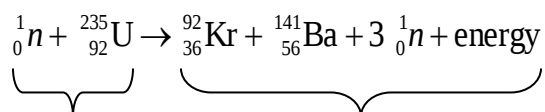


NUCLEAR REACTIONS

Nuclear Fission

- Nuclear reaction in which the nucleus of a massive atom is split into two smaller nuclei, subatomic particles and energy
- Results in the production of a large amount of energy
 - Example: fission of 1 g of uranium-235 = energy from burning 2 tonnes of coal
 - *Orally: explosion is 1 million times greater than TNT by mass.*
- Advantage
 - Allows the use of a small amount of nuclear material to produce large amounts of electricity
- Disadvantage
 - Results in the production of radioactive waste material with a long half-life
 - Waste materials must be stored
 - Life span of nuclear reactors is approximately 40 years
- Fission reactions can be induced (caused to occur) by bombarding certain atoms with neutrons

Nuclear Fission of Uranium



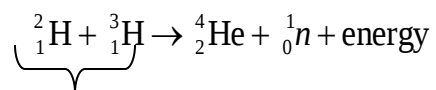
- Rules:
 - The sum of the atomic mass on each side must equal
 - The sum of the charges must equal (count atomic numbers)
- This is the reaction used in the Canadian-built CANDU (Canadian Deuterium Uranium) reactors

Chain Reactions

- The above reaction was started by a neutron hitting a stable atom of uranium to create an unstable uranium nucleus
- Note that on the products side are three new neutrons → these neutrons are free to collide with three other uranium atoms to create three new fission reactions each of which will result in 3 more neutrons
- Chain Reaction → self-driving reaction
- This reaction is slowed down using a cooling system
- If the reaction gets out of control, it results in a nuclear reactor meltdown → the reaction produces so much energy that it literally destroys the power plant and releases all of the radioactive waste material into the environment
- http://www.youtube.com/watch?feature=player_embedded&v=0v8i4v1mieU#! Video of mass traps and ping pong balls to demo U235 decay.

Nuclear Fusion

- Nuclear fusion is the process of combining two nuclei into one more massive nucleus
- Process that drives solar reactions in our Sun



Hydrogen-2 and Hydrogen-3
isotopes

- Advantages of Fusion vs. Fission
 - Produces approximately 4.5 times the amount of energy per equivalent mass of starting material
 - Product is helium, a non-hazardous material
- Disadvantages
 - Need extreme temperatures and pressures (10 million Kelvin in sun = 100 million Kelvin on Earth due to less pressure)
 - Have no way to contain the energy and heat from a nuclear fusion reaction
 - Only way to start a fusion reaction at present is with a fission reaction (ex: Hydrogen bomb)

<https://www.youtube.com/watch?v=6FT-QJ1RYuc>

Demon Core explained.

<https://www.youtube.com/watch?v=hh89h8FxFhQ>

Demon core movie clip

<https://www.youtube.com/watch?v=f5ptI6Pi3GA>

Chernobyl

https://www.youtube.com/watch?v=jY9VwCE_Dsg

Hiroshima

<https://www.youtube.com/watch?v=JL4Kqfxg2KU>

What if there was a nuclear war?

<https://www.youtube.com/watch?v=TRL7o2kPqw0>

veritasium travels to most radioactive places on earth

Homework Radioactivity (BC Science 10 SWB pg. 140)
 Comparing Nuclear Fission & Fusion (BC Science SWB pg. 141)
 Nuclear Fission & Fusion Reactions (BC Science 10 SWB pg. 142)