

Potential Energy Functions

Potential Energy

- Conservative forces have potential energy functions associated with them.
- Force is the negative derivative of the potential energy function with respect to position.

$$F = -\frac{dU}{dx}$$

- Gravitational PE = mgh

$$F = -\frac{dU}{dh} = -mg$$

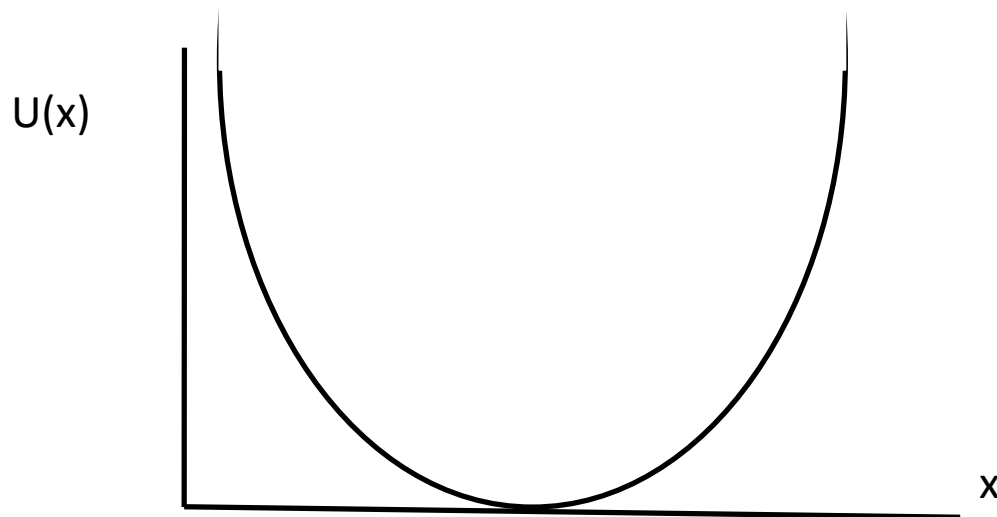
- Elastic PE = $\frac{1}{2}kx^2$

$$F = -\frac{dU}{dx} = -kx$$

Potential Energy Curves

- We can analyze the behavior of a system if we are given a graph of potential energy as a function of x .

Ex: Draw the PE of a pendulum as a function of x .



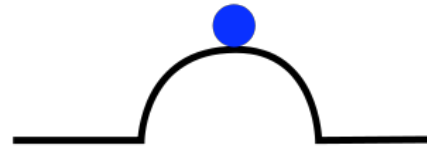
- When is the object in equilibrium?
 - At turning point, when slope = 0, so force = 0
- What type of equilibrium is it?
 - If object is displaced slightly, it returns to its equilibrium position. This is called **stable equilibrium**.

Types of Equilibrium

- Stable equilibrium –



- Unstable equilibrium –



- Neutral –



Ex: For the potential energy curve shown, (a) determine where the force is +, -, or 0 at the five points indicated, and (b) indicate points of stable, unstable, and neutral equilibrium.

