Problem Set 2 – free-fall & projectile motion

1. A person drops a rock down a well. The person hears the rock hit the water 2.2 seconds after the person releases the rock. How deep is the well?

2. You throw a ball straight upward. The ball rises to its maximum height in 3 seconds.

(a) With what speed did the ball leave your hand?

(b) How high did the ball go?

(c) What is the velocity of the ball when it is 20 meters off the ground?

(d) At what time in its flight is the ball 20 meters above your hand?

3. A nut comes off a bolt of an elevator that is moving upward at 2 m/s. The nut comes off the bolt when the elevator is 10 meters above the ground.

(a) How much time does the nut take to hit the ground?

(b) How high above the ground is the nut 0.2 seconds after the nut comes off the bolt?

4. A car has a speed of 20 m/s when the car drives horizontally off the top floor of a parking deck.

The car hits the ground 40 meters horizontally from the bottom of the deck.

(a) How long did the car stay in the air?

(b) How tall is the deck?

5. An arrow is shot into the air with a speed of 50 m/s at an angle of 37o with the level ground.

(a) How high will the arrow go?

(b) How far horizontally will the arrow go?

6. A catapult launches a stone at a castle wall that is 36 meters away. The stone leaves the catapult with a speed of 20 m/s at an angle of 53o with the level ground. **Use *g*** = ***10 m/s2*.**

(a) How much time does the stone take to reach the wall?

(b) How high on the wall does the stone hit?

ANSWERS

1. 23.7 m 3. (a) 1.62 s 5. (a) 46 m

(b) 10.2 m (b) 245 m

2. (a) 29.4 m/s

(b) 44.1 m 4. (a) 2 s 6. (a) 3 s

(c) +21.7 m/s & -21.7 m/s (b) 19.6 m (b) 3 m

(d) 0.79 s & 5.2 s