hits the ground below at a velocity of 15.0 m/s, from what height was the rock released? **10.2 m/s**

9. An object is thrown vertically downward. If the object hits the ground with a velocity of 10.0 m/s and it fell for 0.880 s, at what velocity was the object released? **1.38 m/s**

10. A steel ball is dropped from a height of 50.0m. How far does this ball travel during the third second? **24.5 m**

11. When an object is dropped from a height of 10.0 m above the surface of planet X, it takes 1.20 s for the object to reach the surface. What is the acceleration of a falling object near the surface of this planet? **13.9 m/s²**

12. When an object is dropped from a height of 24.0 m above the surface of Planet Z, it hits the surface at a velocity of 19.6 m/s. What is the acceleration of a falling object near the surface of this planet? **8.00 m/s²**

13. When an object is dropped near the surface of Planet F, it reached a velocity of 11.0 m/s in 1.5 s. What is the acceleration of a falling object near the surface of Planet F? **7.3 m/s²**

14. A rock is thrown vertically downward travels 10.0 m before hitting the ground. If it strikes the ground at a velocity of 15.0 m/s, how long did it take to reach the ground? **0.981 s**