As an ASNT-TC-1A, level-I radiographer trainee, having a general understanding of the scientific principles, terminology and mathematical formulas is critical to your personal safety as well as the safety of others (co-workers, supervisors, general public). Once we have a solid foundation of the science, we can then safely learn the intricacies in the field of radiography.

In this course, we are training for industrial radiography divided into gamma-ray radiography and X-ray radiography. Each method has its own set of safety concerns and protective measures to follow in order to keep everyone safe and to follow the ALARA principle.

Gamma Radiography is used widely throughout industrial radiography fields such as oil and chemical pipelines, large casting and forging inspections, and a variety of other specialized applications. Gamma radiography has the benefit of portability and superior penetration to that of X-ray. The main disadvantage however is that X-ray machine can be turned off with a power switch and gamma cannot. Furthermore, the process of creating the gamma sources (radioactive activation) and disposing of spent or decayed sources is costly and potentially hazardous. To reiterate the earlier statement, it is critical for radiographers to have a solid understating of the sources and processes of which they are working.

* **Nuclear Fission:** The process by which the nucleus of a stable atom splits upon impact of another particle and splits into 2 smaller parts. The resulting atoms are not the same element as the parent atom and are considered unstable and radioactive. This is the process by which Industrial isotopes (Cobalt 60, Iridium 192, Cesium 137) are created. For more information, follow the link below:
* <https://study.com/academy/lesson/what-is-nuclear-fission-definition-process-quiz.html>
* **Nuclear Fusion**: This is what scientists purport powers the sun and could be the answer to all of mankind’s energy needs. In this chemical reaction, two or more atomic nuclei are combined to form one (or more) different atomic nuclei. For more information, follow the link below:
	+ <https://en.wikipedia.org/wiki/Nuclear_fusion>
* **Half-Life:** the amount of time required for ½ of the original number of radioactive atoms to decay or change into daughter atoms. The original term was “half-life period” coined by physicist Ernest Rutherford when he discovered the principle in 1907. Rutherford went on to receive the 1908 Nobel Prize in Chemistry. For more information, follow the link below:
	+ <https://www.sciencehistory.org/historical-profile/ernest-rutherford>

The table shows some common isotopes and their respective half-life values:

* **ISOTOPE ½ LIFE**
* Uranium 238 4.5 Billion Years
* Potassium 40 450 million Years
* Radium 226 1600 years
* Iodine 128 25 minutes
* Cobalt 60 5.27 Years
* Iridium 192: 73.83 Days
* Cesium 137 30 years
* Thulium 170 128.6 Days