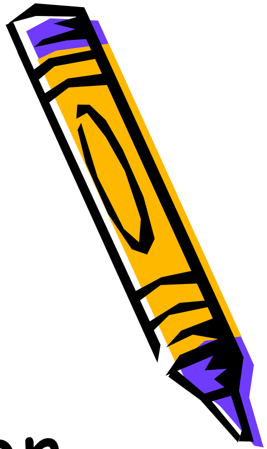
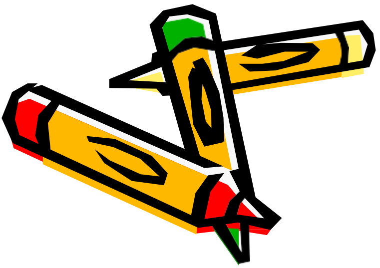
Falling Bodies

Free Fall

Gravity



- The attraction due to gravitation that the Earth exerts on or near its surface



Christian Huygens

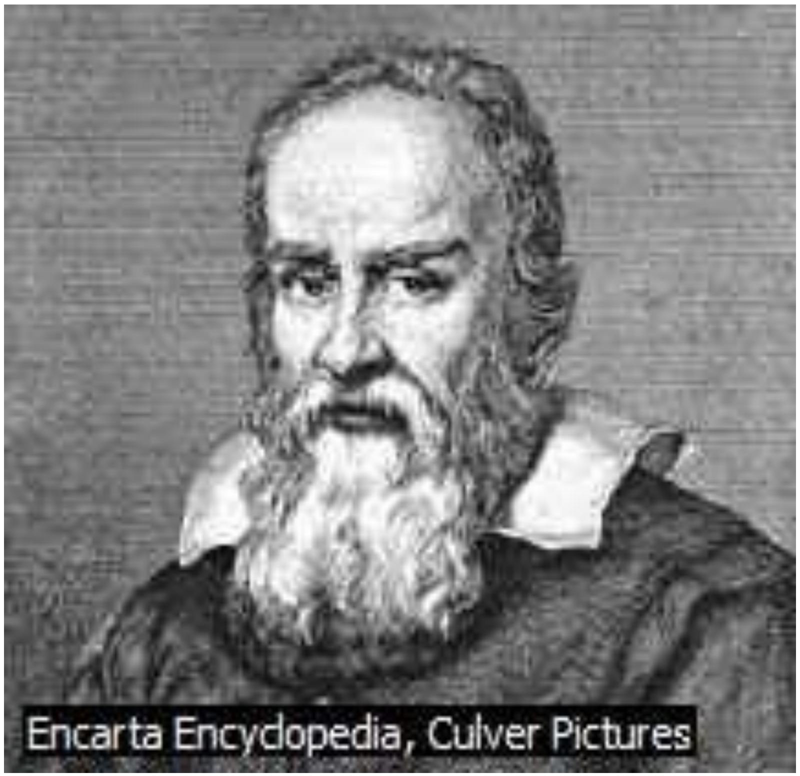
- First one to determine the magnitude of gravity from the swing of the pendulum using a ruler and a good timepiece.

The magnitude of gravity is

$$g = 9.8\,\frac{m}{s^2}$$

- In the late 16th century, it was believed that heavier objects fall first to the ground than the lighter ones.

