Chapter 8: Potential Energy

Potential Energy:

- Associated with the configuration of a system
  - How objects are arranged with respect to each other
  - How objects are connected to each other
- We focus on two forms of potential energy
  - Gravitational potential energy (associated with weight)
  - Elastic potential energy (associated with a spring force)

Potential Energy

Need something that can store energy

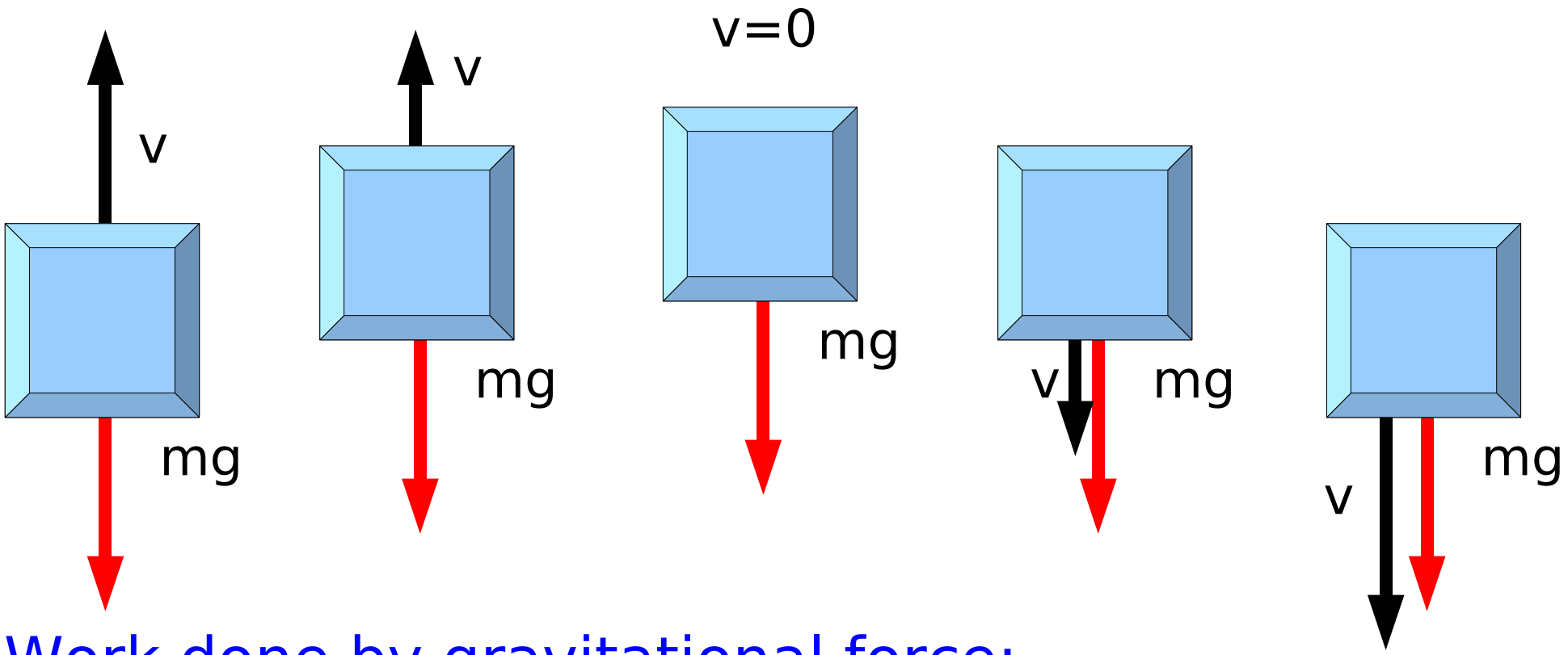
- Gravitational Field
  - Bowling Ball on a closet shelve
  - Bungee jumper on a bridge
  - ...

  Everything that has to do with heights

- Spring
  - Bungee cord stretch
  - Blade spring in a suspension system
  - ...

