Energy

- Many types
- Units 1 Joule (J) = 1 kg-m^2/s^2
- Kinetic Energy – $K = \frac{1}{2}mv^2$
  - (also rotational and vibrational)
- Gravitational Potential Energy – $U_g = mgh$
- Elastic (Spring) Potential Energy – $U_s = \frac{1}{2}kx^2$
- Internal or Thermal Energy – E_{TH}
- Chemical Energy – E_{chem}
- Mass Energy – $E = mc^2$

- Has Science identified all the possible energies?
- Probably not
- Dark Energy
  - Causes the accelerating expansion of universe
  - Not really known what it is

FIGURE 10.1 Energy transformations occur within the system.

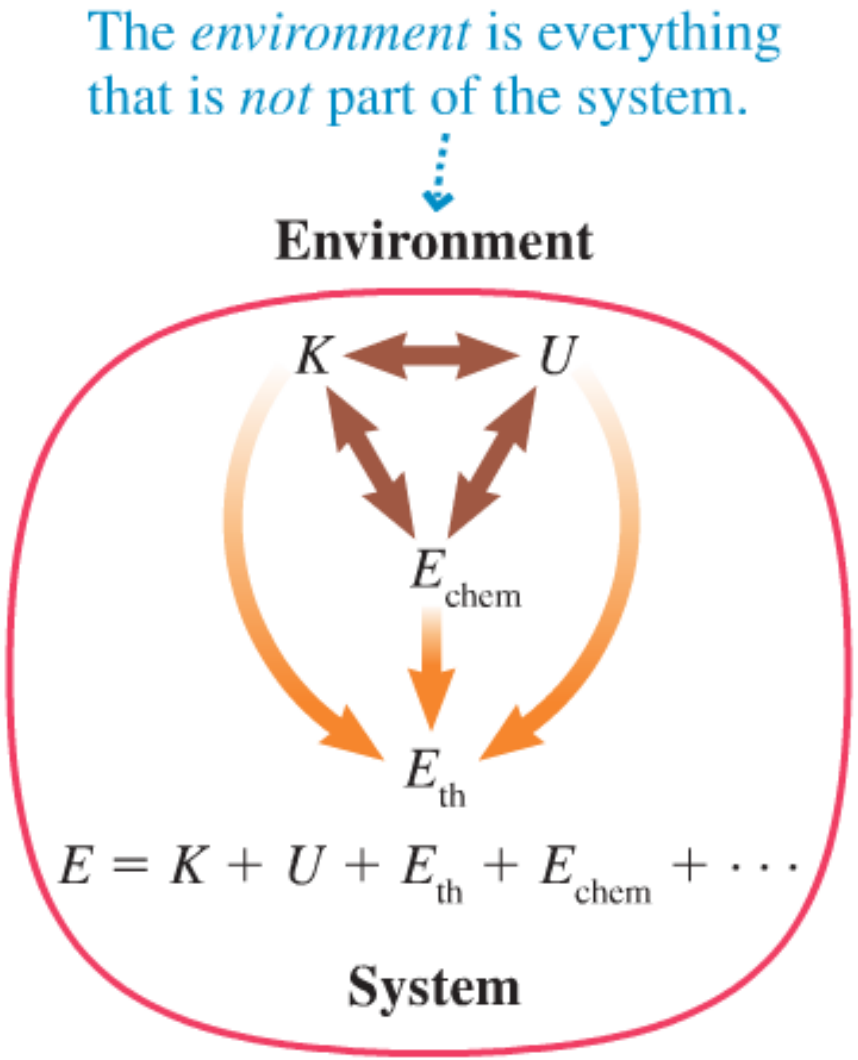
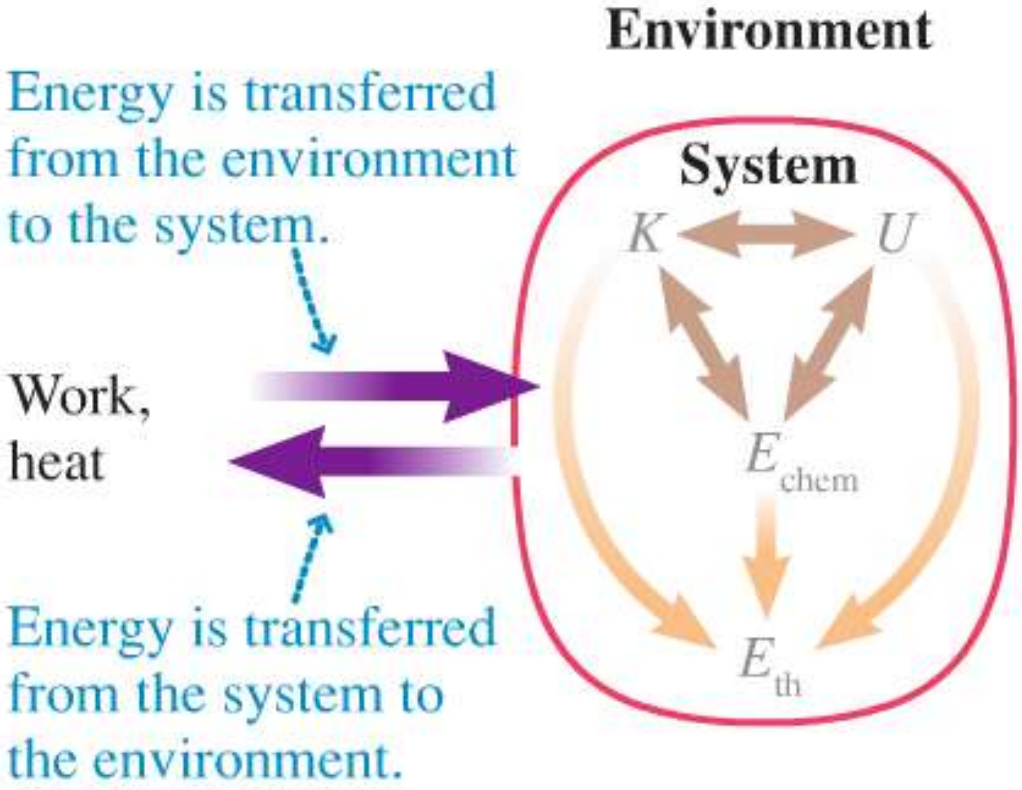
