

Continue

Problems based on projectile motion

How to projectile motion problems. How to solve a projectile motion problem. How to do a projectile motion problem.

We previously discussed the bike of the bullet and its key components and the basic equations. Using this information, we can solve many problems involving the movement of the bullet. Before doing this, we examine some of the key factors that will go to this problem-solving. What is the bike of the bullet? The bike of the bullet is when an object moves in a symmetrical bilateral parabolic path. The path that the object follows is called its trajectory. The bike of the bullet occurs only when there is a force applied to the beginning, after which the only influence on the trajectory is that of gravity. What are the key components of the bike of the bullet? The key components That we need to remember to solve bullet motion problems are: initial launch angle, Ã, $ IFA $ early speed, Ã, $ u $ flight time, Ã, $ T $ acceleration, Ã, $ to $ horizontal speed , Ã, $ v_x $ vertical speed, Ã, $ v_Y $ Moving, Ã, $ D $ Maximum height, Ã, $ h $ range, Ã, $ R $ Now, we give a look at two examples of problems involving The bike of the bullet. We are given that you have given an object that needs to delete two places of equal height separated by a specific distance. Refer to this example. The bullet is launched at $ 25 SQRT {2} $ m / s with a corner of 45 °. If the object is to free up both poles, each with a height of 30 m, find the minimum: (a) the position of the ground launch compared to the poles and (b) the distance between the poles. For simplicity, use a gravity constant equal to 10. Problems of any kind in physics are much easier to solve if you list the things you know (the "data"). Use this figure as a reference to solve the example 1. The problem is to make sure that the object is able to delete both places. Solution: The first thing we need to do is understand what time $ T $ is, the object reaches the specified height. Because the bike has a parabolic shape, it will occur twice: once when the object moves towards the high and another time when the object moves down. For this we can use the movement equation in the vertical direction, $ y-y_0 $: $ y-y_0 = (v_y cdot t) â € "(frac {1} {2} cdot g cdot {t ^ 2}) $ Replace in the appropriate variables: $ v_y = u cdot sin theta = 25 sqrt {2} text {m / s} cdot 45 {circ} = 25 text { m / s} $ so: $ 30 text {m} = 25 cdot t- frac {1} {2} cdot 10 cdot {t ^ 2} $ we can use the quadratic equation to find the roots Of this equation there are 2s and three. This means that the bullet will reach 30m after 2s, on its climb, and after 3s, on its descent. A object is launched from the base of a slope, which is located at an angle of 30Â °. If the launch angle is 60 ° from the horizontal and the launch speed is 10 m / s, what is the total flight time? The following information is provided: $ u = 10 frac {text {m}} {text {s}} $; $ theta = 60 $ Â‚Â °; $ g = 10 When it comes to a bullet moving object on a tilt, we must first use the information provided to redirect the coordinate system so that we have the object launched and fall on the same surface. solution: solution:To take into account the inclined angle, we must reorient the coordinate system so that the projection and return points are on the same level. The projection angle compared to the $ X $ direction is $ theta - ALFA $ and acceleration in the $ Y $ direction Ã¨ $ G CDOT so {alpha} $. Replace $ $ $ with $ theta - Alpha $ and $ G $ with $ G CDOT so {alpha} $: $ DisplayStyle {{t = frac {2 clot u cdot pein (theta)} {g} = frac {2 clot u cdot pein (theta- alpha)} {g cdot cos (alpha)}} Clot (60-30)} {10 Clot SQRT3} text {s}} $ Page 2 Principles Movement is a form of movement in which an object moves in a parabolic path. The path followed by the object is called his trajectory. The movement of the bullet occurs when a force is applied at the beginning of the trajectory for launch (after this the bullet is only subject to gravity). The only key components of the bullet movement, and the following trajectory is the initial angle launch. The angle in which the object is launched called the range, height and flight time that the object will experience while it is moving bullet. Show different paths for the same object launched at the same initial speed and several launch angles. As shown in the figure, the larger is the initial launch angle and the maximum height, plus the flight time of the object. The launch angle determines the interval and the maximum height that an object will experience after being launched. This image shows that the path of the same object is started at the same speed but different angles. Previously we discussed the effects of different launch angles on the range, height and flight time. However, what happens if there is no angle and the object is just launched horizontally? It makes sense that the object should be launched at a certain height ($ h $), otherwise it wouldn't have traveled very far before hitting the ground. Let's examine how an object has been launched horizontally to a $ h $ trips. In our case it is when $ alpha $ is 0. Bullet moving after a parable. The style launch angle is $ alpha $, and speed is $ V_0. Duration of FlightCe is not a vertical component in the initial speed ($ V_0 $) because the object is started horizontally. Because the object travels the $ h $ distance in the vertical direction before striking the ground, we can use the kinematic equation for vertical movement: $ (y-y_0) = -h = 0 cdot t - frac {1 } {2} GT ^ 2 $ Here, $ T $ is the duration of the flight before it is its soil. Therefore: Ã ¢ $ DisplaySyle T = sqrt {frac {2h} {g}} $ range The horizontal direction, the object travels at a constant speed $ V_0 $ during the flight. Therefore, range $ R $ (in a horizontal direction) Form of movement in which an object moves in a bilaterally symmetrical parabolic path. The path that follows the object is its trajectory. Projectile motion only occurs when a force is applied at the beginning of the trajectory, after which the only interference is due to gravity.One