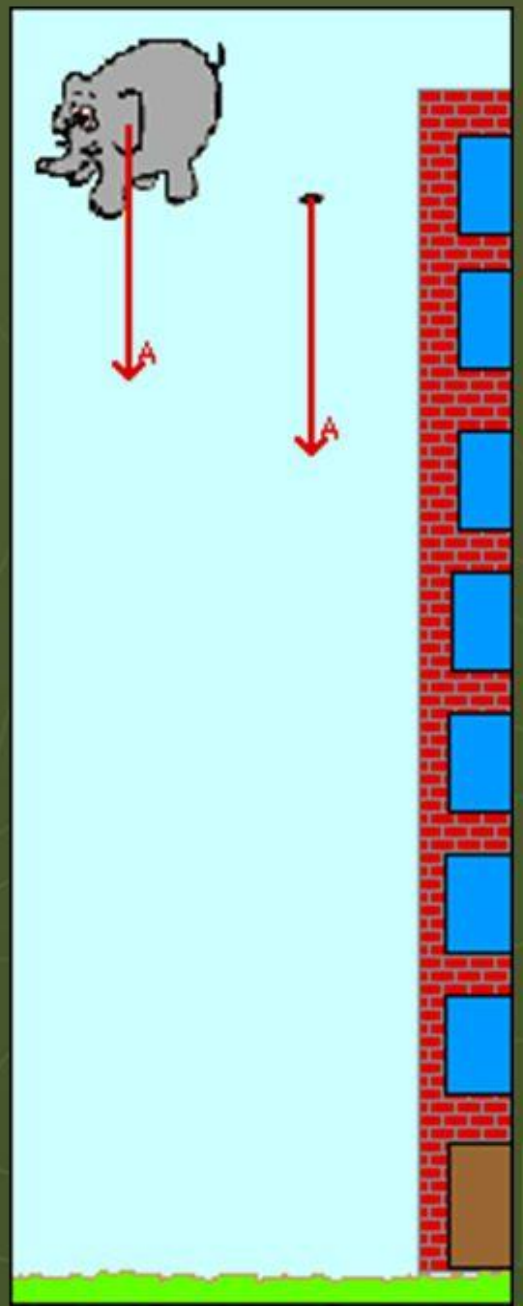
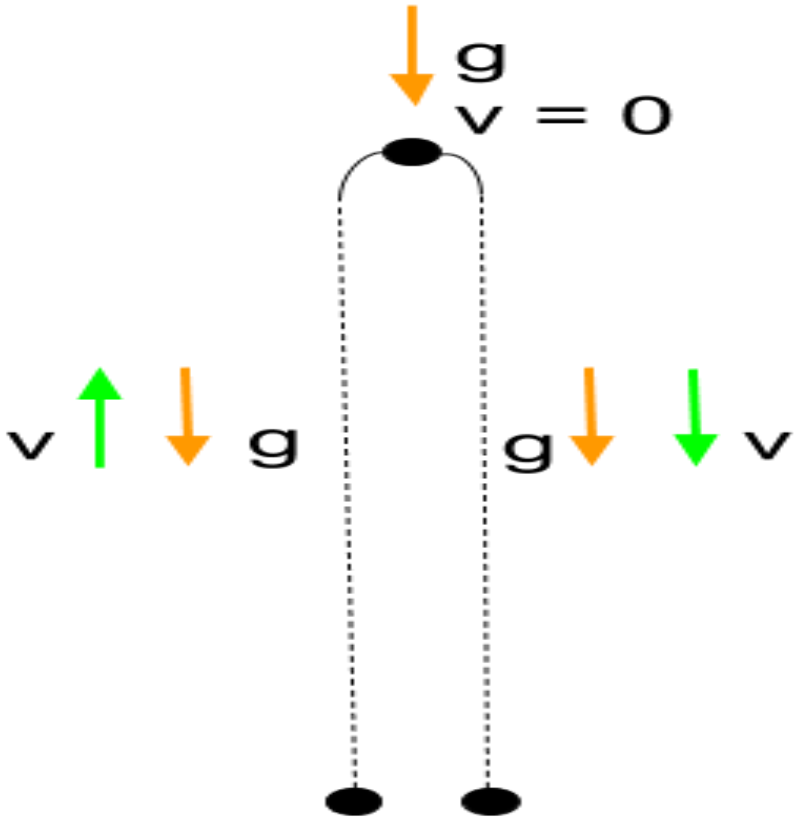
Motion of a Freely Falling Body



Galileo

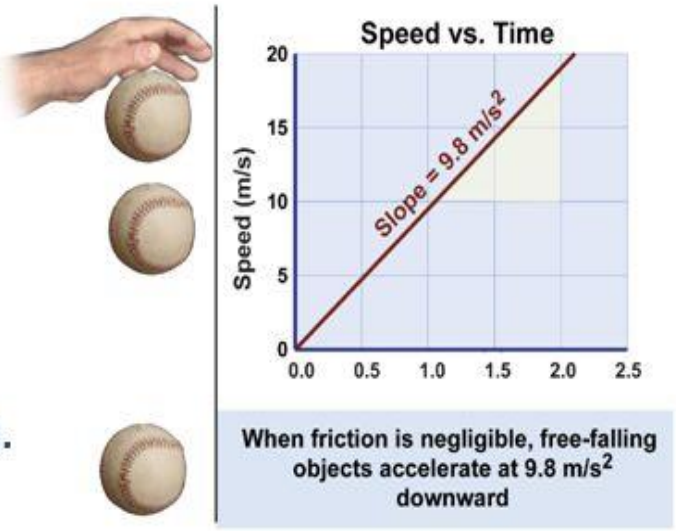
- The remarkable observation that all free falling objects fall at the same rate was first proposed by **Galileo,** nearly 400 years ago.

