

# Exercises for Basic Alternative Energy

1. Does the time of day matter when using a solar cell?
2. What does temperature measure?
3. How can we store energy in water for later use?
4. What are common problems with windmills?
5. What are three different kinds of batteries, and what are their limitations?
6. What is the difference between dehydration and hydration, and why is this important?
7. Name two ways a homeowner can save money on a home's energy bills during the summer.
8. How can we get fuel from a peanut?

# Exercises for Advanced Alternative Energy

1. What are three different sources of alternative energy?
2. What's the difference between *alternative* and *renewable* energy?
3. What is power a measure of?
4. What is energy?
5. How does a solar cell work?
6. Where does the power from a crystal radio come from?
7. How does a wind turbine create electricity?
8. Are a motor and a generator the same thing?
9. Does a water molecule give energy when you split it apart?
10. Would you get more energy from splitting an atom or a proton?
11. How can a car be powered by only sunlight and water?

# Answers to Basic Energy Exercises

1. Does the time of day matter when using a solar cell? *Yes, the sun's angle in relation to the solar cell will change the amount of power generated.*
2. What does temperature measure? *The average speed of the molecules in a substance.*
3. How can we store energy in water for later use? *A large container of salt water can absorb heat energy during the day and release it during the evening because, in a salt water pond, the warmer water is trapped below the surface of the water under an insulating layer and does not escape through convection.*
4. What are common problems with windmills? *No-wind conditions and storms will limit the amount of power generated.*
5. What are three different kinds of batteries, and what are their limitations? *Dry cells (found in flashlights and portable radios), mercury batteries (inside cameras and watches), and lead storage batteries (car batteries). Most batteries are non-reversible and cannot be recharged, making them single-use.*
6. What is the difference between dehydration and hydration, and why is this important? *Dehydration means the water has been removed from a substance. Hydration means that water has been added to a substance. Hydrated magnesium sulfate requires heat when combined with water to break the ions, and will become cold (endothermic). Dehydrated magnesium sulfate generates heat when combined with water and becomes warm (exothermic).*
7. Name two ways a home owner can save money on a home's energy bills during the summer. *A homeowner can cut down on energy loss with proper insulation to keep the cool air indoors and decrease the heat transfer through walls, windows, and doors. Also, by surrounding the house with shady trees, the air conditioner's work load can be decreased by keeping the house out of direct sunlight.*
8. How can we get fuel from a peanut? *A peanut is not a nut, but a seed which has proteins, fat, and carbohydrates. The oil (fat and carbs) from the peanut can be ignited and the energy can be released in the form of heat and light.*

## Answers to Advanced Alternative Energy Exercises

1. Solar cells, wind turbine, hydro (water) power plants, fuel cells.
2. Renewable energy is the energy created from natural sources, like sunlight, water, wind, and temperature differences (geothermal).
3. Power measures how quickly work can be done.
4. Energy is the ability to do work. Work is moving something against a force over a distance.
5. A solar cell converts sunlight straight into electricity by using a special material that allows electrons to be knocked out of their shells when hit by a photon. The free electrons are directed into a flow of DV current.
6. The source of power comes directly from the radio waves themselves.
7. Wind turbines spin big coils of wire around very powerful magnets when their propellers (which are attached to the motor shaft) rotate.
8. Yes, they are the same object, but it's how you use them that makes them different. A motor uses electricity (applied to the terminals) to rotate the shaft and a generator rotates the shaft to create electricity at the terminals. If you spin the shaft of a motor with your fingers, you can measure a voltage at the terminals.
9. No. A water molecule requires energy to split it apart (endothermic reaction). When the opposite occurs, or hydrogen and oxygen combine, the reaction is exothermic (gives off energy).
10. *Much* more energy is released from splitting a proton than an atom. The forces that hold together a proton are much greater than the forces that bind an atom.
11. When you combine oxygen and hydrogen together, it makes water and a puff of energy. That's what a fuel cell does. Most fuel cells are reversible, meaning that you can fill their tank with water and leave them out (with their solar panel pointed toward the sun), and the solar cell will split apart the water molecules and store the gases in separate tanks. When you're ready to drive your car, the fuel cell

switches so it can combine the gases to create electricity to turn the motor (which turns the wheels of the car).