

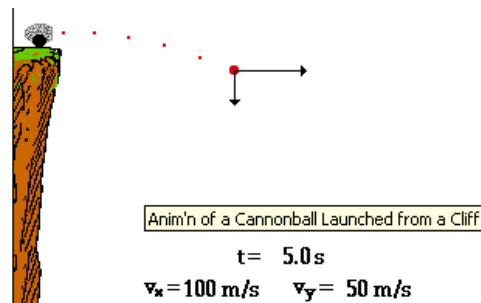
Projectile Problems

Name _____

Honors Physics

Horizontal Projectile Problems [Neglect air resistance.]

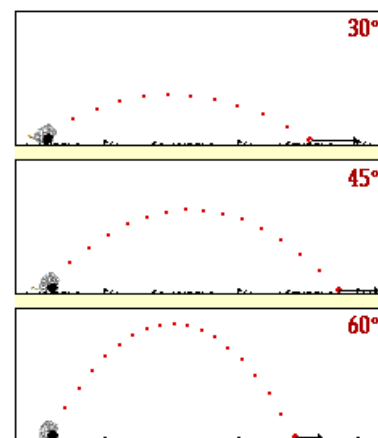
1. A toy train runs off a tabletop, which is 1.4 meters high. If the train is moving at 5.0 m/s, how far from the base of the table will the train land?
2. A stone is thrown horizontally with a speed of 30.0 m/s from the top of a vertical cliff which is 324.0 m high. How far from the base of the cliff will the stone strike the ground?
3. From a 15-meter high cliff, a cliff diver launches himself horizontally straight out at 8.0 m/s. How far from the cliff will he land? If there are rocks that are 10 meters away, will he clear them?
4. An airplane is flying 100 meters above the ground while traveling at a constant velocity of 60 m/s. The plane drops a bomb out of the bomb bay doors. From where the plane drops the bomb, how far horizontally will the bomb travel before striking the ground? What does the path of the bomb look like to an outside observer? What does the path of the bomb look like from the view of the plane?
5. If a paintball gun is fired horizontally from a second story window at 40 m/s at a building that is 30 meters away, how far will the paintball drop during its flight?



Non-horizontal Projectile Problems [Neglect air resistance.]

**make sure you find the components v_x and v_y before you start calculating*

6. A soccer ball is kicked with a velocity of 20. m/s at an angle of 15° above the horizontal. (a) How much time is the soccer ball in the air? (b) How far horizontally will the ball travel?
7. On a kick-off, a football is kicked with a velocity of 27 m/s at angle of 35° . (a) How much time is the football in the air? (b) How far horizontally will the ball travel before hitting the ground?
8. A mortar fires a shell with a velocity of 160 m/s at an angle of 53° from the horizontal. (a) How far away from the mortar will the shell hit? (b) At what angle will the mortar shell have the same range?
9. Consider a long jumper, whose take off velocity is 9.0 m/s at 43° . (a) How much time is the long jumper in the air? (b) How far did he travel before landing?
10. At the circus, a human cannonball is launched from a cannon at 28 m/s at 57° above the horizontal. The human cannonball lands in a net that is at the same height at which he was launched. (a) What is the flight time of the human cannonball? (b) How far horizontally will the cannonball travel before landing? (c) What is the maximum height achieved by the cannonball?



Selected Answers

1. 2.7 m 2) 244 m 3) 14 m 4) 271 m 5) $t = 0.75 \text{ s}$ to get there and falls $d = 2.76 \text{ m}$
6) $t = 1.06 \text{ s}$; $d = 20.4 \text{ m}$ 7) $t = 3.16 \text{ s}$; $d = 70 \text{ m}$ 8) $t = 26 \text{ s}$; $d = 2511 \text{ m}$ 9) $t = 1.22 \text{ s}$, $d = 8 \text{ m}$
10) (a) $t = 4.8 \text{ s}$ (b) $d = 73 \text{ m}$ across (c) $d = 28 \text{ m}$ high

- 1.) A cannon ball is fired horizontally with a velocity of 350 m/s from the top of a cliff 85 m high. (a) In what time will it strike the plane at the foot of the hill? (b) At what distance from the foot of the cliff will it strike? (c) With what velocity will it strike? 4.2 s 1470 m 352 m/s

- 2.) A plane drops a raft to the survivors of a shipwreck. The plane is flying at a height of 1960 m and at a speed of 90.0 m/s. The raft lands next to the survivors. How far away from the shipwreck was the plane when the raft was dropped. 1800 m

- 3.) An arrow is fired directly (horizontally) at the bull's eye of a target 60.0 m away. The arrow has a speed of 89 m/s when it leaves the bow. When it is fired, the arrow is 1.0 m above the ground. How far short (in front of) of the target does it strike the ground? 19.8 m

- 4.) A player kicks a football from ground level with a velocity of magnitude 27.0 m/s at an angle of 30.0° above the horizontal. Find: (a) its "hangtime," that is, the time the ball is in the air, (b) the distance the ball travels before it hits the ground, and (c) its maximum height. 2.76 s 64.6 m 9.3 m

- 5.) The kicker now kicks the ball with the same speed as before, but this time at an angle of 60.0° from the horizontal. Find: (a) Hangtime (b) downfield distance (range), and (c) maximum height. Compare these answers with #4...what does this tell you about the ranges of projectiles launched at these angles 30° and 60°? 4.78 s 64.5 m 27.9 m

- 6.) A baseball is hit at 30.0 m/s at an angle of 53.0° with the horizontal. Immediately, an outfielder runs 4.00 m/s toward the infield and catches the ball at the same height it was hit. What was the original distance between the batter and the outfielder? 108.3 m

- 7.) A broad jumper takes off at an angle of 20 degrees above the horizontal and jumps 0.6 m high. (a) What is his forward velocity? (b) How far does he jump? 9.42 m/s 6.6 m

- 8.) A projectile is fired at 200 m/s at an angle of 53° with the horizontal. Calculate (a) the time the shell remains in the air, and (b) the horizontal distance it travels. 32.6 s 3924 m

- 9.) A diver takes off with a speed of 8.0 m/s from a diving board 3.0 m high, at an angle of 30° above the horizontal. How much later does he strike the water? 1.3 s

- 10.) A projectile is fired into the air from the top of a 200.0 m cliff above the valley. Its initial velocity is 67 m/s at an angle of 60° with the horizontal. Neglecting air resistance, where does the projectile land? 489.1 m

- 11.) A batted baseball leaves the bat at an angle of 37° above the horizontal and with a velocity of 40.0 m/s. The ball is caught by a spectator in the outfield bleachers at a horizontal distance of 128 m from home plate. How far above the level at which the ball was struck was it caught? 17.7 m