Electricity From Nuclear Fission: Splitting the Atom

1. What does “nuclear fission” mean?

2. What fuel is commonly used in commercial nuclear power production?

3. Name TWO other elements that are used in nuclear power production.

4. Draw and label the diagram called “Nuclear Fission Reaction.” Then, describe a “chain reaction” from the reference material.

5. What controls the chain reaction?

6. How much of the United States’ energy is produced by nuclear fission? What type of energy is produced?

7. List the advantages of nuclear fission as an energy source.

8. Explain the potential hazards and disadvantages of nuclear power production.

9. Name TWO types of fission reactors and make SKETCHES of each using the diagrams from the reference materials. Be sure to label all parts of each.

10. The last paragraph of the second page and the beginning of the third page of the reference material describes a “breeder reaction.” What fuel is used for this type of reactor? What is a “breeder reaction?”

11. Click on the following links and give three points of summary for each:

**Nuclear Energy Overview & Pressure Water Reactor** [**https://screenpal.com/watch/c0XIrKVGtXa**](https://screenpal.com/watch/c0XIrKVGtXa) **(8:39)**

a)

b)

c)

**Nuclear Fission & Fusion** [**https://screenpal.com/watch/c0XIryVGtjB**](https://screenpal.com/watch/c0XIryVGtjB) **(8:25)**

a)

b)

c)

Nuclear Energy Worksheet

Answer Key

1. What does “nuclear fission” mean?

* The nuclei of some isotpes (atoms containing the same number of protons and electrons, but different number of neutrons) can be split, releasing huge amounts of energy

1. What fuel is commonly used in commercial nuclear power production? Name two other elements that are used as well.

* Uranium – 235 is the easier isotope of uranium to fission, but Uranium-239 is 99.3% abundant in nature.
* Thorium and plutonium are also used in fission reactions.

1. Describe the chain of events that produce atomic energy.

* Nuclear fission of the isotope of Uranium-235 is initiated in a nuclear reactor.
* Nuclear fission results in kinetic or moving energy and radiation being released by the dividing atoms.
* Fragments of radiation collide with some of the surrounding atoms
* Most fission energy is converted to heat energy which is then transferred to water
* Water boils to form steam (as with fossil fuel power plants, solar boilers and geothermal power plants)
* Steam turns the turbine
* The turbine turns the generator
* The generator converts mechanical energy (rotation of the turbine) to electrical energy (electricity for transmission)

1. Draw and label the diagram labeled “Nuclear Fission Reaction.” The, describe a “chain reaction” from the reference material.

* Drawing as shown in reference material
* CHAIN REACTION: Uranium-235 absorbs a free moving neutron
* The Uranium atom becomes unstable and splits into fission fragments and two to three more free neutrons.
* The newly freed neutrons strike other Uranium-235 atoms and cause them to split and release more neutrons.
* This reaction is self-perpetrating

1. What controls the chain reaction?

* By restricting the number of free neutrons available foe interacting with other nuclei
* Control rods contain substances which easily absorb neutrons are lowered into the reaction chamber to control the chain reaction

1. How much of the United States energy is produced by nuclear fission? What type of energy is produced?

* 12% of the ELECTRICITY in the U.S. is from nuclear energy

1. List the advantages of nuclear fission as an energy source.

* Cheaper than fossil fuels
* No air pollution
* Readily available fuel source
* Produces enormous amounts of energy
* Well tested and good performance record

1. Explain the potential hazards and disadvantages of nuclear power production.

* Escape of radioactive fission products would threaten public health
* Radioactive wastes: where to put them
* MELTDOWN: failure of control rods to absorb free moving neutrons could result in overheating the facility and melting the reactor chamber thus allowing radiation into environment

1. Name two types of fission reactors and make sketches of each using the diagrams from the reference materials. Be sure to label all parts of each.

* Boiling water reactor diagrams shown in reference material
* Pressurized water reactor

1. The last paragraph of the second page and the beginning of the third page of the reference material describes a “breeder reaction.” What fuel is used for this type of reactor? What is a breeder reaction?

* Plutonium is used for a breeder reactor
* Breeder reactors produce more fuel than they use (theoretically up to 60 times more)
* Still under investigation for safety and usefulness in U.S.