- Galileo conducted experiments using a ball on an inclined plane to determine the relationship between the time and distance traveled.


g
v = 0
v
g
g
v

Gravity and free fall

Near Earth's surface, free-falling objects have a downward acceleration of 9.8 m/s^2.



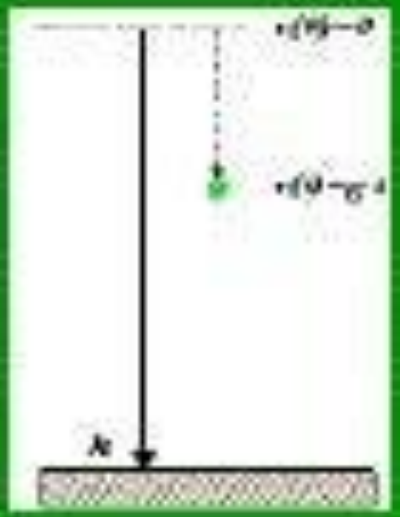
When friction is negligible, free-falling objects accelerate at 9.8 m/s^2 downward

If an object is dropped from rest, then . . .

- after 1 second its velocity is -9.8 m/s.
- after 2 seconds its velocity is -19.6 m/s.
- after 3 seconds its velocity is __?__
- after 10 seconds its velocity is __?__

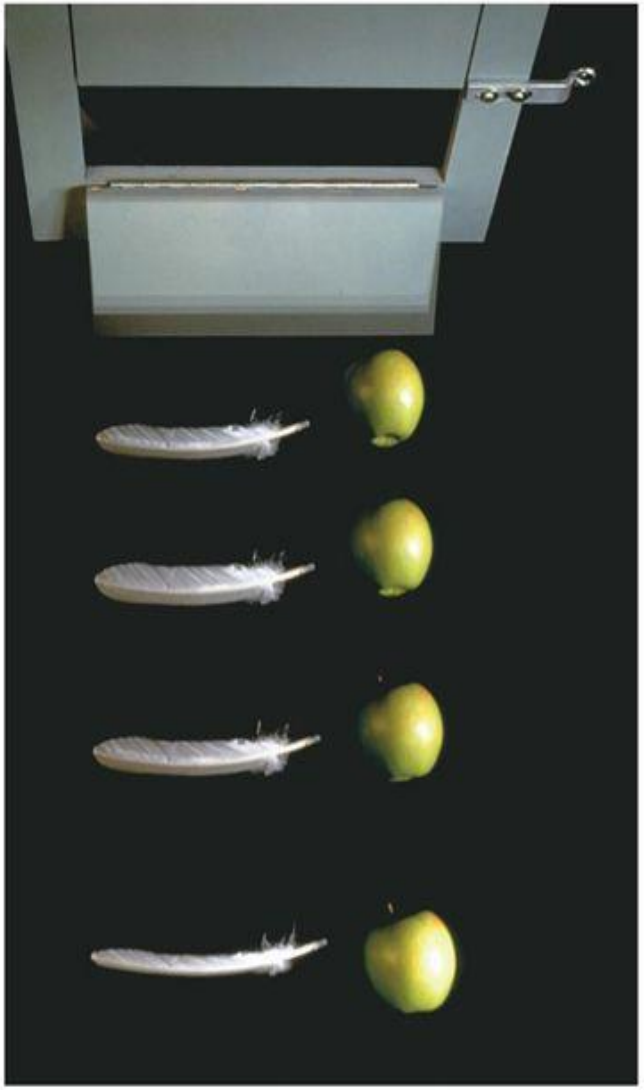
Free-Fall

- Any object which is being acted upon only by the force of gravity is said to be in a state of **free fall**
  - Free-falling objects do not encounter air resistance
    - On Earth, only approximate free-fall is possible
  - All free-falling objects on Earth accelerate downwards at a rate of 9.81 m/s^2



Freely Falling Objects

- An object is in **free fall** when it accelerates downward only under the influence of gravity
  - Air resistance must be removed
  - This is an *idealization*, not applicable to real-world situations
  - The object is in free fall as soon as it is released, whether it is dropped, thrown downward, or thrown upward
  - ALL OBJECTS UNDERGOING FREE FALL HAVE THE SAME ACCELERATION, RAGARDLESS OF SHAPE OR MASS!!!!!!!



What is Free fall?

Free fall is the downward motion under the influence of gravity.

In other words, when the only force acting on an object is gravity, the object is said to be in free fall.

In a vacuum (no air) all objects in free fall accelerate at the same rate, regardless of mass.

Falling objects & air resistance

(a)

More air resistance on without crumpled-up piece of paper

(b)

Less air resistance on crumpled-up piece of paper

Free-Fall & Projectiles