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| **Natural Transmutation vs Artificial Transmutation**  When a **radioisotope** (an isotope that is radioactive) spontaneously decays into a different element and another particle, it is called **transmutation**. **Natural Transmutation** is when a radioactive substance such as C-14 or N-16 decay on their own in nature. There is only one “reactant.” Ex:  **Artificial transmutation** is when scientists cause a radioisotope decay in a lab by forcing it to collide with small particles like neutrons.  Ex:  **Two types of artificial transmutation: Fission and Fusion**  ***Nuclear fission:***a [nuclear reaction](http://en.wikipedia.org/wiki/Nuclear_reaction) in which the [nucleus](http://en.wikipedia.org/wiki/Atomic_nucleus) of a particle splits into smaller parts (lighter [nuclei](http://en.wikipedia.org/wiki/Atomic_nucleus)). Fission sounds like division: a large atom divides into smaller atoms. The fission process often produces free [neutrons](http://en.wikipedia.org/wiki/Neutron) and [gamma rays](http://en.wikipedia.org/wiki/Gamma_ray) which contain a very large amount of [energy](http://en.wikipedia.org/wiki/Energy). For example, U-235 is used in nuclear power plants.  Although nuclear fission provides a lot of energy, it also produces other radioactive isotopes that also emit [gamma rays](http://en.wikipedia.org/wiki/Gamma_ray) which can cause cancer. These waste products from nuclear power plants is called nuclear waste. Nuclear waste must be buried deep underground with thick cement walls to block the gamma rays.    ***Nuclear fusion:* nuclear fusion** is a [nuclear reaction](http://en.wikipedia.org/wiki/Nuclear_reaction) in which two or more [atomic nuclei](http://en.wikipedia.org/wiki/Atomic_nuclei) collide at a very high speed and join to form a new type of atomic nucleus. **Fusion means “to join,” like a latin fusion restaurant combining Latin and Asian foods.** During this process, matter is not conserved because some of the mass of the fusing nuclei is converted to [photons](http://en.wikipedia.org/wiki/Photons) ([energy](http://en.wikipedia.org/wiki/Fusion_power)). We haven’t learned how to obtain energy from fission yet, but it would be safer than nuclear fusion because it does not make nuclear waste. | 1. During **natural transmutation**, how many reactants are used?  2. During **artificial transmutation**, how many reactants are used?  3. What is the difference between **natural transmutation** and **artificial transmutation**?  4. How can you remember that in a **fission reaction**, one atom break apart into smaller atoms? |