of the key components of projectile motion and subsequent trajectory is the initial launch angle. This angle can be anywhere from 0 to 90 degrees. The angle at which the object is launched determines the distance, height, and flight time you will experience as the bullet moves. It shows different paths for the same object launched at the same initial speed at different launch angles. As you can see from the figure, the higher the initial launch angle, the closer the object gets to the maximum height and the longer the flight time. The largest range will be tested with a throw angle of up to 45 degrees. The launch angle determines the maximum interval and height an object will experience after launch. This image shows the path of the same object being launched at the same speed but with different angles. The range, maximum height and flight time can be found by knowing the initial launch angle and velocity, using the following equations: $\small{\sf{R=\frac{v_i^2\sin2\theta_i}{g}}}\\\\\sf{h=\frac{v_i^2\sin^2\theta_i}{2g}}}}\\\\\small{\sf{T=\frac{2v_isin\theta}{g}}}$ Where R â maximum height, T â flight time, vi â initial speed, is i â initial launch angle, g â gravity. important role in many other components of the trajectory of a moving projectile object, we can apply this knowledge to make an earth object where we want. If there is a certain distance, d, at which you want your object to move and you know the initial velocity at which it will be launched, the initial launch angle needed to get that distance is called the range angle. It can be found using the following equation: $\small{\sf{\theta=\frac12sin^{-1} (\frac{gd}{v^2}) }$ At the end of this section, you will be able to do the following: Describe the properties of projectile motion Applying kinematic equations and vectors to solve problems involving projectile motion The learning objectives of this section will help your students master the following standards: (4) Scientific concepts. The student knows and applies the laws that regulate two-dimensional motion for a variety of situations. The student is required to: (C) analyze and describe accelerated motion in two dimensions using equations. In addition, the Physics Laboratory Manual of the High School addresses the contents of this section of the laboratory entitled: Movement in Two Dimensions, as well as the following standards: (4) Scientific concepts. The student knows and applies the laws that regulate motion in a variety of situations. The student is required to: (C) analyze and describe accelerated motion in two dimensions using equations, bullet and circulatory examples. Air resistance maximum height (of a bullet) bullet range of trajectory movement the motion of the bullet is theof an object launched (projected) in the air. After the initial force that launches the object, it only experiences the force of gravity. The object is called a bullet, and its path is called its trajectory. As an object travels through the air, it encounters a friction force that slows down its movement called air resistance. Air resistance significantly alters the movement of trajectory, but due to the difficulty of calculation, it is ignored in in introductory physics. [BL] [OL] addition of graphically and analytically revised vectors. [BL] [AL] Explains the term bullet movement. Ask the students to guess what a bullet movement might depend on? Is the initial speed important? Is the angle important? How do these things affect your height and the distance it covers? Introduce the concept of air resistance. Review the film equations. The most important concept of the bullet movement is that horizontal and vertical movements are independent, which means that they do not influence each other. Figure 5.27 compares a free falling cannonball (blue) to a cannonball launched horizontally in bullet movement (red). You can see that the cannonball in the free fall falls at the same rate as the gunball in motion of the bullet. Keep in mind that if the cannon threw the ball with any vertical component at speed, vertical movements do not align perfectly. Since vertical and horizontal movements are independent, we can analyze them separately, along the perpendicular axes. To do this, separate the movement of the bullet into the two components of its movement, one along the horizontal axis and the other along the vertical. Figure 5.27 The diagram shows the movement of the bullet of a shot of cannonball at a horizontal angle compared to a dropped without horizontal speed. Note that both cannonballs have the same vertical position over time. We will call the horizontal axis the x axis and the vertical axis the y axis. For notation, D is total displacement and X and Y are its components along horizontal and vertical axes. The magnitudes of these vectors are X and Y, as shown in Figure 5.28. Figure 5.28 A boy kicks a ball at the corner Î¸, and a distance of S is displaced along his trajectory. As usual, we use speed, acceleration and shift to describe the movement. We also need to find the components of these variables along the X and Y axes. The acceleration components are therefore very simple = â € "G = â €" 9,80 m / s2. Note that this definition defines the direction upwards as positive. Because gravity is vertical, axe = 0. Both accelerations are constant, so we can use film equations. For the revision, the cinematic equations from aprevious are summarized in Table 5.1. (v) V = V = V = V = V = V 0 + V 0 + V 0 + V 0 + V 0 + V 0 + V 0 + V 0 + V 0 T + 1 2 x = 0 + V 0 + V 0 + V + V + V + V + V + V + V + V + V + 1 + V + V + V + 1 + 2 + V + V + V + V + V + V + V + V + V + 1 + V + V + V + V + V + V + V + V + V + Va) where x is the position, x0 is the initial position, v is the speed, vavg is the average speed, t is the time and to is acceleration. to analyze the motion of the bullet the following steps are used: separate the bike into horizontal and vertical components along the axes x and y. these axes are perpendicular, then to x =acosî¸ to x =acosî¸ and to y =asinî¸ a y =asinî¸. the size of the shift s along the axes x and y are called x and y. y. the speed components are v~~~