Galileo

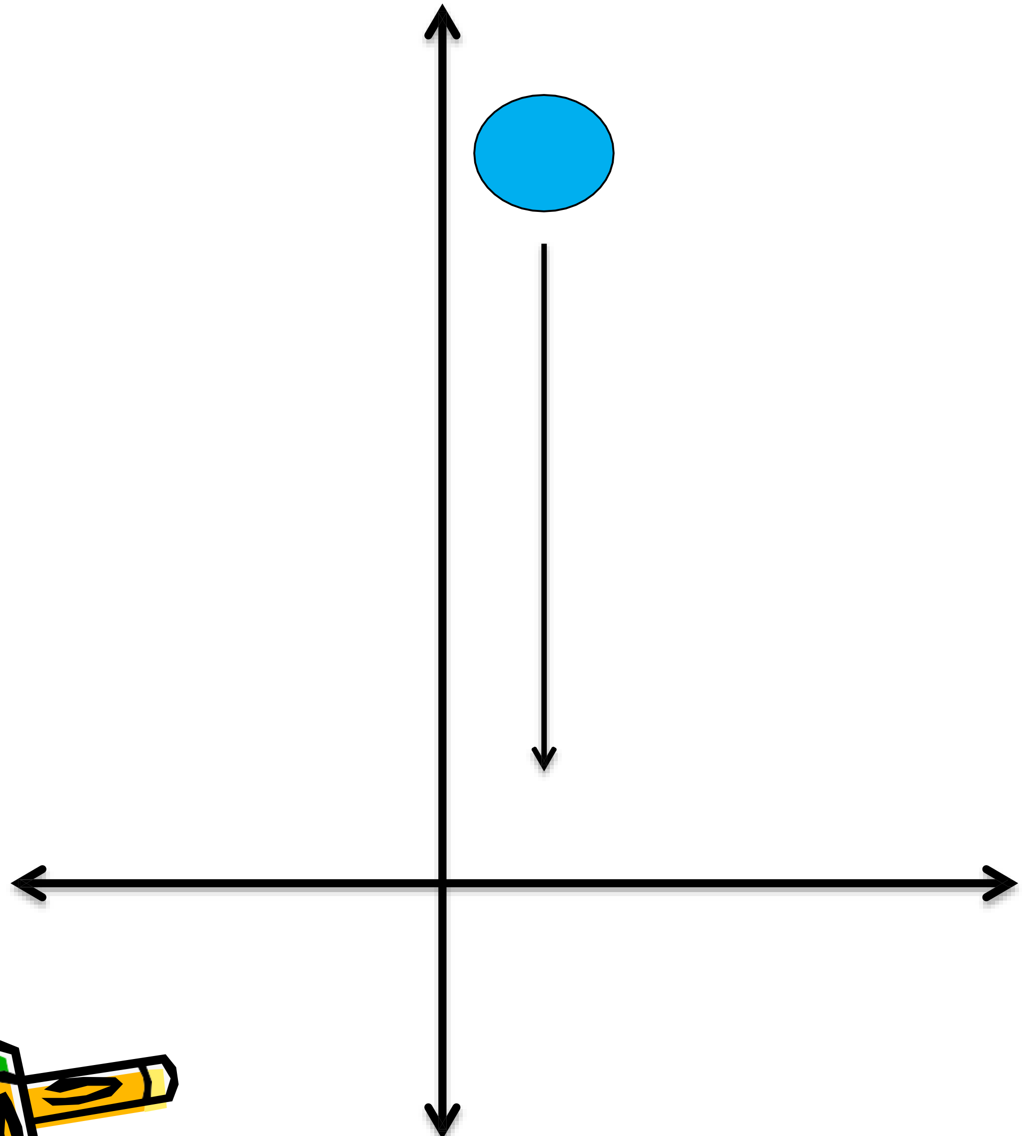


- Proved that regardless of weight and air resistance, the rate of fall of all falling bodies are the same.

Experiment of Galileo

Materials: metal ball, inclined plane, and a water timer

How can we measure the distance covered and final velocity of a falling body?



