Solar Energy Questions

1) How can you take advantage of passive solar energy?

2) Describe the use of active solar technology.

3) PV cells are also known as _______. What are they made up of?

4) What are the initial costs of solar power? High or low?

5) What are the advantages using solar cells to generate electricity?

6) What are the disadvantages?

7) According to the pie chart, rank the renewable energy consumption from greatest to least.

8) What biome do you think has the most potential for solar energy produced electricity?

Wind

1) Wind energy converts ___________ energy into electrical energy to power homes, businesses, and schools.

2) What structure is used to collect wind energy?

3) How does it work?

4) What are the advantages of wind powered energy?
   a. __
   b. __
   c. __

5) What are the disadvantages?
   a. __
   b. __
   c. __
   d. __
   e. __
   f. __
   g. __
Passive solar is an old concept that takes advantage of the sun rather than compete with it. In building design, the position of structures such as windows and solar panels are very important considerations. Good passive solar design is based upon the position of the sun. For example, the sun faces the south side of a building for most of the day in the northern latitudes. Thus the south side of the building has the most solar radiation. Placement of solar panels, windows, and insulation are all based upon this information in mind. Building with windows and building materials that absorb and slowly release the sun's heat represent a passive solar design. No mechanical means are employed in passive solar heating. Incorporating passive solar designs can reduce heating bills by as much as 50 percent. Passive solar designs can also include natural ventilation for cooling.

Active solar - hot water heaters, for example, use the sun to heat either water or a heat-transfer fluid in collectors. A typical system will reduce the need for conventional water heating by about three-fourths. Hot temperature solar water heaters can provide energy-efficient hot water and hot water heat for large commercial and industrial facilities. Since hot water is actively regulated by pumps and thermostats, this process is considered active, thus the term active solar.

Photovoltaics - also called PV systems convert light energy into electricity. The term “photovoltaic” is a combination of the Greek “phos” which means “light” and “voltaic” which means “electricity.” Photovoltaic solar cells, which already convert sunlight into electricity, are made of semiconducting materials. Most commonly known are solar cells. PV systems are already an important part of our lives. The simplest systems produce only the electricity needed to run a small light or a microwave oven. A more complicated system can power the entire house and even sell electricity to the grid.

Advantages:

1. Little to no environmental damage
2. No pollution
3. Easy to handle, operate and maintain
4. Saves fossil fuel resources

Disadvantages:

1. Not always available
2. Cannot be stored
3. High initial cost
4. Must have appliances and lamps that run on lower voltage

Wind - energy has been harnessed for hundreds of years. From old Holland to barns in the United States, windmills have been used for pumping water or grinding grain. Modern windmills use a wind turbine and use the wind’s energy to generate electricity. The term “wind energy” or “wind power” describes the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity to power homes, businesses and industries.

Wind turbines, like windmills, are mounted on a tower to capture more wind energy. As 100 feet (30 meters) or more above ground, they can take advantage of the faster and less turbulent wind. Turbines catch the wind’s energy with their propeller-like blades. Usually, two or three blades are mounted on a shaft to form a rotor.

A blade acts much like an airplane wing. When the wind blows, a pocket of low-pressure air forms on the downwind side of the blade. The lower pressure air pushes the blade toward it, causing the rotor to turn. This is called lift. The force of the lift is actually much stronger than the wind force against the front side of the blades which is called drag. The combination of lift and drag causes the rotor to spin like a propeller, and the turning shaft drives a generator to make electricity.

Wind turbines can be used as stand-alone applications, or they can be connected to a utility power grid or even combined with a photovoltaic (solar cell) system. Stand-alone wind turbines are typically used for water pumping or communications. However, homeowners or farmers in windy areas can also use wind turbines as a way to cut their electric bills. For utility-scale sources of wind energy, a large number of wind turbines are usually built close together to form a wind farm. Several electricity providers today use wind plants to supply power to their customers.

Even though the cost of wind power has decreased dramatically in the past two decades, the technology still requires much of the initial investment in turbines and turbines. Typically, it is cheaper to build a wind farm than to build a power plant. However, wind farms can be more competitive with other generating technologies because there is no fuel to purchase and minimal operating expenses.

