**What are the phenomena we are seeing?**

* Single mass in motion
  + Inclined plane
  + Vertical loop-the-loop
  + Irregular shaped track
  + Other cases
* Single mass feeling a variable force (non-constant acceleration)
  + Spring
  + Pendulum
  + Other variable force
* Elastic Collision

**What are the quantities and relevant definitions and special cases?**

* Kinetic energy
* Related to object’s motion
* Proportional to square of object’s speed
* Proportional to object’s mass
* Translational kinetic energy
* Rotational kinetic energy
* Potential energy
* Related to object’s position
* Potential energy must be defined relative to a reference frame
* Derivative of potential energy with respect to position equals negative of (conservative) force
* Gravitational potential energy
* Proportional to object’s mass and height (from reference)
* Elastic potential energy
* Reference position is at system’s equilibrium position
* Due to other conservative force
* Work
* Dot product of constant force and displacement
* Area under a (component) force vs. position graph (integral)
* Work done by a force is positive if it is adding energy to the system
* Work done by a force is negative if it is removing energy from the system
* Path independent if done by a conservative force
* Depends on path if done by a non-conservative force
* Power
* Rate at which work is done
* Dot product of constant force and velocity
* Area under a (component) force vs. velocity graph (integral)

**What are the physical laws involved?**

* The work done by all external forces on an object equals the change in its kinetic energy.
* The work done by all non-conservative forces equals the change in the total mechanical energy of a system