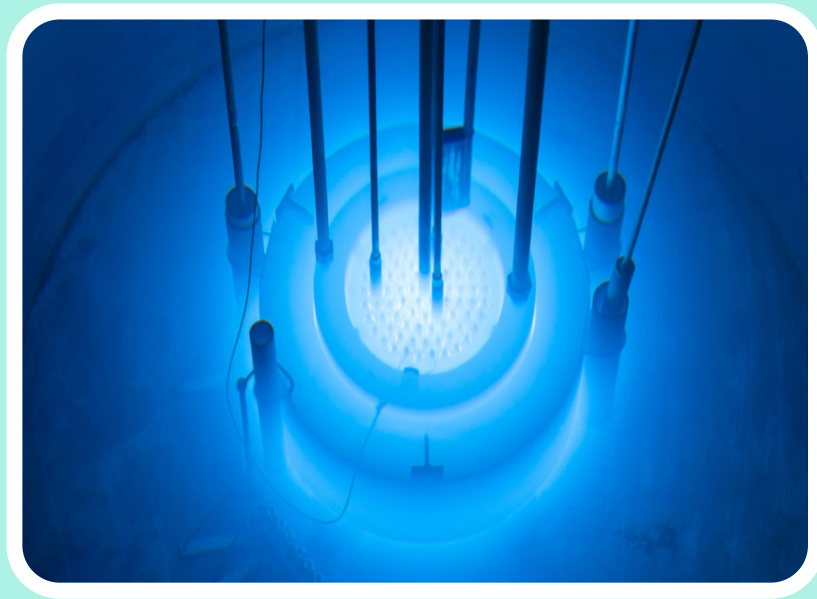


# Nuclear Band



# Nuclear Band

## Do you need an idea for a scientific study? Try out one of our ideas or make one of your own.

While chemical reactions result in the rearrangement of atoms, nuclear reactions involve changing one atom into a different atom. Take the following brief quiz to see how much you already know about nuclear reactions. See the bottom of page 4 to check your answers.

- Who is credited with coining the word “radioactive?”
  - Henri Becquerel
  - Marie Curie
  - Ernest Rutherford
  - John Dalton
- In what year did Enrico Fermi’s team successfully complete the first controlled nuclear chain reaction?
  - 1932
  - 1939
  - 1942
  - 1945
- Where did the first world’s first nuclear reactor for commercial energy product take place?
  - Chernobyl, Ukraine
  - Three Mile Island, US
  - Paris, France
  - Idaho, US
- Imagine a superhero whose power comes from controlling tiny suns. Nuclear fusion is similar, but instead of controlling existing stars, scientists are trying to:
  - capture stars and bring them to Earth.
  - create miniature, controlled stars for energy production.
  - harness the energy released when stars explode (supernovae).
  - develop a way to travel to and harvest energy from nearby stars.
- Concerns exist regarding the potential dangers of nuclear power plants. One of the main safety challenges relates to:
  - the depletion of the element used as fuel.
  - the difficulty in transporting radioactive waste.
  - the risk of an uncontrolled chain reaction leading to a nuclear meltdown.
  - the emission of large amounts of greenhouse gases.



## Don't Break the Chain

Chain reactions occur when the products of one reaction continue to react to create multiple reactions. Nuclear bombs depend on chain reactions to produce a large amount of energy released in a very short time. In this investigation, you'll use your period table to study the chain reaction that uranium-234 undergoes. Get started now and don't break the chain.

### Materials Required

1 – Periodic Table

### Procedure

1. Use the periodic table to complete row 1 of Table 1 below for the isotope uranium-234.
2. Alpha decay involves the emission of an alpha particle, which consists of 2 protons and 2 neutrons. Simulate alpha decay from uranium-238 by subtracting 2 from the atomic number of uranium to find the daughter product formed after the decay. Enter this value in row 2 of Table 1.
3. Subtract 4 from the mass number to find the mass number of the daughter product. Enter this value in row 2 of Table 1 and identify the name of the daughter product.
4. The daughter product can also undergo alpha decay. Repeat steps 2 and 3 until a daughter product with a stable nucleus is found. Make sure to record each daughter product in Table 1. (Hint: The number of rows in Table 1 indicates the total number of alpha decays.)

**Table 1. Alpha Decay Chain**

Element	Atomic Number	Mass Number	Daughter Product
Uranium-234			---

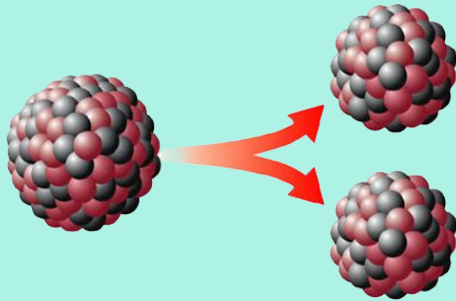
### Questions

1. Why does uranium-234 undergo alpha decay?
  
  
  
  
  
  
  
  
  
  
2. Research alpha particles. What safety precautions would you take to protect yourself from a radioactive source emitting alpha particles?

# Nuclear Band

## Nuclear Energy

Nuclear energy taps into the immense power stored within the nucleus of atoms. This energy is released through two main processes: fission and fusion. Fission, currently used in nuclear power plants, splits heavy nuclei like Uranium-235 into smaller nuclei, releasing a tremendous amount of heat. This heat boils water to generate steam, which spins turbines to produce electricity.



Fission



Fusion

Nuclear power offers several advantages. It's a reliable source of energy, not dependent on weather conditions like solar or wind. Compared to fossil fuels, it produces minimal greenhouse gas emissions, contributing to the fight against climate change. However, concerns also surround nuclear energy. Nuclear waste disposal remains a challenge, and the risk of accidents, like Chernobyl, raises safety questions. Additionally, the fissile material used in some reactors can be used to create nuclear weapons, posing a proliferation threat.

The future of nuclear energy is uncertain. Research into safer reactor designs and advanced waste management techniques is ongoing. Meanwhile, scientists are working on achieving controlled nuclear fusion, a process that combines lighter nuclei to generate even more energy – mimicking the power source of stars. Nuclear energy remains a complex topic, with both potential benefits and drawbacks to consider.



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Answers: Page 2 Answers: 1) b, 2) c, 3) d, 4) b, 5) c. Page 3 Answers: Don't Break the Chain: U234 – Th230 – Ra226 – Rn222 – Po218 – Pb214. (1) to achieve a stable nucleus (2) A piece of paper can block an alpha particle.

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