Advantages:

1. Numerous public opinion surveys have consistently shown that the public prefers wind and other renewable energy forms over conventional sources of generation.
2. Wind energy is a free, renewable resource, so no matter how much is used today, there will still be the same supply in the future.
3. Wind energy is also a source of clean, non-polluting electricity. Unlike conventional power plants, wind plants emit no air pollutants or greenhouse gases. In 1980, California’s wind power plants offset the emission of 2.6 million pounds of carbon dioxide, and 15 million pounds of other pollutants that would have otherwise been produced. In 1988, California’s wind power plants produced enough energy to power 15 million homes.
4. Good wind sites are often located in remote locations far from areas of electric power demand (such as cities).
5. Wind turbine development may compete with other uses for the land and those alternative uses may be more highly valued than electricity generation. However, wind turbines can be located on land that is also used for grazing or even farming.
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<th>Answers</th>
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<tbody>
<tr>
<td>1) Where is tidal energy available?</td>
<td>Tidal plants are working in China.</td>
</tr>
<tr>
<td>3) List the disadvantages:</td>
<td>a. High initial cost; b. Competition with fisheries.</td>
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**Biofuels:**

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<td>2) What does the term biofuels refer to?</td>
<td>The term biofuels refers to the use of plant material as an energy source.</td>
</tr>
<tr>
<td>3) What are the two common biofuels in the US?</td>
<td>Ethanol and biodiesel.</td>
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<tr>
<td>4) How is ethanol made?</td>
<td>Ethanol is made from the fermentation of plant material.</td>
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<tr>
<td>5) Ethanol is used to increase the octane rating of fuel.</td>
<td></td>
</tr>
<tr>
<td>6) What crop has been diverted from human food production to making fuel?</td>
<td>Corn.</td>
</tr>
<tr>
<td>7) What are mandated by the EPA?</td>
<td>The sale of oxygenated fuels in areas with high CO levels.</td>
</tr>
<tr>
<td>8) What is meant by E85?</td>
<td>85% ethanol, 15% gasoline.</td>
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<tr>
<td>9) What are the advantages?</td>
<td>a. Renewable; b. Reduced dependency on oil.</td>
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<tr>
<td>10) What is biodiesel made of?</td>
<td>Plants.</td>
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The principal of harnessing the energy of the tides dates back to eleventh century England when tides were used to turn waterwheels, producing mechanical power. More recently, rising and falling tides have been used to generate electricity, in much the same manner as hydroelectric power plants.

One of the main barriers to the increased use of tidal energy is the cost of building tidal generating stations. For example, it has been estimated that the construction of the proposed facility on the Severn River in England would have a construction cost of $1.6 billion. Operating and maintenance costs of tidal power plants are very low because the "fuel" (sea-water) is free, but the overall cost of electricity generated is still very high.

The few studies that have been undertaken to date have identified the environmental impacts of tidal power schemes. The most important is that the specific site is different and the impacts depend greatly upon local geography. Local tides change only slightly due to the relative location and the environmental impact has been negligible, but this may not be the case for other sites. It has been estimated that the Bay of Fundy tidal power plants could decrease local tides by 55 cm. This does not seem a high enough value to consider.

Another problem is that tidal power plants are not widely considered as a viable source of energy. The level of the tides fluctuates by several meters several times a day. The amount of energy that can be generated is directly proportional to the size of the tidal range.

Advantages:
1. Tidal energy is a renewable source of electricity, which does not result in the emission of greenhouse gases responsible for global warming.
2. There is no generation of acid precipitation associated with fossil fuels.
3. Use of tidal energy also decreases the need for nuclear power, with the associated radiation risks.

Disadvantages:
1. Changing tidal flows by damming a bay or estuary could result in negative impacts on aquatic and terrestrial ecosystems, as well as navigation and recreation.
2. Very little is understood about how altering the tides can affect complex aquatic and terrestrial ecosystems. One fear is that enhanced mixing of water could cause toxic tidal herring to potentially increase the growth of the "red tide" organism, Gymnostomum enucleatum, which causes paralytic shellfish poisoning.
3. Unfortunately, only a few methods of increasing our knowledge about how tidal changes affect ecosystems may be to study the effects of changes made to the Bay of Fundy.

Biofuels are alcohols, ethers, esters, and other chemicals made from renewable biomass, such as herbaceous and woody plants, agricultural and forestry residues, and a large proportion of municipal solid and industrial waste. The term "biofuels" usually refers to fuels for electricity and fuels for transportation. Biofuels that are used for transportation include biodiesel, ethanol, methanol, and polyethylene. The two most common types of biofuels that are being developed and used in the United States are biodiesel and ethanol. This is due to several factors including the low and availability of fossil fuel conversion technology, feedstock availability, and fuel usability.

