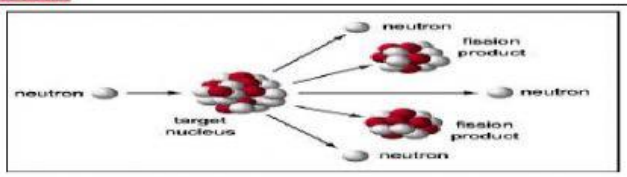
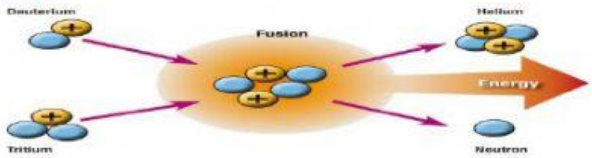
Nuclear Energy

Worksheet: Section 2

fission	fusion
	
Occur when: a heavy unstable nucleus splits into two or more smaller nuclei.	**Occur When:** two or more small nuclei combine to form a heavier, more stable nucleus.

Small amount of mass→a tremendous amount of energy

Practical Why??	Not Practical Why??
1. No need for high temperature to start 2. convert nuclear energy into electrical energy	**1. Occurs at millions of degrees Celsius** 2. No chamber can hold this high temperature

➢ Nuclear reactors:

Uses energy from controlled nuclear reactions to generate electricity.

- **Similarities share between all reactors:**

1.Nuclear fuel: elements have nuclei that can undergo fission.

Isotope U-235 can be split apart. The fuel that is used in a reactor is usually uranium dioxide.

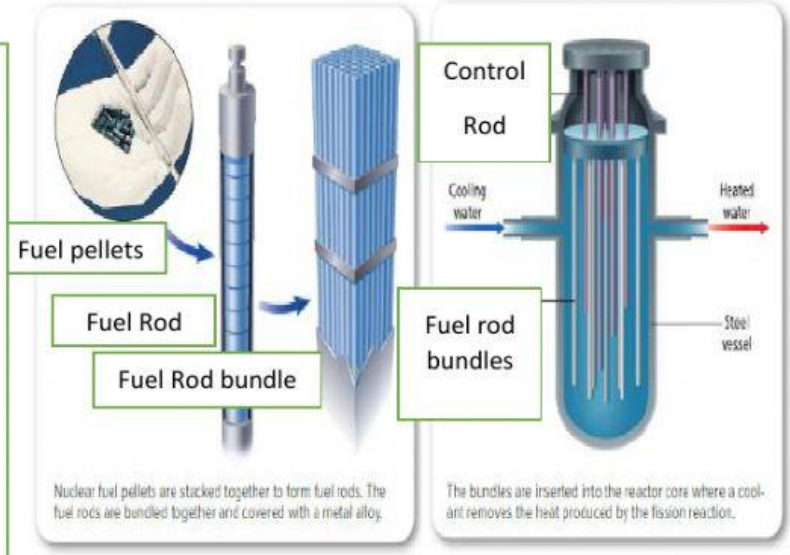
2. Fuel rods: uranium dioxide fuel

Tiny pellets→ fuel rod→fuel rods bundled and covered with a metal alloy.

1kg of uranium →1g of matter is converted into energy

3. Control Rod: Used to control the nuclear reactions.

Control rods absorb neutrons and slow down the chain reaction. (Boron – Cadmium)



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Nuclear Energy

➢ The nuclear chain reaction:

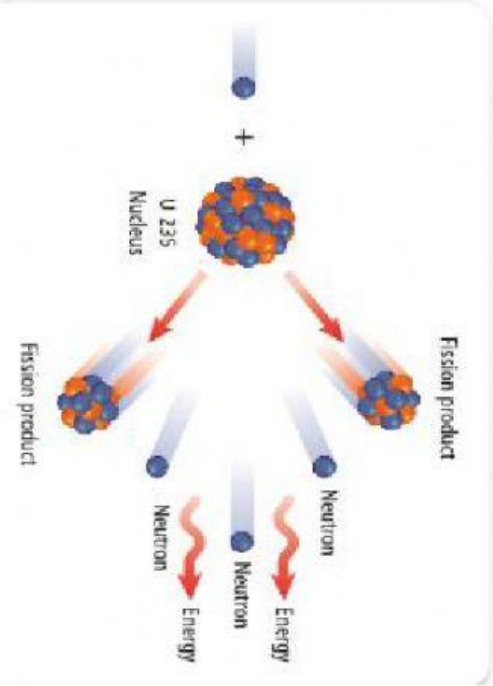
When a U-235 undergo fission:

1. Neutrons are released.
2. Another nucleus absorbs a neutron.
3. it splits into two smaller nuclei and two or three free neutrons.
4. These neutrons strike other U-235 nuclei.

