

Projectile Motion Worksheet

- A ball is thrown horizontally from the top of a vertical cliff. The cliff is 50 m high and the ball lands 60 m from the bottom of the cliff.
 - How long does it take for the ball to reach the bottom of the cliff?
 - What is the horizontal speed of the ball?
 - What is the vertical speed of the ball as it lands?
- A tennis ball is hit horizontally from the top of a high building. It takes 4 seconds to reach the ground and it lands 80 m from the building.
 - What is the height of the building?
 - At what vertical velocity does the ball hit the ground?
 - What is its horizontal velocity?
 - What is its resultant velocity and at what angle does it hit the ground?
- An object is projected horizontally at a speed of 16m /s into the sea from a cliff top of height 45.0m. Calculate:
 - how long it takes to reach the sea.
 - how far it travels horizontally.
 - its impact vertical velocity.
- On August 25, 1894, Chicago catcher William Schriver caught a baseball thrown from the top of the Washington Monument (169.16 m).
 - If the ball was thrown horizontally from the top of the monument with a speed of 5.00 m/s, where did it land?
 - What was the ball's speed and direction of motion when caught?
- A swimmer runs horizontally off a diving board with a speed of 2.50 m/s and hits the water a horizontal distance of 1.96 m from the end of the board.
 - How high above the water was the diving board?
 - If the swimmer runs off the board with a reduced speed, does it take more, less, or the same time to reach the water?
- The great, grey-green Zambezi River flows over Victoria Falls in south central Africa. The falls are approximately 108 m high. If the river is flowing horizontally at 3.60 m/s just before going over the falls, what is the speed of the water when it hits the bottom? Assume the water is in free-fall as it drops.
- A mountain climber jumps a 3.0-m wide crevasse by leaping horizontally with a speed of 8.0 m/s. If the climber's direction of motion on landing is 45° below the horizontal, what is the height difference between the two sides of the crevasse?

8. A scientist wants to find out how fast he can throw a ball. He throws the ball horizontally from a height of 2 m and it lands 20 m away from where he is standing. Calculate the original velocity of the ball.
9. An astronaut on the planet Zircon tosses a rock horizontally with a speed of 6.75 m/s. The rock falls through a vertical distance of 1.20 m and lands a horizontal distance of 8.95 m from the astronaut. What is the acceleration of gravity on Zircon?
10. Pitcher's mounds are raised to compensate for the vertical drop of the ball as it travels 18 m to the catcher.
 - (a) If a pitch is thrown horizontally with an initial speed of 32 m/s, how far does it drop by the time it reaches the catcher?
 - (b) If the speed of the pitch is increased, does the drop distance increase, decrease, or stay the same? Explain.
 - (c) If this baseball game were to be played on the moon, would the drop distance increase, decrease, or stay the same? Explain.
11. In a game of basketball, a forward makes a bounce pass to the center. The ball is thrown with an initial speed of 4.30 m/s at an angle of 15.0° below the horizontal. It is released 0.800 m above the floor. What horizontal distance does the ball cover before bouncing?
12. When the dried up seed pod of a scotch broom plant bursts open, it shoots out a seed with an initial velocity of 2.7 m/s at an angle of 60.0° above the horizontal. The seed pod is located 1.0 m above the ground.
 - (a) How long does it take for the seed to land?
 - (b) What horizontal distance does it cover during its flight?
13. A fire hose ejects a stream of water at an angle of 35.0° above the horizontal. The water leaves the nozzle with a speed of 25.0 m/s. If the water behaves like a projectile, how far from a building should the fire hose be located to hit the highest possible fire?
14. A baseball player hits a home run, and the ball lands in the left-field seats, 7.50 m above the point at which it was hit. It lands with a velocity of 36.0 m/s at an angle of 28.0° below the horizontal. Ignoring air resistance, calculate the initial velocity (magnitude and direction) with which the ball leaves the bat.
15. The "hang time" of a punt is measured to be 4.50 s. If the ball was kicked at an angle of 63.0° above the horizontal and was caught at the same level from which it was kicked, what was its initial speed?
16. On a hot summer day, a young girl swings on a rope above the local swimming hole. When she lets go of her rope, her initial velocity is 2.25 m/s at an angle of 35.0° above the horizontal. If she is in flight for 1.60 s, how high above the water was she when she let go of the rope?

17. A soccer ball is kicked with an initial speed of 10.2 m/s in a direction 25.0° above the horizontal.
- Calculate the magnitude and direction of its velocity at 0.250 s and 0.500 s after being kicked.
 - Is the ball at its greatest height before or after 0.500 s? Explain.
18. In a friendly game of handball, you hit the ball essentially at ground level and send it toward the wall with a speed of 13.0 m/s at an angle of 20.0° above the horizontal.
- How long does it take for the ball to reach the wall if it is 5.2 m away?
 - How high is the ball when it hits the wall?
 - What are the magnitude and direction of the ball's velocity when it strikes the wall?
 - Has the ball reached the highest point of its trajectory at this time? Explain.
19. During a match a football is kicked upwards at an angle of 30° to the horizontal and leaves the ground in this direction with a velocity of magnitude 12 m/s. A player catches the ball 0.50 s before it hits the ground.
- What is the maximum height that the ball reaches?
 - At what height is the ball caught?
20. An archerfish hunts by dislodging an unsuspecting insect from its resting place with a stream of water expelled from the fish's mouth. Suppose the archerfish squirts water with an initial speed of 2.30 m/s at a beetle on a leaf 3.00 cm above the water's surface.
- If the fish aims in such a way that the stream of water is moving horizontally when it hits the beetle, what is the launch angle?
 - How much time does the beetle have to react?
 - What is the horizontal distance between the fish and the beetle when the water is launched?