Chemical Reactions On The Sun: Benefits And Issues

The sun, which is 4.5 billion years old, is at the centre of our solar system where it is the largest object in the system. It holds 99.8 percent of the solar system's mass and its diameter is 109 times the diameter of the Earth. The sun gains all its energy from fusing the hydrogen atoms that make up 73 percent of the sun. The remaining 27 percent of the composition of the sun is mostly made up of helium that has been fused from hydrogen. The process of fusing hydrogen to helium is called nuclear fusion.

History

The sun was formed 4.5 billion years ago when a solar nebular collapsed into itself. The nebular collapsed because of over whelming pressure created from its strong field of gravity. Most of the material was drawn to the centre to form our sun witch accounts for the sun containing 99.8 percent of the solar systems mass. The process of nuclear fusion was studied in the 1940s as part of the research to create the atomic bombs during the Manhattan Project and again in the 1950’s to create an energy resource that was clean and sustainable for the future.

The Chemistry of the Sun

Hydrogen and helium are the most abundant elements in the universe. All the other elements are created in the cores of stars like the sun .The source of the sun's fuel is hydrogen and helium gases. Through a special chemical reaction, called nuclear fusion, the hydrogen gas is 'burned' releasing an enormous amount of energy in the form of light and heat. The two different isotopes of hydrogen, tritium and deuterium collide together to create helium. When atoms smash together very fast it can cause several things to happen. When these atoms smash together at high speeds they lose partials in the process it releases large amounts of energy and creates the fusion of hydrogen atoms to helium atoms. The hydrogen gas is heated to such a high heat that 4 hydrogen nuclei combine to form one helium atom.

The nuclear fusion reactions are happening all the time and we don’t have a bigger enough number to count them. The light and heat energy travels from the core of the sun to its exterior where we see it from earth. It takes a million years for the energy of a single reaction to reach the surface of the sun.

Benefits and Issues

When the hydrogen fusion in the centre of the sun diminishes to the point that it is no longer in hydrostatic equilibrium, the core will undergo a massive change, increasing density and temperature whilst the outer layers expand causing the sun to transform into a red giant. This will cause the sun to become large enough to consume Mercury and Venus and render Earth inhospitable, though this won’t happen for an estimated 5 billion years. When the hydrogen runs out the sun will start to fuse the helium into other heavier elements like carbon and oxygen. When the sun runs out of helium it will turn into a dense type of star called a White Dwarf and constantly cool, it would no longer generate heat on its own, but still glow from the fusion

reactions that still have energy to release from the core.

Fusion reactors produce electrical energy. If fusion energy generation could be replicated in a controlled manner on Earth, it might very well provide safe, clean and unlimited energy. In the 1950s the world started to develop a fusion reactor. Fusion reactors work the same as the cores of stars. The heat up the atoms so the protons can fuse, If we do create a fusion reactor, it will be so efficient that one glass of sea water would have the output of burning a drum of oil and have no waste to speak of. This is due to the reactors using either Hydrogen or Helium as their fuel source. The problem is that normal Hydrogen won't work, specific isotopes are needed that have extra neutrons and they are H Deuterium and H Tritium. Deuterium is stable and can be found anywhere, especially in sea water, but Tritium is radioactive and extremely rare, so rare that there is an estimated 20kg on Earth, most of which is used in nuclear weapons. Using Helium-3 as a substitute is a better idea for the reaction. The material is also rare on earth, but could be found in abundance on the moon from solar winds blasting the surface of the moon for many, many years. A fusion reactor is far less deadly than other reactors we use today, this is due to instead of a meltdown occurring, the plasma would expand and cool, resulting in next to no damage. The waste produced by the reactors would also be a minimum as very little fuel is used at any one time and the waste quickly disperses anyway.

The sun which is approximately 4.5 billion years old and has an expected 5 billion more years of activity provides us with light and energy that in turn provides for life on earth and without the sun we would perish. Hydrogen and Helium are the most abundant elements in the universe the source of the sun's fuel is hydrogen and helium gases through a special chemical reaction, called nuclear fusion. If fusion energy generation could be replicated in a controlled manner on Earth, it might very well provide safe, clean and unlimited energy. A fusion reactor is far less deadly than other reactors we use today in case of a meltdown occurring, the plasma would expand and cool, resulting in little damage. The waste produced by the reactors would also be a minimum as very little fuel is used at any one time and the waste quickly disperses anyway. As we continue to look for an energy resource that is clean and sustainable for the future we continue to look at the sun for as long as it shines.

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Glossary

- solar nebular- gaseous cloud from which, in the so-called nebular hypothesis of the origin of the solar system,
- isotopes- are variants of a particular chemical element which differ in neutron number, and consequently in nucleon number
- nuclei- the very dense central region of an atom.
- hydrostatic equilibrium- When a fluid is at rest or when the flow velocity at each point is constant over time