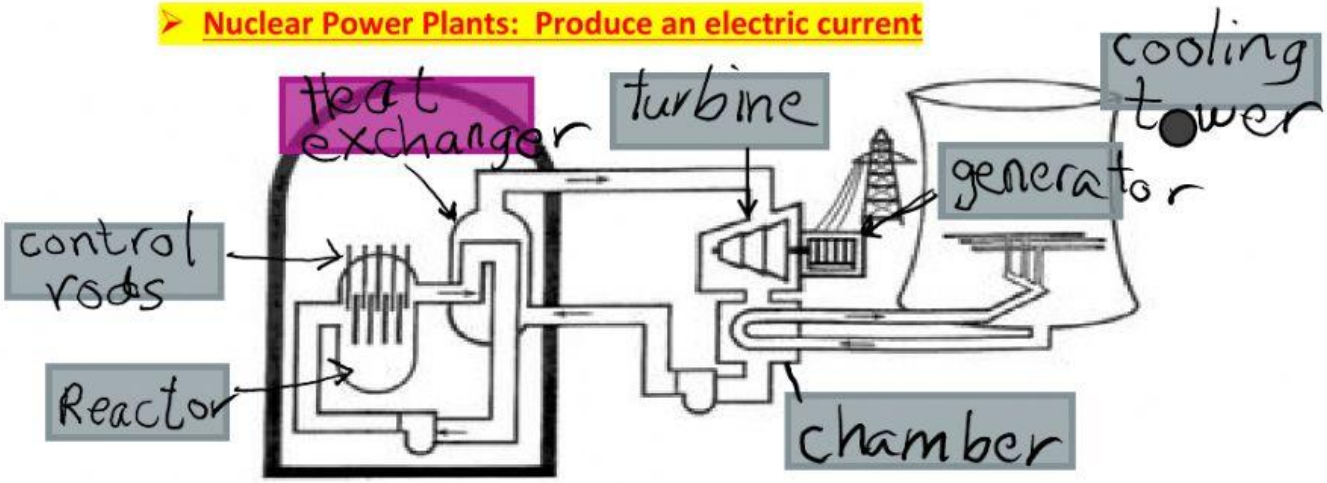
Because every uranium atom that splits a part releases free neutron that cause other uranium to split apart → this process is called a nuclear chain reaction.

As a result: An enormous number of nuclei can be split after only a small number of stages.

To control the chain reaction: Some of neutrons that are released when U-235 splits must be prevented from colliding with other U-235 nuclei. By controlled rod that absorbed it.



➢ Nuclear Power Plants: Produce an electric current



1.Nuclear Reactor	Nuclear energy → Thermal energy
2.Heat exchanger	(Boiler) Using thermal energy change water → pressurized stream
3.Turbine	Steam spins the turbine
4.chamber	Condense steam back to water
5.generator	Mechanical → Generates electricity (about 35%)
6. cooling tower	Release thermal energy to environment.

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➢ Benefits and risks of nuclear power:

✓ Advantage	✓ Disadvantage
Do not produce air pollutants	**Nuclear power plants are very expensive to build and take 10 or more to complete**
Do not release carbon dioxide into atmosphere	**Produce radioactive waste**

➢ The disposal of Nuclear Waste:

After 3 years → U-235 too small → spent Fuel.

Spent fuel includes radioactive fission products + some leftover U-235

Spent fuel is a form of Nuclear waste

Nuclear waste: is any radioactive material that results when radioactive materials are used.

Low- Level waste	High-Level Waste
Contains a: small amount of radioactive waste or Short half-lives.	Contains a: large amount of radioactive waste also contains materials that will remain radioactive for tens of thousands of years.
Example: by product of electricity generation, medical research and treatments, pharmaceutical industry and food preparation, water and air filters from nuclear power plants and smoke detectors.	Example: nuclear power plants and nuclear weapons programs
How kept? Insolated and treated as hazardous material and stored in spill-safe containers underground.	How Kept? Stored in steel- lined concrete pools filled with water. /airtight steel. Seal waste in ceramic glass, placed in protective metal containers, then buried hundreds of meters belowground.

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