Displacement of Falling Bodies

$$d_y = v_{yo}t + \frac{gt^2}{2}$$

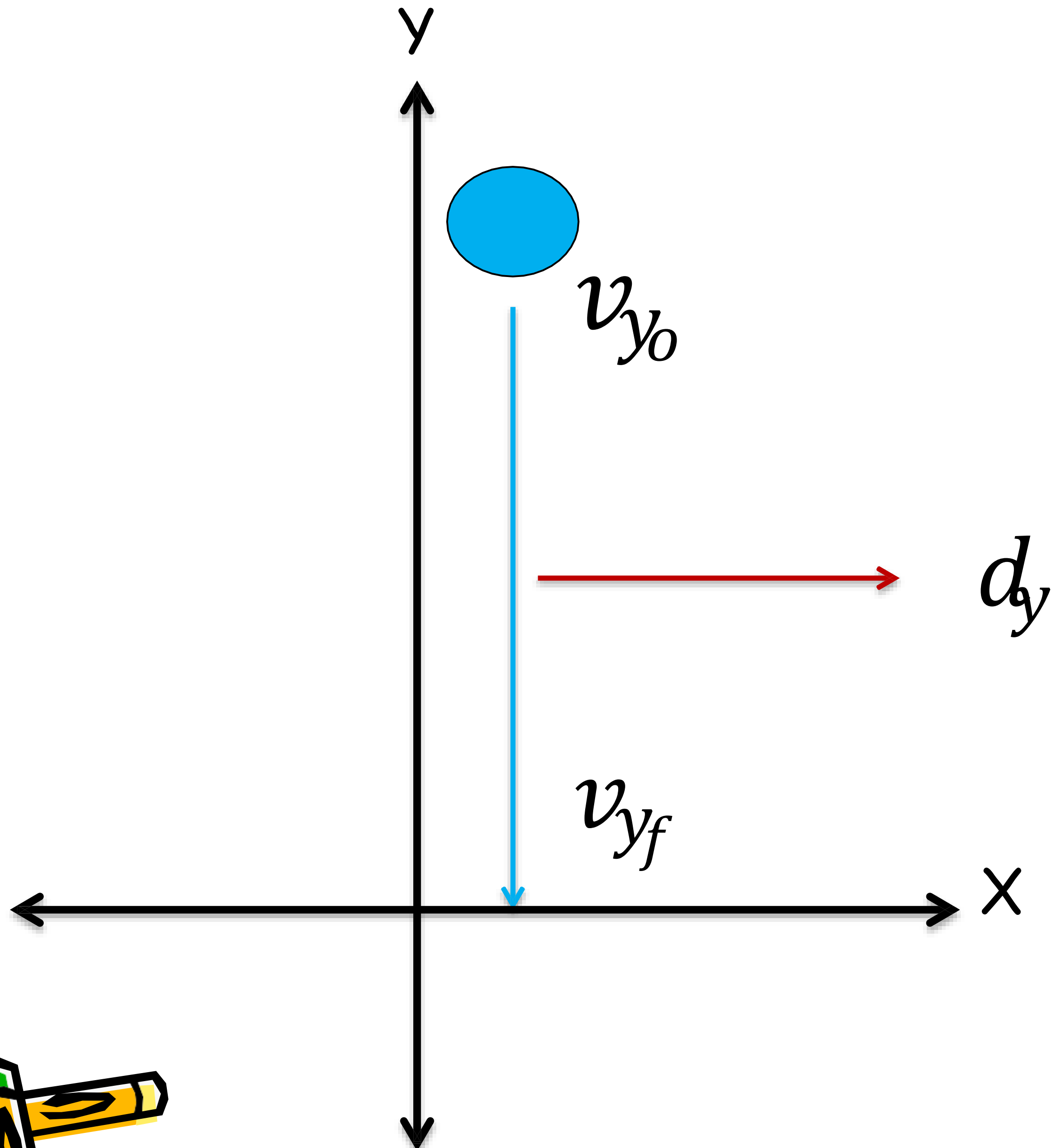
Where:

- d_y is displacement
- v_{yo} is initial velocity
- g is gravity ($9.8 m/s^2$)
- t is time interval

Velocity of Falling Bodies

$$v_{y_f} = v_{y_o} + gt$$

Where v_{yf} is final velocity.


y
v_{y_o}
d_y
v_{y_f}
x

Sample Problem:

- The time a male bungee jumper is freely falling is 1.5 seconds.
  - What is the velocity of the jumper at the end of 1.5 seconds?
  - How far does he fall?

Encarta Encyclopedia, Robert Holmes/Corbis

Given:

- $v_i = 0$
- $t = 1.5$ s $g = 9.8$ m/s^2

- $v_f = v_i + gt$
- $v_f = 0 + (9.8 m/s^2)(1.5 s)$
- v_f = 14.7 m/s or 15 m/s

- $d = v_i t + \frac{gt^2}{2}$
- $d = (0)(1.5 s) + (9.8 m/s^2)(1.5 s)^2/2$

- d = 11.025m or 11 m