Stuff that Falls

(Vertical Motion)

Falling Objects

- When an object falls freely, it accelerates
- This acceleration is due to gravitational force
- The amount of acceleration, *g*, varies with height above the surface of the earth
  - Although not enough to really notice
    - ~9.82 ms^{-2} (sea level) to ~9.79 ms^{-2} (Mt. Everest)
- For our purposes, ***g* = 9.81 ms^{-2}** down

What happens when a ball is thrown straight up in the air?

- On its way up, the ball slows down
  - The acceleration due to gravity is in the opposite direction of the velocity of the ball
  - Ball is going up; gravity is pulling down
- On its way down, the ball speeds up
  - The acceleration due to gravity is in the same direction as the velocity of the ball
  - Ball is going down; gravity is pulling down

- That means that the acceleration due to gravity is always down
  - We probably already suspected that
- What happens to the ball at the very top of its path?
  - It stops
- What is the acceleration at that point?
  - It is still the acceleration due to gravity and it is still down
  - However, rather than changing the speed of the ball, the gravitational acceleration is causing a change in **direction**

Air Resistance

- All objects in a vacuum fall with the same rate of acceleration regardless of mass
- We see different rates because of air resistance
  - The air pushes up on the object slowing it down
- If we remove the effect of air resistance the objects will fall at the same rate

Terminal Velocity

- When an object falls the air is compressed under it and pushes up against the object
- At some point, the force of the air is equal to the force of gravity
- The object will continue to fall but will no longer accelerate
- This maximum velocity is called terminal velocity
- The terminal velocity depends on the surface area and mass of the object and the density of air