

Unit 5 - Projectiles Review

Concepts:

- I) What is the difference between the path of Type 1 and Type 2 projectiles?
- II) Explain why v_{oy} is zero for Type 1 projectiles.
- III) After drawing the picture what should be the first step in solving a Type 2 projectile?
- IV) What formula is used to find time for all projectiles?
- V) What conditions are necessary to use the horizontal components to find time for a Type 1 projectile?
- VI) What is the relation between v_{ox} and v_{fx} , explain why this is.
- VII) How are v_{fy} and v_{fx} used to find the final velocity of any object?
- VIII) When should $v_f^2 = v_o^2 + 2ad$ be used and when should $v_f = v_o + at$ be used to find the final vertical velocity?

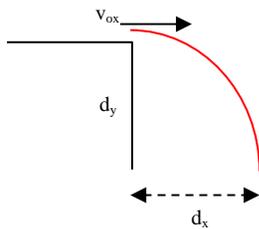
Problems:

- 1) A physics student runs at 6.0 m/s horizontally off a 10.0 m high diving board. What will be her range when landing in the water below?
- 2) A rock is tossed off a bridge horizontally at 9.0 m/s and strikes the ground below 3.2 s later. How high is the bridge and what was the range of the throw?
- 3) A rifle is shot horizontally at 300 m/s from a height of 1.8 m. What is the maximum distance the bullet will travel before hitting the ground?
- 4) Water sprays horizontally out of a shower head which is 2.12 m above the ground. If the water hits the shower floor 0.85 m from the wall of the shower how fast was the water coming out the showerhead?
- 5) A supply plane flying at 250 m/s releases supplies 3900 m in front of survivors of a shipwreck. How high is the plane?
- 6) An Olympic javelin thrower releases the javelin at 30 m/s at an angle of 40° above the horizontal. What is the range of the projectile?
- 7) While skateboarding, a student leaves a jump at 20° with a velocity 5.0 m/s. What will be the range of his jump?
- 8) A football kickoff is moving with an initial velocity of 20 m/s at 58° above the field, what is the range of the kick?
- 9) A small electric current zaps a frog causing it to jump at 2.0 m/s on an angle of 30° , if the frog was in the middle of a 30 cm x 30 cm plate of copper will it get off the copper in one jump? (Justify your answer with kinematics. Answering yes or no is not enough.)
- 10) While studying a kangaroo at a distance, a scientist notes the kangaroo consistently jumps at an angle of 35° . Careful measurements show the range of all jumps to be 4.0 m. With what velocity was the kangaroo leaving the ground?
- 11) Calculate velocity of the student in #1 when she reaches the water.
- 12) What is the velocity of the bullet in #3 when it has dropped a vertical distance of 1.0 m?

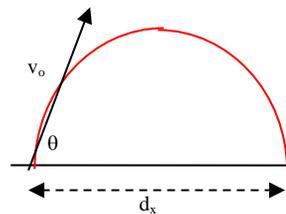
- 13) What is the velocity at the maximum height for the football in #8?
- 14) What is the maximum height of the football in #8?
- 15) Calculate the speed of the kangaroo in #10 after 0.30 seconds.
- 16) A rock is thrown horizontally from a cliff at 15 m/s. If the cliff is 20.0 m high:
 How long will it take to reach the ground?
 How far from the base of the cliff will it land?
 What are its final vertical and horizontal velocities?
- 17) A football is kicked at 40° and travels 23 m. With what velocity was it kicked? What was its total air time? What was its maximum height?

Answers: Concepts

I) type 1



type 2



II) because the projectile is launched horizontally

III) find v_{ox} and v_{oy}

IV) $d = v_o t + \frac{1}{2} a t^2$

V) must be given v_{ox} and d_x

VI) they are the same because there is no acceleration in the x direction

VII) Pythagorean theorem

VIII) use $v_f^2 = v_o^2 + 2ad$ when given d_y , use $v_f = v_o + at$ when given time

Answers: Problems

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|-----------------------------------|----------------------------------|-------------|
| 1) 8.6 m | 2) 50.2 m, 29 m | 3) 182 m |
| 4) 1.3 m/s | 5) 1.2×10^3 m | 6) 91 m |
| 7) 1.6 m | 8) 37 m | 9) yes |
| 10) 6.5 m/s | 11) 15.2 m/s @ 67° S of E | 12) 300 m/s |
| 13) 10.6 m/s | 14) 14.7 m | 15) 5.3 m/s |
| 16) 2.02 s; 30 m; -20 m/s; 15 m/s | | |
| 17) 15 m/s; 1.98 s; 4.8 m | | |