The 7 Forms of Energy

Directions: Read and highlight the following information.

Electricity

So now we have the total transformation for coal-generated electricity. Working backwards from the generator through the turbine into the steam stopping at burning coal, we have 4 different energies that are used along the electricity generating process.

Chemical Energy

In Ohio, electricity begins with burning coal. Burning coal releases chemical energy. Chemical energy is the energy given off during a chemical change. During chemical changes atoms rearrange creating new molecules and compounds. When they rearrange, they give off energy. Even just burning something as we do with coal is enough to cause the atoms to rearrange and release chemical energy.

When a chemical change occurs, there are a variety of signs that help identify when the change is occurring. Indicators such as gas formation, light generation, heat creation, formation of a precipitate, permanent color change, and odor are all signs that a chemical change has occurred. When one of the signs is present during a change, chemical energy is released. The reason we use coal, oil, and natural gas is because when burned, the chemical energy released gives off lots of thermal energy (and some other energy as well).

Thermal Energy

When coal is burned, a chemical change occurs. We know this because coal gives off lots of thermal energy (heat). It also displays all of the signs of a chemical change (gas, light, heat, precipitate, color, and odor). In order to capture the thermal energy in a more useable form, power plants heat water.

Using the heat directly isn’t as efficient as heating liquid water. Since thermal energy refers to the kinetic energy of the molecules, it’s easier to increase the kinetic energy of a liquid molecule than it is a gas molecule. Think of it this way; there are a lot more liquid water molecules in a small bucket than there are water vapor molecules in a whole classroom (maybe even on the whole 6th grade floor at Genoa). Since there are so many more in a small space, they can absorb more thermal energy.

When we draw solids, liquids, and gases, the picture shows solids and liquids tightly compacted but gas molecules spread out and flying around. It’s easier to heat things when they are tightly compacted. Imagine trying to shoot a molecule with an arrow. The arrow in this case is heat. The liquids and solids would be pretty easy but the gas molecules would be flying around and much more difficult to hit.
Mechanical Energy

Once the liquid water molecules start dancing they turn into steam. The steam molecules now have lots of kinetic energy. Power plants want to use that kinetic energy to make things move. Power plants use steam to spin a turbine.

Remember that mechanical energy is energy of position (potential energy) and energy of motion (kinetic energy). Since the turbine is spinning, it has motion which means it has kinetic energy. When we talk about the forms of energy, we usually talk about the general form, in this case mechanical energy.

Electrical Energy

Although the spinning turbine is fun to watch, it’s not a useful form of energy. You don’t see too many people walking around with giant turbines powering their iPods. So, another transformation must occur to use this energy. The turbine is connected directly to a magnet. As the turbine spins, the magnet spins.

The magnet is wrapped with copper wire. As the magnet spins inside the copper wire, electrons start to jump from atom to atom. When the electrons jump, they give off energy which, as we have discussed, is electrical energy.

Sound Energy

The title of this assignment is the 7 forms of energy, but we have only identified 4 in the coal generated electricity transformation. There are others that enter the picture along the way. Let’s take your TV. As the electrical energy powers a television, it produces two different types of energy.

One type is sound energy. Sound energy is defined as the energy of vibrating molecules. Sound energy works by pushing and pulling molecules. Typically, speakers push and pull the air around us which is why we can hear a TV or a radio. When the molecules are pushed and pulled, they collide, transferring sound energy.

In your TV, electrical energy vibrates a speaker. When speakers vibrate back and forth, they vibrate the air molecules. The stronger the speaker vibrates, the stronger the sound. If there are no air molecules, there can’t be any sound which is why a movie such as Star Wars has a big scientific “mistake.” When a space ship blows up, it wouldn’t make a sound in space. The movie would be kind of boring without all of the special effects so movie makers use some creative license and have sound in outer space.

Light Energy

The other energy that comes out of your TV is light energy (which is why it is fun to watch). Your television produces light energy by transforming electrical energy into light energy. Light energy comes from the vibration of electrically charged particles.

Those same electrons that we got jumping from atom to atom back at the power plant strike molecules inside your TV. Based on which molecule the electrons strike, they create red, green, and blue light which combine to give all of the other different types of colors we see.
Nuclear Energy

The final type of energy is one that we use clear back in the beginning of the electricity generation process. Instead of using coal to heat water (or oil or natural gas), we can also use nuclear energy. **Nuclear energy** is defined as energy that comes from changes in the nucleus of an atom. We either break the nucleus apart to form different elements or press together one nucleus with another nucleus to form a new element.

There are two ways that we can change the nucleus of an atom. One way is actually splitting the nucleus apart. This is called **nuclear fission**. This is the most common type of nuclear energy on earth and one that gets lots of publicity. Nuclear reactors use fission to create their energy as does the atom bomb.

Fission works by shooting a neutron like a bullet at other atoms. When the neutron collides with an atom, it strikes the nucleus splitting it in half. Since the neutrons of the atom are split in half, there are now two neutrons looking to collide with more atoms. Once these two neutrons collide with other atoms, they split those atoms into 4 neutrons which now are looking to collide with more atoms. This is called a chain reaction because the chain continues to grow by a factor of 2 (1 collision becomes 2 which becomes 4 and then 8 and then 16 and so on).

Each time a nucleus splits in half there is a lot of energy that is released. This energy is called nuclear energy. It is very hot as well as very dangerous (it gives off a special type of light called radiation). When controlled inside a nuclear reactor, it heats water turning it into steam which can be used to turn a turbine just like the heat from coal is used to spin a turbine.

The other way nuclear energy occurs is through the process of **nuclear fusion**. Fusion happens when the nuclei of two different atoms are pressed together (fused) to form a new atom. This does not happen easily on earth. It does happen close by earth though.

The sun is constantly combining hydrogen atoms into helium atoms which is why the sun is so hot. It takes millions of degrees to combine two atoms which is why we struggle to make this type of energy on earth. But it’s not impossible.

The technology to create nuclear fusion is becoming better understood. Scientists have been successful in making nuclear fusion happen. They believe that in the next 30 years the first power plant using this type of energy will be available. The neat thing about nuclear fusion is that the fuel comes from water. Nuclear fusion uses hydrogen to press into other atoms. As it is pressed into other atoms, it releases the energy as heat with no nasty problems like those that occur from nuclear fission.
**Directions:** Fill in the blank with the appropriate energy form.

<table>
<thead>
<tr>
<th>Form of Energy</th>
<th>Definition</th>
<th>Complete the transformation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical Energy</td>
<td>When trees do photosynthesis they complete the following transformation: ________ → Chemical Energy</td>
<td></td>
</tr>
<tr>
<td>Vibration of electrically charged particles</td>
<td>When I turn on the lights at home I complete this transformation: ________ → __________</td>
<td></td>
</tr>
<tr>
<td>Mechanical Energy</td>
<td>A power plant spins a turbine with this transformation: ________ → __________</td>
<td></td>
</tr>
<tr>
<td>The energy of vibrating molecules.</td>
<td>To listen to music on your iPod, it must complete this transformation: ________ → __________</td>
<td></td>
</tr>
<tr>
<td>Electrical Energy</td>
<td>Generators use this transformation to create electricity: ________ → __________</td>
<td></td>
</tr>
<tr>
<td>Energy that comes from changes in the nucleus of an atom.</td>
<td>A Power Plant does this transformation: Nuclear energy → __________</td>
<td></td>
</tr>
<tr>
<td>Thermal Energy</td>
<td>Sunlight striking the earth provides this transformation: ________ → __________</td>
<td></td>
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