Do Now:

• What does it mean to “conserve energy”?

Energy Transformations and Conservation
Energy Transformations

• What does flowing water have to do with electricity?
• You may already know that the mechanical energy of moving water can be transformed into electrical energy.
Most forms of energy can be transformed into other forms

- A change from one form of energy to another is called an energy transformation.
- Some energy changes involve single transformations, while others involve many transformations.
Single Transformations

• Sometimes, one form of energy needs to be transformed into another to get work done.
• For example, a toaster transforms electrical energy to thermal energy to toast your bread.
• A cell phone transforms electrical energy to electromagnetic energy that travels to other phones.
- Your body transforms the chemical energy in your food to mechanical energy you need to move your muscles.
- Chemical energy in food is also transformed to the thermal energy your body uses to maintain its temperature.
Multiple Transformations

- Often, a series of energy transformations is needed to do work.
- For example, the mechanical energy used to strike a match is transformed first to thermal energy.
- The thermal energy causes the particles in the match to release stored chemical energy, which is transformed to thermal energy and the electromagnetic energy you see as light.
• In a car engine, another series of energy conversions occurs.
• Electrical energy produces a spark.
• The thermal energy of the spark releases chemical energy in the fuel.
• The fuel’s chemical energy in turn becomes thermal energy.
• Thermal energy is converted to mechanical energy used to move the car, and to electrical energy to produce more sparks.
Transformations Between Potential and Kinetic Energy

• One of the most common energy transformations is the transformation between potential energy and kinetic energy.
• In waterfalls such as Niagara Falls, potential energy is transformed to kinetic energy.
• The water at the top of the falls has gravitational potential energy.
• As the water plunges, its velocity increases.
• Its potential energy becomes kinetic energy.
Swinging Pendulum
Energy Transformation in a Pole Vault

- The pole-vaulter has kinetic energy as he runs forward.
- When the pole-vaulter plants the pole to jump, his velocity decreases and the pole bends.
- His kinetic energy is transformed to elastic potential energy in the pole.
• As the pole straightens out, the pole-vaulter is lifted high into the air.

• The elastic potential energy of the pole is transformed to the gravitational potential energy of the pole-vaulter.

• Once he is over the bar, the pole-vaulter’s gravitational potential energy is transformed back into kinetic energy as he falls toward the safety cushion.
Conservation of Energy

• If you set a spinning top in motion, will the top remain in motion forever?
• No, it will not.
• Then what happens to its energy?
• Is the energy destroyed?
• Again, the answer is no.
• The law of conservation of energy states that when one form of energy is transformed to another, no energy is destroyed in the process.
According to the law of conservation of energy, energy cannot be created or destroyed.

So the total amount of energy is the same before and after any transformation.

If you add up all the new forms of energy after a transformation, all of the original energy will be accounted for.
Energy and Friction

• So what happens to the energy of the top?
• As the top spins, it encounters friction with the table and friction from the air.
• Whenever a moving object experiences friction, some of its kinetic energy is transformed into thermal energy.
• So, the mechanical energy of the spinning top is transformed to thermal energy.
• The top slows and eventually falls on its side, but its energy is not destroyed—it is transformed.
• The fact that friction transforms mechanical energy to thermal energy should not surprise you.
• The fact that friction transforms mechanical energy to thermal energy explains why no machine is 100 percent efficient.
• You may recall that the output work of any real machine is always less than the input work.
• This reduced efficiency occurs because some mechanical energy is always transformed into thermal energy due to friction.
Closure:

Describe the energy transformations that occur in a clothes dryer.