Fission and Fusion Homework Solutions

1) Our understanding of atomic structure developed over decades, based on the research of hundred of brilliant scientists. These scientists built on the models of pervious researchers and developed new models based on their experimental findings.

For us, this process begins with JJ Thompson. Thompson suspected that atoms were made of smaller pieces and that these pieces traveled from place to place through electrical current. By passing electrical current through a cathode ray tube and exposing this beam of particles to a magnetic field, Thompson determined that the particles traveling through the tube were negatively charged. These particles were later called electrons. Based on this finding, Thompson believed that atoms were spheres filled with a matrix of positive charge with the negative electrons suspended in the matrix…much like plums in plum pudding.

In an effort to refine Thompson's model of the atom, Robert Millikan sought to determine how negative the charge on an electron is. To do this, he carried out what was later termed the oil drop experiment. While we didn't discuss the details of this experiment, it did allow Millikan to measure the negative charge of an electron.

The next major step in our understanding of atomic structure is attributed to Ernest Rutherford. Rutherford carried out his gold foil experiment in an effort to determine the inner structure of the atom. Firing positively charged alpha particles at a thin sheet of gold, Rutherford found that most of the alpha particles passed straight through the foil. Not all, however, did go straight through. A few of the particles deflected straight back while a few bent at angles. Based on these results, Rutherford showed that atoms are mostly space yet have a dense positively charged nucleus. His model, then, refined the Thompson model by placing all the positive charge in the middle of the atom. He didn't, however, understand the organization of the electrons.

It was Neils Bohr who first suggested that the electrons were organized in atom. By studying the light that atoms emit when they are energized, he was able to determine the organizational structure of the electrons, placing them in circular orbits around the nucleus. Because these orbits resembled planets orbiting the sun, we call this the planetary model.

2) In a nucleus chain reaction, the splitting of a large nucleus with a neutron causes the release or additional neurons. These additional neutrons cause other nuclei to break apart, releasing even more neutrons. This creates a chain reaction which can magnify and run out of control.

3) A nuclear reaction is a process in which the strong nuclear force is disrupted. Disrupting this force allows more matter to be converted into energy. When this happens in a nuclear fission process, breaking the strong nuclear force releases lighter nuclei and converts some mass into energy.

4) By definition, fusion reactions create heavier elements from lighter ones, while fission breaks heavier nuclei into lighter ones.

5) Currently, fusion reactions are not viable sources of energy because they are so hard to start and sustain. We can use fusion reactions in nuclear weapons but cannot yet harness them to generate electrical power.

6) In the previous unit, we discussed nuclear fusion in the context of atomic evolution. We discussed fusion as the process that takes place in stars that takes lighter elements and turns them into heavier elements.