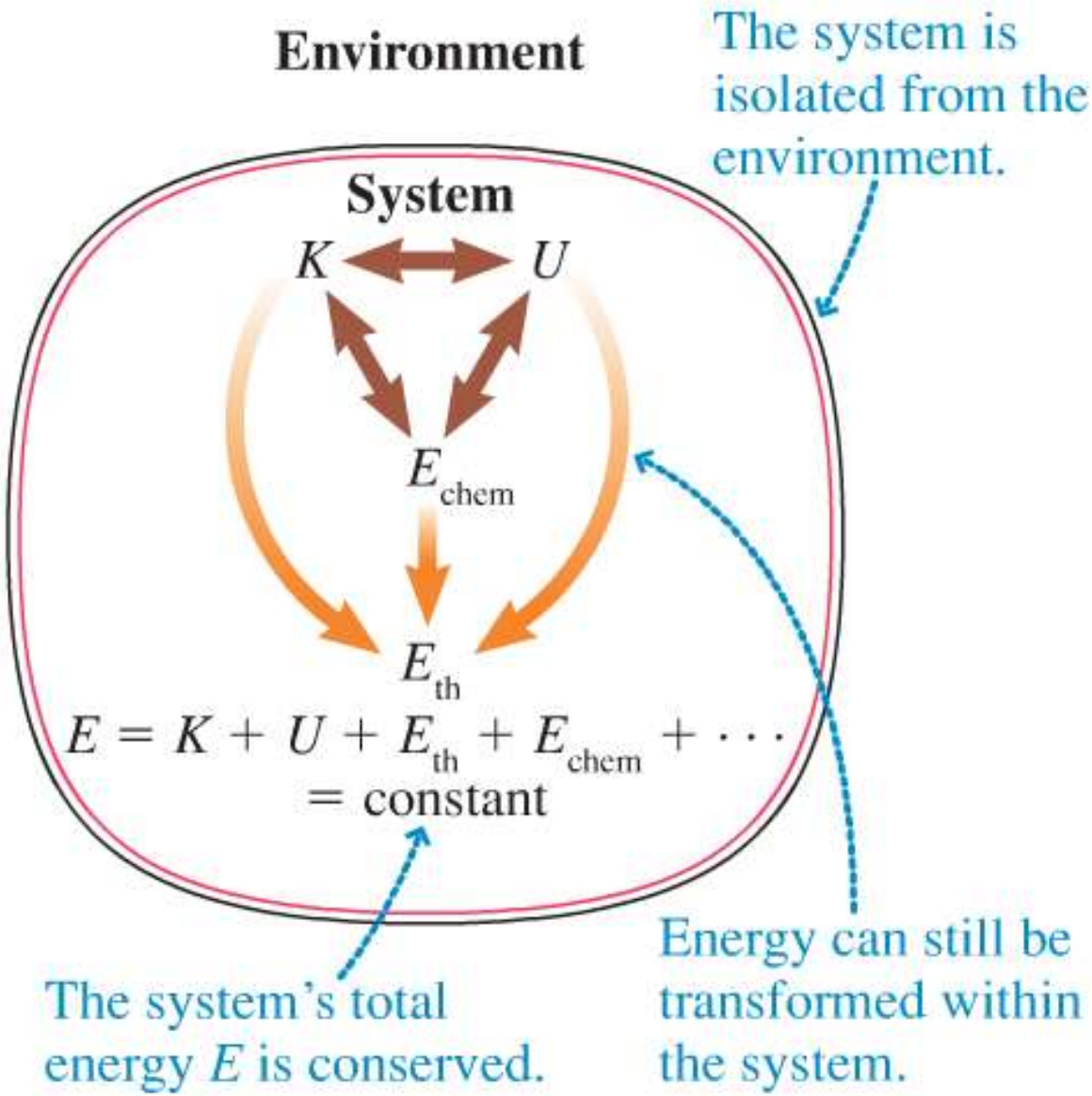


FIGURE 10.2 The basic energy model shows that work and heat are energy transfers into and out of the system, while energy transformations occur within the system.



$$W + Q = \Delta E_{sys}$$

FIGURE 10.3 An isolated system.



$$0 = \Delta E_{sys}$$

$$E_{final} = E_{initial}$$

Using Conservation of Energy

- Use if interested in changes of height or speed
- Identify the system (often connected by ropes or springs!)
- If no object objects exerting forces on system
- Note gravity force accounted by *mgh* already.
- Internal system forces do no work.
- Look at t = 0 and t_{final}, how has the energy of each member of the system changed?