

POGIL – Nuclear Fission & Fusion

Background

Fission and fusion are two processes that alter the nucleus of an atom. Nuclear fission provides the energy in modern day nuclear power plants and fusion is the source of the sun's energy. The use of fission in power plants can help conserve or one day possibly eliminate the need for fossil fuels. Without the energy produced by fusion of hydrogen in the sun, the Earth would quickly change into a cold planet that could not support life as we know it.

Transmutation can be accomplished through many types of reactions, including fission. Nuclear transmutations always obey two fundamental conservation laws:

- (1) Mass number is conserved
- (2) Electrical charge is conserved

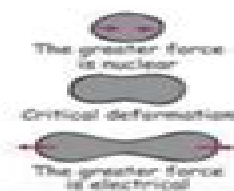
Energy and mass are **not** conserved, but can be interconverted according to Einstein's equation:

$$E = mc^2$$

Where E = energy, m = mass, and c = the speed of light

Nuclear Fission

The process of fission occurs when a nucleus splits into smaller pieces. Fission can be induced by a nucleus capturing slow moving neutrons, which result in a highly unstable nucleus.



<http://www.arpansa.gov.au/images/basics/fission.jpg>

Watch the following clip for a brief explanation (double-click on Fission.mov) :

Fission.mov

For an animation of this process, view the PhET model linked below and click on the "Fission – One Nucleus" tab.

<http://phet-web.colorado.edu/sims/nuclear-physics/nuclear-physics.html>

Nuclear Fusion

Fusion occurs when 2 nuclei join together to form a larger nucleus. For a fusion reaction to occur, the atoms of hydrogen must be heated to millions of degrees and subjected to high pressure. When done properly, the positively charged nuclei of the hydrogen isotopes, which naturally repel each other, combine.



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Table of Contents Pogil Answer Key 2005 Nuclear

1. Understanding the eBook Pogil Answer Key 2005 Nuclear
 - The Rise of Digital Reading Pogil Answer Key 2005 Nuclear
 - Advantages of eBooks Over Traditional Books
2. Identifying Pogil Answer Key 2005 Nuclear
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Pogil Answer Key 2005 Nuclear
 - User-Friendly Interface
4. Exploring eBook Recommendations from Pogil Answer Key 2005 Nuclear
 - Personalized Recommendations
 - Pogil Answer Key 2005 Nuclear User Reviews and Ratings
 - Pogil Answer Key 2005 Nuclear and Bestseller Lists
5. Accessing Pogil Answer Key 2005 Nuclear Free and Paid eBooks

- Pogil Answer Key 2005 Nuclear Public Domain eBooks
- Pogil Answer Key 2005 Nuclear eBook Subscription Services
- Pogil Answer Key 2005 Nuclear Budget-Friendly Options
- 6. Navigating Pogil Answer Key 2005 Nuclear eBook Formats
 - ePub, PDF, MOBI, and More
 - Pogil Answer Key 2005 Nuclear Compatibility with Devices
 - Pogil Answer Key 2005 Nuclear Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Pogil Answer Key 2005 Nuclear
 - Highlighting and Note-Taking Pogil Answer Key 2005 Nuclear
 - Interactive Elements Pogil Answer Key 2005 Nuclear
- 8. Staying Engaged with Pogil Answer Key 2005 Nuclear
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Pogil Answer Key 2005 Nuclear
- 9. Balancing eBooks and Physical Books Pogil Answer Key 2005 Nuclear
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Pogil Answer Key 2005 Nuclear
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Pogil Answer Key 2005 Nuclear
 - Setting Reading Goals Pogil Answer Key 2005 Nuclear
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Pogil Answer Key 2005 Nuclear
 - Fact-Checking eBook Content of Pogil Answer Key 2005 Nuclear
 - Distinguishing Credible Sources
- 13. Promoting Lifelong Learning
 - Utilizing eBooks for Skill Development

- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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