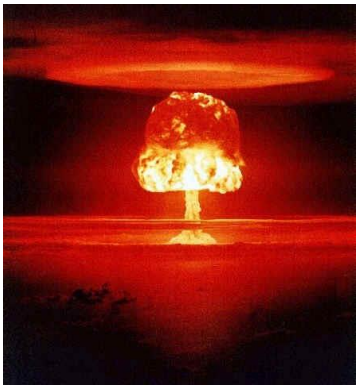
Nuclear Reactions - Fission

Prior knowledge: What do you know about nuclear reactions?

- They are strong, explosive
- Atomic bombs
- They can be dangerous and potentially harmful

Define- **Nuclear reaction:** process by which the nucleus of an atom changes by emitting particles or energy

When we think about nuclear reactions, sometimes we think about nuclear bombs, nuclear reactors, etc.



Think/pair/share: *Fill in the following chart using your textbook and/or phones. You may work in pairs.*

Artificial Radioactivity	**Nuclear Reactions and the Effects on Humans**
What is it? The process of making a non-radioactive substance become radioactive by hitting it with alpha particles; it does not occur naturally Why is this useful/not useful? It is useful to prepare radioactive species for uses in medicine or treating diseases such as cancer Example: $^{24}_{12}\mathrm{Mg} + {}^{2}_{1}\mathrm{H} \rightarrow {}^{22}_{11}\mathrm{Na} + {}^{4}_{2}\mathrm{He}$ -magnesium is not radioactive normally	Examples (list 5): 1. can change the shape of DNA or break it entirely causes cells to die 2. can lead to cancer if there are mutations caused in the DNA 3. products of uranium decay in rocks can be inhaled 4. medical X-rays (positive effect) 5. radiation from the sun comes to Earth Explain how the above examples are caused. - radiation comes into the body and gets absorbed – this gives extra energy to the body tissues and can harm DNA, cells, or penetrate through the body

There are two types of nuclear reactions: **Fission and Fusion**

All of these reaction are **DIFFERENT** than chemical reactions. There is NO **conservation of mass.** Rather, the actual nucleus of the atom changes. Small changes in mass = **HUGE** changes in energy.

What did Albert Einstein discover about radioactivity?

Mass is related to energy → **$E = mc^2$**

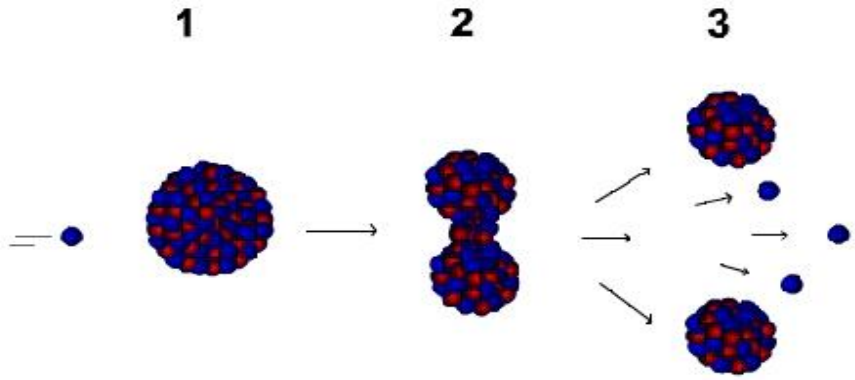
What does this mean?

In nuclear reactions, the products have **less** mass than the mass of the reactants or **original** materials.

Small amount of mass change results in **HUGE** amounts of energy (see equation below).

Nuclear Fission

Involves the splitting of one heavy **nucleus** to produce 2 (or more) smaller **nuclei, neutrons**, and **energy**.



Example: Uranium-235 is hit with a neutron and splits in barium, krypton, and 3 neutrons.

$$^{235}_{92}\mathrm{U} + {}^{1}_{0}n \rightarrow {}^{141}_{56}\mathrm{Ba} + {}^{92}_{36}\mathrm{Kr} + 3{}^{1}_{0}n$$