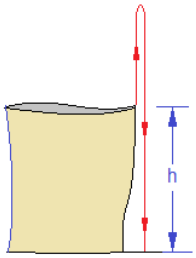
Physics I

Falling Objects

In case of free fall, the acceleration in the vertical direction is a_y=-9.8m/s^2

$$y = v_{y1}t + \frac{1}{2}a_y t^2 \qquad v_{y2} = v_{y1} + a_y t \qquad {v_{y2}}^2 = {v_{y1}}^2 + 2a_y y \qquad \langle v_y \rangle = \frac{v_{y1} + v_{y2}}{2} = \frac{y}{t}$$

Problem 1.- A stone is thrown straight upwards with an initial speed of 15 m/s at the edge of a cliff whose height is h=65m. Calculate the time it will take for the stone to reach the bottom of the cliff.



Problem 2.- A stone is thrown vertically upwards with an initial velocity of 25 m/s. Determine:

i) The maximum height reached and

ii) How long it takes to get there.

Problem 3.- Neglecting air resistance, estimate the time it would take a penny to fall straight down from the top of the Empire State Building (380 m high), and its velocity just before hitting the ground. Assume zero initial velocity.

Problem 3a.- Neglecting air resistance, estimate how long it would take a penny to fall straight down from the top of the Eiffel Tower (324 m high), and its velocity just before hitting the ground. Assume the initial velocity to be zero.

Problem 4.- A stone is thrown vertically upwards with an initial velocity of 29.6 m/s. Determine its velocity when it reaches a height of 18 m.

Problem 5.- Two projectiles are shot straight up with initial velocities of 30 m/s, but with 1s of delay between them. At what height will the projectiles hit each other?

Problem 6.- To measure the height of a building you drop a marble from the roof and measure the time it takes to hit the ground. Calculate the height of the building if the time is t=4.95 s

Problem 7.- In an experiment you determine that at a certain point the velocity of an object is 1.5 m/s. Knowing that its initial velocity was zero calculate:

a) How long it has been falling (time, t).

b) How much it has fallen (distance, y).