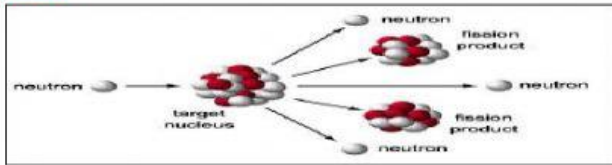


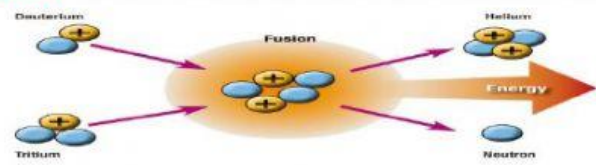
## Worksheet: Section 2

### fission



**Occur when:** a heavy unstable nucleus splits into two or more smaller nuclei.

### fusion



**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??**

- 1. No need for high temperature to start**
2. convert nuclear energy into electrical energy

**Not Practical**

**Why??**

- 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.

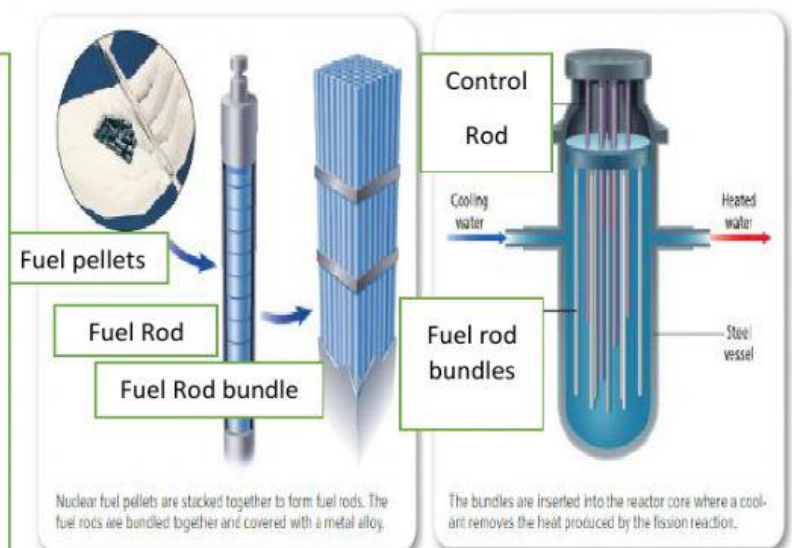
**2. Fuel rods:** uranium dioxide fuel

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)



## ➤ The nuclear chain reaction:

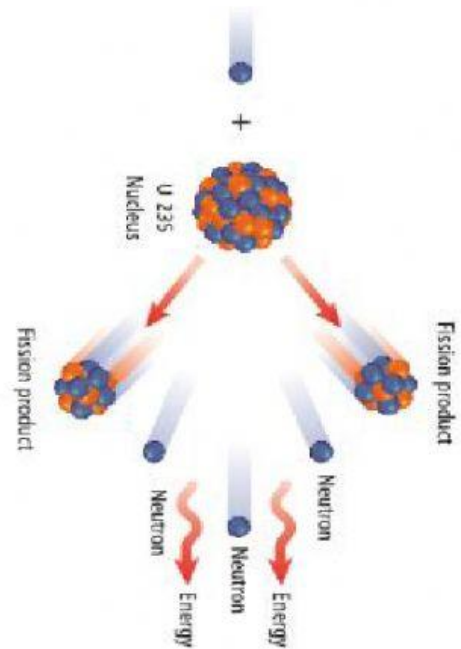
When a U-235 undergo fission:

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.

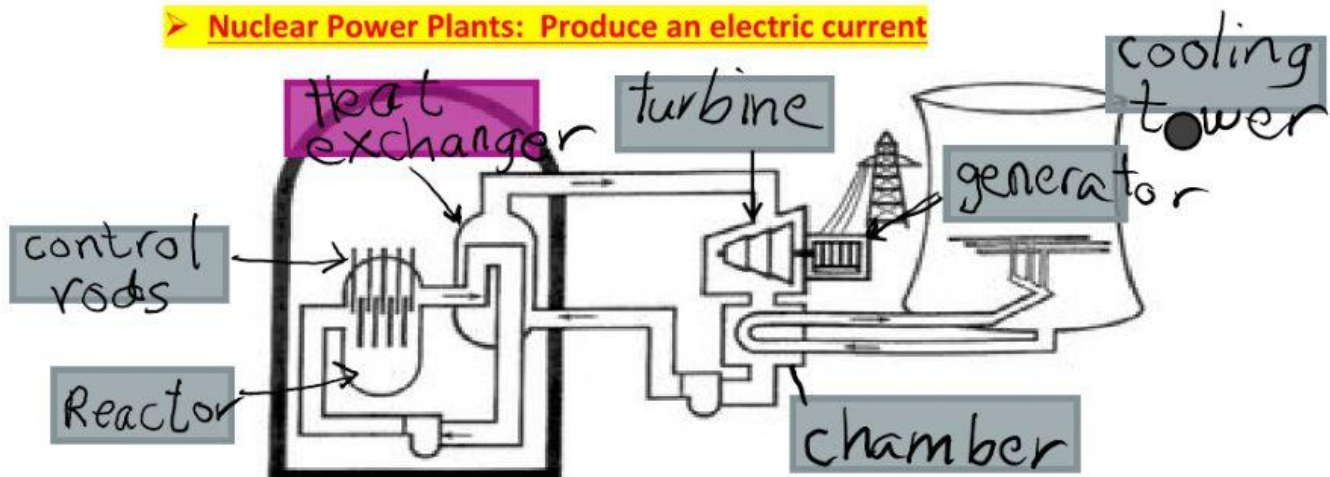
Because every uranium atom that splits a part releases free neutron that cause other uranium to split apart → this process is called a nuclear chain reaction.

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.



## ➤ Benefits and risks of nuclear power:

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

## ➤ 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.

<b>Low- Level waste</b>	<b>High-Level Waste</b>
<b>Contains a:</b> small amount of radioactive waste or Short half-lives.	<b>Contains a:</b> large amount of radioactive waste also contains materials that will remain radioactive for tens of thousands of years.
<b>Example:</b> 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.	<b>Example:</b> nuclear power plants and nuclear weapons programs
<b>How kept?</b> Insolated and treated as hazardous material and stored in spill-safe containers underground.	<b>How Kept?</b> 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.