Kim

Projectile Review - Short

1.) How many parts are in a projectile problem, and what are they?

2 PARTS. HORIZONTAL (x)

VERTICAL (y)

2.) A rock is thrown horizontally from a cliff at 15 m/s, if the cliff is 20.0 m high:

a.) how long will it take to reach the ground?

$\vec{d} = \vec{v}_0 t + \frac{1}{2}\vec{a}t^2$ / $-20 = 0(t) + (-4.905)(t^2)$

$\frac{+20}{+4.905} = \frac{(-4.905)t^2}{-4.905}$ / $t^2 = \pm\sqrt{4.07747}$ / $t = 2.019\ s$

$t = 2.02$

b.) how far from the base of the cliff will it land? RANGE

$\vec{v}_x = \frac{\vec{d}_x}{t}$ / $15 = \frac{\vec{d}_x}{2.02}$ / $\vec{d}_x = 30.289\ m$.

$\vec{d}_x = +30.3\ m$

c.) what are its final vertical and horizontal velocities?

$\vec{v}_x = +15\ m/s$

$\vec{v}_y \Rightarrow \quad \vec{v}_{F_y} = \vec{v}_{oy} + \vec{a}_y t$ / $\vec{v}_{F_y} = 0 + (-9.81)(2.02)$ / $\vec{v}_y = -19.8\ m/s$.

3.) A cliff diver wishes to clear 3.0 m of rock from the base of a 20.0 m high cliff. With what initial velocity must the diver jump (horizontally) to land safely in the water?

$\vec{d}_y = \vec{v}_{oy} t + \frac{1}{2}\vec{a}t^2$ / $-20 = (-4.905)(t^2)$ / $t = 2.019275\ s$.

$\vec{d}_x = \vec{v}_x t + \frac{1}{2}\vec{a}_x t^2$ / $3.0 = (v_x)(2.02) + 0$ / $t = 1.485\ s$ / $t = 1.49\ s$.

4.) A cat is thrown at 3.0 m/s off a 75 m high building, will it strike a physics student who is standing 12 m form the building's base? Prove your answer.

$\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}t^2$ / $-75 = 0(t) + (-4.905)(t^2)$ / $t = 3.9103\,s$

$\vec{d}_x = \vec{v}_x t + \frac{1}{2}\vec{a}t^2$ / $\vec{d}_x = (3.0)(3.91) + \cancel{(0)(3.91^2)}$ $\vec{d}_x = 11.731\,m$

$\vec{d}_x = 11.7\,m$

IT DOES NOT HIT THE STUDENT.

5.) A football is kicked at 40° with a velocity of 15 m/s, find its total air time, range, and max height.

15 m/s, 40°: i 9.6418 m/s, → 11.491 m/s.

(1.) (2.) (3.)

① $\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_y t^2$ / $0 = (9.6418)(t) + (-4.905)(t^2)$

$t = 1.96575$ / $t = 1.97\,s$

② $\vec{d}_x = \vec{v}_x t + \frac{1}{2}\vec{a}t^2$ / $\vec{d}_x = (11.491)(1.97) + \cancel{\frac{1}{2}(0)(1.97)^2}$

$\vec{d}_x = 22.587\,m$ / $\vec{d}_x = 22.6\,m$

③ $\vec{d}_y = \vec{v}_{oy}t + \frac{1}{2}\vec{a}_y t^2$ / $\vec{d}_y = (9.64)(0.983) + (-4.905)(0.983)^2$ 1.90 3

$\vec{d}_y = 4.7382\,m$ / $\vec{d}_y = +4.74\,m$

Answers - 1.) 2, vertical and horizontal 2.) 2.02 s, 30m. 20 m/s down, 15m/s 3.)1.5 m/s

4.) Misses by 30.cm 5.) 1.97 s, 23m, 4.7m. 4.74 m

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