  Everything that has to do with elastic deformation

Work and Potential Energy

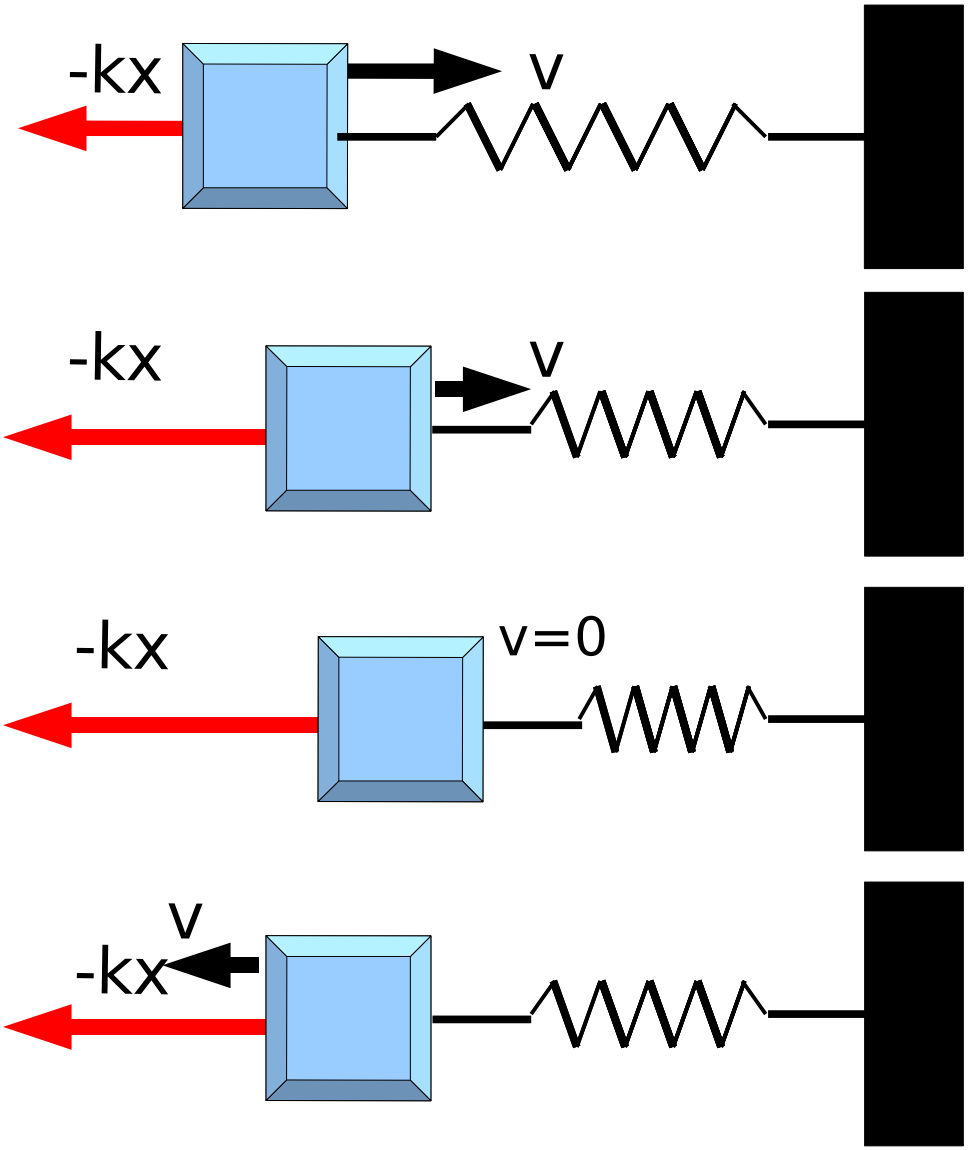


Work done by gravitational force:

- Changes from negative to positive at turning point (Ch 7)
- Transfers energy from kinetic into potential into kinetic energy

$$\Delta U = -W$$

Work and Potential Energy



Work done by spring (elastic) force:

- Changes from negative to positive at turning point (Ch 7)
- Transfers energy from kinetic into potential into kinetic energy

$$\Delta U = -W$$

Only for conservative systems

<=>

No friction

Conservative Forces

Conservative Forces

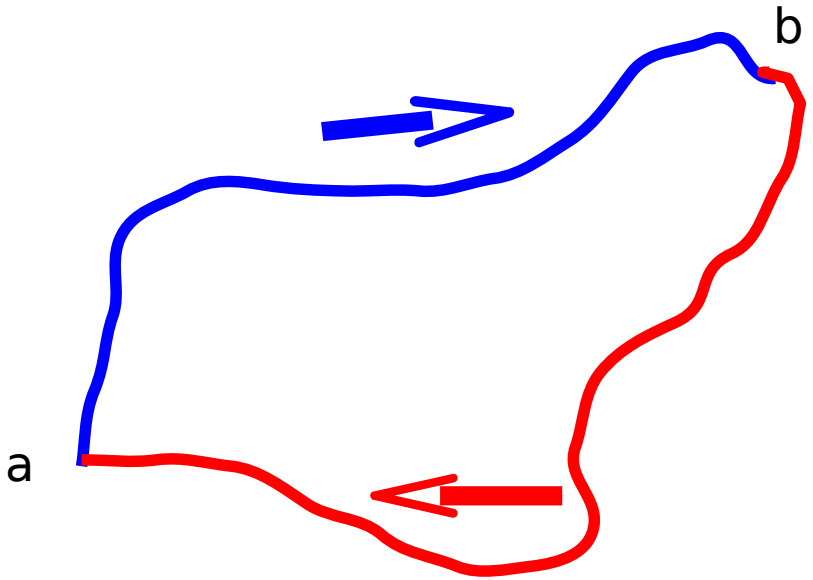
- A force between two objects
  - Gravity: Bowling Ball and Earth
  - Spring: Mass and Wall (where the spring is attached to)
- Force transforms energy
  - kinetic energy into potential energy (Work W_1)
  - potential energy into kinetic energy (Work W_2)

Conservative force if after a complete reverse $W_1 = -W_2$

Conservative and Nonconservative Forces

1. Formal approach (Do we love our theorists?): The net work done by a conservative force on a particle moving around any closed path is zero.

$W_{ab} = -W_{ba}$



$$W_{ab} = \int_a^b \vec{F} \cdot \vec{ds}$$

Note: $\vec{F} \cdot \vec{ds}$

Can change sign while moving along the path between a and b!

Conservative and Nonconservative Forces

1. The net work done by a conservative force on a particle moving around any closed path is zero.

2. The work done by a conservative force on a particle moving between two points does not depend on the path taken by the particle.

$$W_{ab,1} = W_{ab,2}$$