Answers

Projectile Motion Introductory Problems
(ignore air resistance)

1. A ball rolls with a speed of 2m/s across a table that is 1 meter above the floor. The ball rolls off the edge of the table and hits the floor. How far along the floor does the ball hit relative to the table?

$$x = .9_m$$

2. A pilot drops a package while his plane is flying at an altitude of 2000 meters with a horizontal velocity of 100 m/s. How far down range, relative to the release point, did the package hit the ground?

$$x = 2020m$$

3. A rifle is fired horizontally. The bullet is found to have traveled 200 meters down range. The rifle barrel is 1.9 meters above the ground. What speed must the bullet have been traveling as it left the barrel of the gun?

$$V = 322.6 m/s$$

4. A skier leaves the horizontal end of a ramp with a velocity of 25 m/s and lands 70 meters from the base of the ramp. How high is the end of the ramp above the landing area?

$$38.4m$$

$$V = \frac{x}{t}$$

$$25 = \frac{70}{t}$$

5. An astronaut stands on the edge of a lunar crater and throws a hammer horizontally with a velocity of 5 m/s. The floor of the crater is 100 meters below the astronaut. What horizontal distance will the hammer travel before hitting the crater floor? (The moon's acceleration due to gravity is 1/6th that of Earth)

$$55.5_m$$

5. 55.5m

6. A baseball player leads off the game and hits a long home run. The ball leaves the bat at an angle of 30° above the horizontal with a velocity of 40 m/s. How far will the ball travel in the air before it is again at the height the ball was hit?

$V_x = 34.6$ m/s $V_y = 20$ m/s

141.9m

7. A golfer is teeing off on a 170 meter long par 3 hole. The ball leaves with a velocity of 40 m/s at an angle of 50° with the ground. Assuming that the ball is on a direct path to the flag, how far from the flag stick is the ball when it strikes the ground?

$V_x = 25.7$ m/s $V_y = 30.64$ m/s $x = 9.6$ m

$x = 160.4$ m

8. A football player kicks a booming high kickoff with a velocity of 25 m/s at an angle of 60° with the horizontal. $V_x = 12.5$ m/s $V_y = 21.65$ m/s

    a. Assuming it is not caught, how long is the ball in the air?
        4.43s

    b. How far down field does the ball hit the ground?
        55.4m

9. A cannon fires a cannonball 500 meters downrange when it is at a 45° angle. At what velocity does the cannonball leave the cannon?

Same
= Solve for t
= bring it the other side

② ←

$V_o = \frac{500}{2v_o}$

⑤ $v_o^2 = (250)(9.8)$

$v_o = 49.5$ m/s

$x = 500m$ $V_{oy} = V_o$ ① $0 = -9.8t + V_o$

$x = 500m$ $V_f = V_o$ a = -9.8 (9.8t)²   ③ $-V_o = -9.8t + V_o$

$V_o = \frac{500}{2t}$ $V = \frac{500}{t}$ $\frac{2v_o}{9.8} = t$

$V_o t$ ④ $\frac{2v_o}{9.8}$

$V = 70$ m/s ✓

$\frac{145}{}$

$V = cos45 \cdot v_o$

49.5 m/s

10. A lovesick young lad wants to throw a bag of candy and love notes into the open window of his girlfriend's bedroom 10 meters above the ground. He will be throwing the bag at an angle of 60° with respect to the ground and would like the bag to enter the window just as it reaches the top of its path.

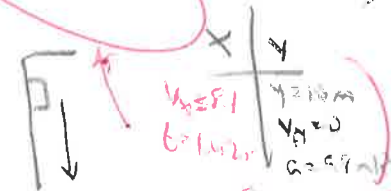   a. At what velocity should he throw the bag?
        $(V_{oy} = 14$ m/s$)$ $V_o = 16.2$ m/s

    b. How far from the house should he stand when he throws the bag?

$V_x = 8.1 = \frac{x}{1.42}$ $x = 11.6$ m $x = 11.6$ m

$\boxed{x} \quad \boxed{y}$

$V_f = y = 0$
$x = 10$

$x = 11.6m$

$V_x = 8.1$ $y = 10m$
$t = 1.42s$ $V_{fy} = 0$
        $a = -9.8$ m/s

$V_f^2 = V_o^2 + 2ay$
$0 = V_o^2 + 2(-9.8)(10)$

14m/s = V_{oy}

$t = 1.42s$

$\frac{14}{9.8}$