

# **An Introduction to Nuclear Energy**

## You May Know...

- Nuclear fission is used in nuclear power plants
- Nuclear fusion powers the Sun
- Nuclear fission is a non-renewable energy sources
- Nuclear fuels include uranium and plutonium
- Nuclear fission creates radioactive waste (radioactive for thousands of years)
- Does not create smoke or harmful gases which contribute to climate change
- Nuclear fuels have much much higher power outputs per kg compared to traditional fossil fuels
  - *1 kg of uranium has the same power output as 14,000 kg of coal*

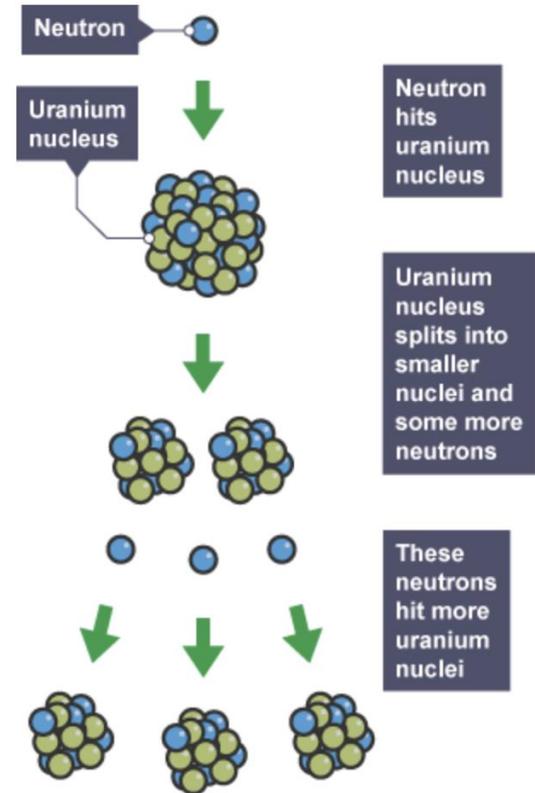
# Nuclear Fission

**Nuclear Fission is the splitting of a large atomic nucleus into smaller nuclei.**

In a nuclear reactor, a slow moving neutron is absorbed by a Uranium-235 nucleus, forming a Uranium-236 nucleus which is very unstable.

The nucleus then splits smaller nuclei (called daughter nuclei) and 2/3 fast moving neutrons. The neutrons then go on to be absorbed by other Uranium-235 nuclei, which causes a chain reaction.

The fast moving neutrons emitted, carry most of the energy, before they can collide with uranium nuclei they need to be slowed. Their energy is passed on to other components in the nuclear reactor, which is used to heat water which drives the turbines that turn the generators.



# Nuclear Fission Reactors

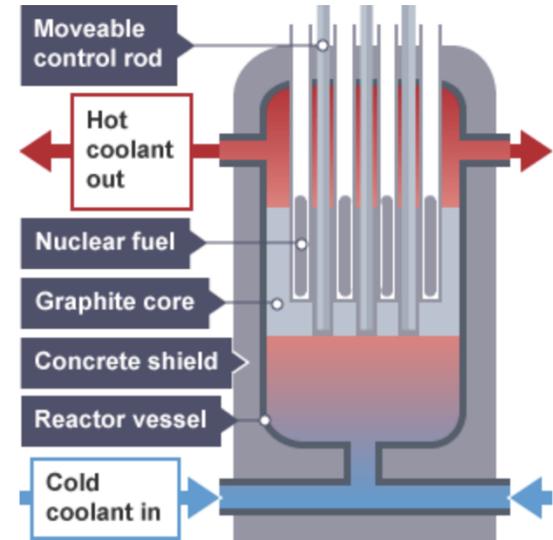
The nuclear fuel is held in **Fuel Rods** so that the neutrons released will escape and cause fission in other fuel rods.

**Moderator** - A graphite core slows the neutrons so that they are more likely to be absorbed into a fuel rod.

**Control Rods** are raised and lowered to prevent neutrons from travelling between fuel rods, thus controlling the speed of the chain reaction.

**Coolant** is fed into the reactor and heated by the energy produced by fission, the hot coolant is fed out of the reactor to boil water. This produces steam which drives turbines.

**Concrete Shield** is used to protect, as the fission products are radioactive and can be harmful.



# Escape Room

You have been invited to the Angstrom Nuclear Power Plant, for a guided tour by Dr Heisenberg.

On your visit, you notice things are a little strange, there are very few workers in sight and Dr H is nowhere to be seen! In your search to find him, you end up in his office.

Unfortunately he is still nowhere to be seen, suddenly lights start to flash and an alarm rings. The door to the office has been locked and you are trapped.

You decide it best to start looking around the room and discover a video is ready to be played on one of the monitors, you press play and hope it will help you figure out what is happening and hopefully escape!

# Escape Room

**This is a collaborative activity, to succeed you need to work together!**

**Around the room are a series of clues and four locked boxes, some of the clues will lead you to the combination of one of the locked boxes, others will be part of the Nuclear Shutdown Code.**

**Working in small teams is a great idea, but you may solve clues which lead to an answer which another team needs to complete the clues they have chosen.**

**Not all the problems can be solved straight away, some of them require the contents of the locked boxes and others answer from another clue.**

**Once you think you have solved a clue, write the answer on the laminated sheet, and place it at the front, then together we can determine the correct Nuclear Shutdown Code.**

**When you think of nuclear energy, what do you think of?**



# **The Reality Of Nuclear Power**

**This escape room was designed to be a fun activity, based around a nuclear meltdown.**

**In reality nuclear power is very safe!**

**Spent nuclear fuel is a solid, kept in sealed metal tubes, the ceramic uranium pellets remain inside the fuel rods. No Green Goo!**

**There isn't actually that much nuclear waste! All of the used fuel ever produced by the commercial nuclear industry since the late 1950s would cover a whole football pitch to a height of 9 metres.  
Coal plants generate the same amount of waste every hour.**

**Used nuclear fuel can be recycled, parts still capable of generating energy are extracted and used to generate energy for use in new fuel.**