

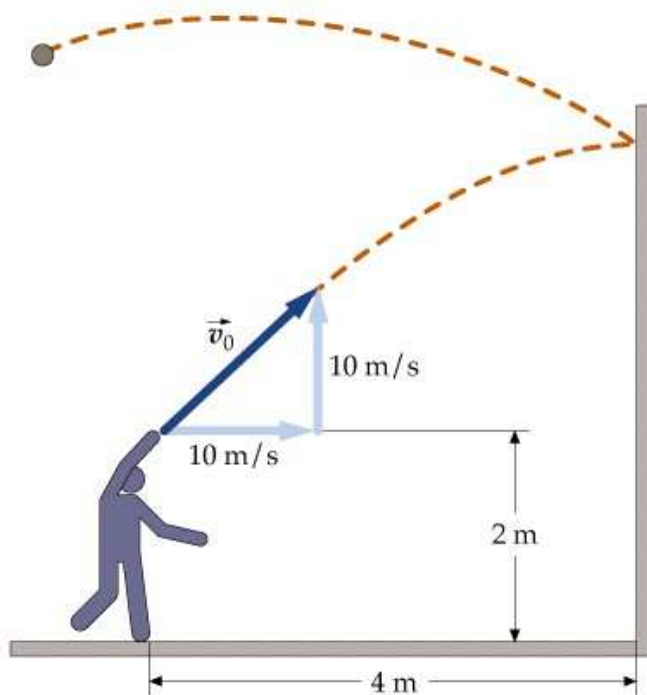
Practice Quiz 1B (The answers are at the end. No peeking!)

These are the type of questions that you will be asked to solve on the upcoming exam.

Don't give up too soon. Take your time and be organized.

1. A home run in a baseball game is hit in such a way that the ball just clears a wall 3.0 meters high, located 125 meters from home plate in Yankee Stadium. The ball is hit at an angle of 30.0° to the horizontal, and air resistance is negligible. Find (a) the initial speed of the ball, (b) the time it takes to reach the wall. (Assume the ball is hit at a height of 1.00 m above the ground at home plate.)

2. Aubrey throws a ball at a vertical wall 4.0 m away. The ball is 2.0 m above ground when it leaves her hand with an initial velocity of $\vec{v}_0 = (10\hat{i} + 10\hat{j}) \text{ m/s}$. When the ball hits the wall, the horizontal component of its velocity is reversed; the vertical component remains unchanged. Where does the ball hit the ground?



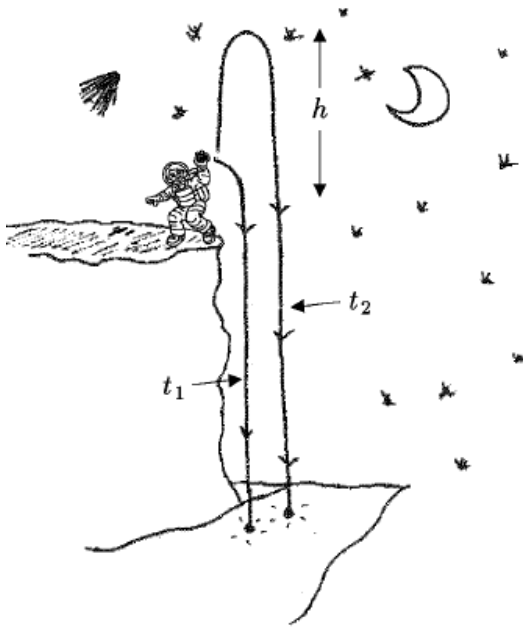
3. A jet is flying at 200 km/hr at an angle of 20° above the horizontal. The pilot launches a rocket with a speed of 400 m/s relative to the jet at an angle of 30° above the jet's path. If the rocket reaches a maximum height above the ground of 20 km, calculate (a) the total horizontal displacement of the rocket, (b) the maximum speed of the rocket, and (c) the initial height of the rocket above the ground. Assume projectile motion for the rocket and level ground.

4. A helicopter takes off vertically from Survivor Island. The height of the helicopter above the ground is given by $h = 4.24t^2$, where h is in meters and t is in seconds. Soon after take-off, the pilot remembers that she forgot to leave the package containing extra food. So 2.85 seconds after take-off, the pilot releases a food-bag from the helicopter. How long after its release does the food bag reach the ground?

5. Water drips from the nozzle of a shower head onto the floor 200.00 cm below. The drops fall at regular (equal) intervals of time, the first drop striking the floor at the instant the fourth drop begins to fall. Find the locations of the second and third drops when the first strikes the floor. Give these locations as measured from the floor.

6. A rock is dropped from rest into a well. (a) If the sound of the splash is heard 2.40 seconds later, how far below the top of the well is the water surface? The speed of sound in air that day is 336 m/s. (b) If the travel time for the sound is neglected, what percentage error is introduced when the depth of the well is calculated.

7. An astronaut on the starship Enterprise is on shore leave on a distant planet. She drops a rock from the top of a cliff and observes that it takes 2.532 seconds to reach the ground at the base of the cliff. She then takes another rock and throws it vertically upwards with a speed of 17.821 m/s so that it reaches a height h above the cliff before falling down to the ground at the base of the cliff near the first rock. The second rock takes a total time of 6.470 seconds to reach the ground, starting from the time it left the crewman's hand. The planet has a very thin atmosphere which offers negligible air resistance. What is the value of g on this planet? (* This is a one-dimensional problem: there is no horizontal motion for either rock. The paths of the rock in the picture have been drawn curved for clarity. Ignore the height of the astronaut's hand above the cliff. *)



Answers

1. a: 38.1 m/s, b: 3.78 s
2. 14.22 m behind her.
3. a: 30 km, b: 698 m/s, c: 14.59 km
4. 6.08 s
5. 2nd drop is 111.11 cm, 3rd drop is 177.78 cm
6. a: 26.4 m, b: 6.91%
7. 6.505 m/s²