Biofuels are the most widely used biofuel today. More than 1.5 billion gallons are added to gasoline in the U.S. each year to improve vehicle performance and reduce air pollution. Ethanol is an alcohol, and methanol is made using a process similar to making beer where starch crops are converted into sugars, the sugars are fermented into ethanol, and then the ethanol is distilled into its final form. Ethanol made from cellulose, however, is instead of traditional fossil-based (at least crop) ethanol by fermentation.

Ethanol is used to increase octane and improve the emissions quality of gasolines. The Clean Air Act Amendments of 1990 mandated the sale of oxygenated fuel in areas of the country with high levels of carbon monoxide. Since that time, there has been a strong demand for ethanol as an oxygenated fuel of gasoline. In some areas of the United States today, ethanol is blended with gasoline to form an E10 blend (10% ethanol and 90% gasoline), but it can be used in higher concentrations such as E85 or E100 pure form.

Unlike ethanol, which is a motor fuel, biofuels are composed of fatty acid esters. Biodiesel is manufactured from most vegetable oils, animal fats, and recycled greases. Through a process called transesterification, organically derived oils are combined with alcohol (ethanol or methanol) and then mixed into form fatty esters such as ethyl or methyl ester. The biomass-derived alcohol or methyl ester can be blended with conventional diesel fuel or used as a neat fuel (100% biodiesel).

Biodiesel is typically used as a fuel additive in 20% blends (E20) with petroleum-based diesel, while other biodiesel levels can be used depending on the cost of the fuel and the environmental aspect. The Energy Policy Act of 2005 (EPACT) as amended in 2007 allows regulated fuel to be used for gasoline and diesel fuel to be used for gasoline and diesel fuel for transportation purposes. In 2005, 2009, and 2014, the tax credit for biodiesel and renewable diesel were extended.

The United States produced about 5 million gallons of soy oil, biodiesel is used in some federal, state, and transit fleets and other equipment. New and biodiesel biodiesel is used in steam, trucks, buses, and locomotives. There is a growing interest in using biodiesel where vehicles are exposed to diesel exhaust, in areas to control local pollution near airports, and in locomotives that face restricted use unless emissions can be reduced.

Advantages:
1. Biodiesel is good for the environment because it adds fewer emissions to the atmosphere than petroleum fuels and has a higher environmental impact than conventional diesel.
2. Unlike petro-diesel, which is a renewable renewable fuel, biodiesel is renewable and an alternative alternative to diesel fuel.
3. Because biodiesel is grown domestically, it reduces our dependence on foreign oil, helps boost the U.S. economy, and helps strengthen U.S. energy security.

Disadvantages:
1. Biodiesel is not currently developed adequately to be a viable viable energy source.

Fuels, however, are expected to be quite expensive compared to conventional fuels.

Advantages:
1. Methanol is clean burning and has lower emissions than coal.
2. Methanol is a good source of energy.
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<td><strong>1)</strong> What is the state of hydrogen in normal temperatures and pressures?</td>
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<td><strong>3)</strong> What is a status of distribution infrastructure for hydrogen fuel?</td>
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<tr>
<td><strong>4)</strong> How does it work in the summer?</td>
<td><strong>4)</strong> Describe the methods of H₂ production.</td>
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<td><strong>5)</strong> Where are most geothermal reservoirs in the US?</td>
<td>a. Electrolysis</td>
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<td><strong>6)</strong> Hot water can be used directly to</td>
<td>b. Synthetic gas production.</td>
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<td><strong>7)</strong> How can geothermal create electricity?</td>
<td><strong>5)</strong> Advantages:</td>
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Geothermal: Geo(Earth) thermal(heat) energy is an enormous, undervalued heat and power resource that is clean (emits little or no greenhouse gases), reliable (average system availability of 95%), and homegrown (making us less dependent on foreign oil).

Geothermal resources range from shallow ground to hot water and rock several miles below Earth's surface, and even farther down to the extremely high temperatures of molten rock called magma.

Earth's energy can be converted into heat and electricity. The three technology categories are geothermal heat pumps, direct-use applications, and power plants.

Almost everywhere, the upper 10 feet of Earth's surface maintains a nearly constant temperature between 80 and 90 degrees F (20 and 30 degrees C). A geothermal heat pump system consists of pipes buried in the shallow ground near the building, a heat exchanger, and ductwork into the building. In winter, heat from the relatively warmer ground goes through the heat exchanger into the house. In summer, heat from the house is pulled through the heat exchanger into the relatively cooler ground. Heat removed during the summer can be used as near-free energy to heat water.

