
Type II Projectiles

1. Draw a velocity vector diagram and determine the horizontal and vertical components of velocity for the following situations:

a) An Olympic javelin thrower releases the javelin at 30 m/s at an angle of 40° above the horizontal.

$$V_x = \underline{\hspace{2cm}}, V_y = \underline{\hspace{2cm}}$$

b) While skateboarding a student leaves a jump at 20° and velocity 5.0 m/s.

$$V_x = \underline{\hspace{2cm}}, V_y = \underline{\hspace{2cm}}$$

c) A football kickoff is moving with an initial velocity of 20 m/s at 58° above the field.

$$V_x = \underline{\hspace{2cm}}, V_y = \underline{\hspace{2cm}}$$

d) A small electric current zaps a frog causing it to jump at 2.0 m/s on an angle of 30° .

$$V_x = \underline{\hspace{2cm}}, V_y = \underline{\hspace{2cm}}$$

e) A golfer strikes a ball giving it a velocity of 35m/s at 70° .

$$V_x = \underline{\hspace{2cm}}, V_y = \underline{\hspace{2cm}}$$

2. A cannon fires a cannonball at a velocity of 208 m/s at an angle of 56° . Determine

a) the maximum height the cannonball reaches.

b) the range of the cannonball.

c) the time of flight.

3. A rifle fires a bullet at a velocity of 500.0 m/s at an angle of 16° . Determine:
 - a) the maximum height the bullet reaches.

 - b) the range of the bullet.

 - c) the time of flight of the bullet.

4. A baseball is hit at 30.0 m/s on an angle of 40° .
 - a) What is its maximum height?

 - b) What is the vertical velocity of the baseball 3.0 s after leaving the bat? is it moving up or down?

 - c) What is the vertical velocity of the baseball when it reaches a height of 10 m?

5. A ball is thrown horizontally at 10 m/s and hits the ground 5.0 seconds later. From what height was it thrown, and what horizontal distance did it go? (Type 1)

6. A cannon is fired at 200 m/s and 30° above the horizon. Calculate the range, max height and velocity at the max height for the cannon ball.

7. What is the range of a projectile whose initial velocity is 417 m/s at an angle of 60° .
8. A rock is thrown from a level field with an initial vertical component of 19.6 m/s and a horizontal component of 9.8 m/s. If frictional forces are considered negligible, what is the horizontal speed of the ball at the top of its path?
9. A ball with a speed of 5.7 m/s rolls along a horizontal table 1.4 m high and falls off the edge. (Air friction is insignificant.) How long does the ball take to fall to the floor?
10. A projectile is fired at 95 m/s at an angle of 22° above the horizontal.
- a) Calculate the **horizontal** displacement of the projectile after 2.3 seconds.
- b) Calculate the **vertical** displacement of the projectile after 2.3 seconds.
11. A 51 g golf ball is projected upwards from a level field with an initial vertical component of 19.6 m/s and a horizontal component of 9.8 m/s. Frictional forces are considered negligible.
- a) What is the total time that the ball remains in the air?
- b) What is the range of the ball?

12. A boy throws a ball upwards. While the ball is rising its: (select one)
- A. velocity and acceleration are both decreasing significantly.
 - B. velocity and acceleration are both downwards.
 - C. velocity is upward and its acceleration is downwards.
 - D. velocity and acceleration are both upward.
13. What is the range and max height of an artillery shell fired at 417 m/s and angle 30.2° , and what is its total velocity after 34.0 seconds?
14. An air rifle is to shoot a target, which is 80.0 m away at the same height. If the bullet leaves the muzzle at 20° what was the initial velocity (magnitude only) of the pellet?

Answers: 1a. 23.0 m/s, 19.3 m/s, b. 4.7 m/s, 1.7 m/s, c. 10.6 m/s, 17.0 m/s, d. 1.7 m/s, 1.0 m/s, e. 12.0 m/s, 32.9 m/s, 2a. 1516 m, b. 4092 m, c. 35.2 s, 3a. 969 m, b. 13500 m, c. 28.1 s 4a. 19 m, b. -10.1 m/s, down, c. 13.3 m/s, 5) 123m, 50.0 m 6) 3.53×10^3 m, 510m, 173 m/s [horizontal] 7) 1.54×10^4 m, 8. 9.8 m/s, 9. 0.53 s, 10. 203 m, 11a. 4.0 s, b. 39.2 m, 12. C, 13) 1.54×10^4 m, 381 m/s at 19° down from horizontal 14. 34.9 m/s