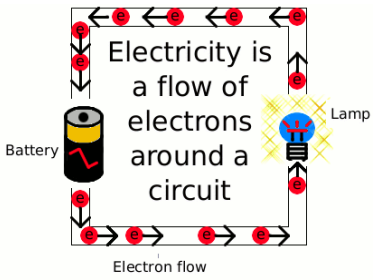
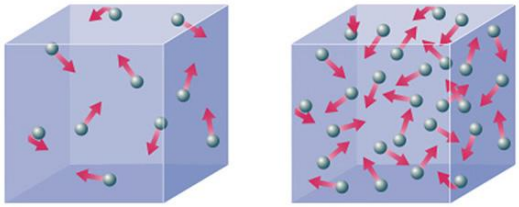
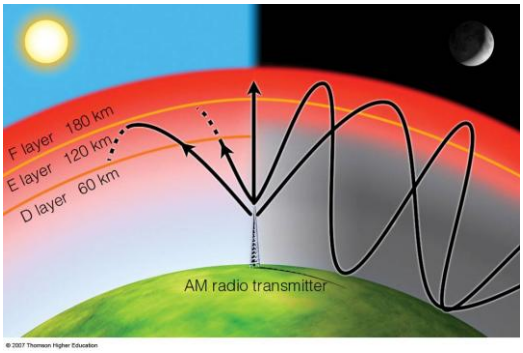
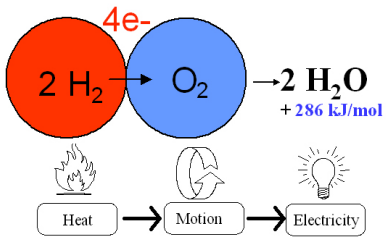
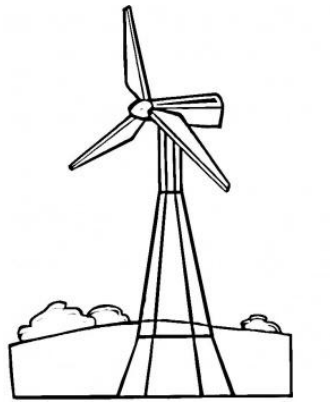
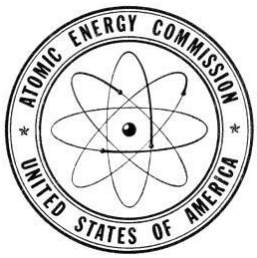
Energy: Its Forms, Conservation and Efficiency

1. **What is energy**?

2. **Forms of Energy**

Form	Description	Examples	How is work being done?
Electrical 	Movement of electrons	Battery, power plant , generator	Electrons through magnetism can move mechanical parts or generate heat, light
Thermal 	Motion of atom and molecules releases heat		

Radiation energy 	Propagation(movement) of electromagnetic waves		
Chemical energy 	Stored in bonds		
Wind energy 	Results from the movement of air		
Nuclear energy 	Stored in the nucleus of atoms		

3. Conservation of Energy

Energy can be transformed from one form to another but cannot be destroyed or created.

Example 1: If a certain amount of water contains 150 kJ of energy, and it splits up into oxygen and hydrogen, which contain a total of 250 kJ, how much energy is required to electrolyze that same quantity of water?

4. Energy Efficiency

$$\%\ efficiency = \frac{useful\ energy}{total\ energy\ consumed} \text{ X } 100\%$$

Example 1 A certain amount of gasoline with a total energy content of 1000 kJ is burnt, but only 120 kJ of it goes towards moving the car's wheels. 330 kJ are wasted through heat and pollution. What is the % efficiency of an automobile burning gasoline?

Example 2 A certain clock is 75% efficient. If it is provided with 0.10 kWh of energy, how much energy goes towards keeping time? How much energy is wasted? Where does the rest of the energy go?

5. The Difference between Heat and Temperature

Heat is a form of energy that depends on temperature and the total number of molecules at that temperature.

Temperature is related to how fast molecules are moving but does **not** depend on the number of molecules.

Example: Give an example of something with lots of heat but with a mild temperature. Also give an example of a high temperature object with a low heat content.

Exercises

1. Give examples for each of the following:
   a) radiation energy=cell phone; radio; cable /satelliteTV
   b) wind energy = wind turbines;
   c) solar energy = solar calculator; solar tiles; solar panels

2. How do microwaves do work on the food? =they excite mostly water molecules, which then excite other food molecules, raising their temperature

3. If a cake contains 1000 kJ of energy, and 150kJ end up stored as fat in your body and 400 kJ ended up as heat, how much of the cake's energy went into movement and thinking etc.?

   1000 = 150 + 400 + x

   x= 1000 - 150 - 400 = 550 kJ

4. A certain bike is 65% efficient. If it is provided with 600 kJ of energy, how much energy goes towards moving the wheels? How much energy is wasted? Where does the rest of the energy go?

   0.65(600) = 390 kJ

   Wasted = 600 – 390 =210 kJ lost as heat(friction)

5. Calculate the % efficiency of a solar cell if it absorbs 2000 kJ of light energy and converts into 400 kJ of electrical energy.

   400/2000 * 100% = 20%

6. Near Jupiter, the temperature of the thin gases from the planet Io's volcanoes is extremely high and yet the space probes that pass through the gases do not get damaged. Why is that?

   The molecules are moving fast (high temp) but there are very few of them, lowering the total heat content.