In the U.S., most geothermal reservoirs are located in the western states, Alaska, and Hawaii. Hot water near Earth's surface can be piped directly into buildings and used to heat buildings. Growers in greenhouses, desalinate ocean water, and heat water for fish farming and pasteurize milk. Some cities pipe hot water under roads and sidewalks to melt snow. District heating applications use networks of piped hot water to heat buildings in whole communities.

Million-dollar deep wells can be drilled into underground reservoirs to tap steam and very hot water that can drive turbines and drive electricity generators. Three types of power plants are operating today:

- **Dry steam plants**, which directly use geothermal steam to drive turbines.
- **Flash steam plants**, which pump hot water into lower-pressure tanks and use the resulting flashed steam to drive turbines.
- **Binary-cycle plants**, pass moderately hot geothermal water by a secondary fluid with a much lower boiling point. This causes the secondary fluid to flash to steam, which then drives the turbine.

Advantages:

1. Very clean (does not burn fuels)
2. Conserves fossil fuels
3. No air pollution
4. Very reliable (runs 24 hours a day)
5. No transportation involved
6. It's renewable and sustainable

Disadvantages:

1. Can't provide our current energy rates
2. Can only be used in certain geologically active areas
3. Possible hot water leaks into surrounding ecosystem
4. Hazardous minerals may be produced which are difficult to safely dispose of
5. Hydrothermal silicified bores are often convoluted

Hydrogen: Gas (H₂) is being explored for use in combustion engines and fuel-cell electric vehicles. It is a clean-burning Compared to gasoline, hydrogen burns with a clean flame, producing water and heat. However, the infrastructure for storing and transporting hydrogen is expensive.

While no transportation distribution system currently exists, hydrogen transportation uses the ability to create fuel from a variety of resources and the clean-burning properties make it a desirable alternative fuel.

Chemical Properties: The simplest and lightest fuel (hydrogen gas) is hydrogen (H₂), which burns to produce water. The fuel is not pure hydrogen gas; it has small amounts of oxygen and other impurities.

Two methods are generally used to produce hydrogen: (1) electrolysis and (2) synthetic gas from steam reforming or partial oxidation.

- **Electrolysis** uses electrical energy to split water molecules into hydrogen and oxygen. The electrical energy can come from any electricity production source including renewable fuels.

The Department of Energy (DOE) has concluded that electrolysis is likely to become the predominant method for large quantities of hydrogen production in the future.

The predominant method for producing synthetic gas is steam reforming of natural gas, although other hydrogen sources can be used as feedstock. For example, biomass and coal can be gasified and used in a steam reforming process to create hydrogen.

A distribution system for hydrogen as a transportation fuel does not exist. While pipeline transportation is generally the most economic means of transporting gaseous fuels, a pipeline system is currently not in place. Transportation of hydrogen is typically in canisters and smaller trucks.

Advantages:

1. Germany, Japan, Canada, Belgium, and Saudi Arabia took the U.S. Invented technology for hydrogen production and have been expanding on it for years. The United States is still struggling to catch up. The U.S. is investing in hydrogen development, which will keep the U.S. strong in energy.
2. Relying on the Middle East for energy might be national strength. The U.S. could be energy self-sufficient with hydrogen.
3. Converting to a hydrogen-based economy would create thousands of permanent scientific and industrial jobs. Building plants manufacturing parts, selling equipment, and developing technological improvements for U.S. jobs and growth.Somewhat, fuel will run dry.
4. Hydrogen is renewable and, therefore, unlimited. Solving energy supply problems today will ensure our nation's energy security in the future.
5. Pollution from cars and airplanes has creased across the country. Many cities are working to clean up. Hydrogen produces no pollutants.
6. U.S. trade balance sheet shows that oil imports cost $7 billion from the U.S. economy every week. The government spends billions of taxpayer dollars every year to subsidize oil exploration and to militarily defend access to the Middle East.
7. Major oil spills are still occurring, causing many other species. If hydrogen were refined, it would evaporate immediately. The only by-product of hydrogen fuel is water.
8. Natural gas consumption of all requires continued drilling into pristine wilderness areas, wreaking havoc on some of the world's greatest ecosystems. Hydrogen production leaves no environmental scars.

Disadvantages:

1. Hydrogen is not currently developed enough to rely on as a steady source of energy.