

Thème : Constitution et transformations de la matière
P9 : Transformations nucléaires
Activity 1 : Nuclear fission and fusion

Activity Goals :

- identify the physical, chemical, or nuclear nature of a transformation
- link Energy and matter

Doc 0 : useful info
→ vocabulary

Token	To spur	Unsung	To overshadow	To grab	Nucleus	Energy release	To occur	Physical quantity	reactant
gage, symbole	inciter, pousser	méconnu	éclipser	saisir	noyau	dégagement /libération d'énergie	avoir lieu	grandeur physique (masse, charge, énergie...)	réactif

→nuclei ,particles and their symbols

Nucleus/particle	Baryum	Deuterium	Helium	Hydrogen	Krypton	Neutron	Tritium	Uranium
Symbol	$^{140}_{56}\text{Ba}$	^2_1H	^4_2He	^1_1H	$^{93}_{36}\text{Kr}$	^1_0n	^3_1H	$^{235}_{92}\text{U}$

Part one : Lise Meitner and the discovery of fission
Doc1 : The Matilda effect

<http://www.openculture.com/2018/08/the-matilda-effect.html> (extract)

I the history of science, like most every history we learn, comes to us as a procession of great, almost exclusively white, men, unbroken but for the occasional token woman— well-deserving of her honors but seemingly anomalous nonetheless. “If you believe the history books,” notes the [Timeline series The Matilda Effect](#), “science is a guy thing. Discoveries are made by men, which spur further innovation by men, followed by acclaim and prizes for men. But too often, there is an unsung woman genius who deserves just as much credit” and who has been overshadowed by male colleagues who grabbed the glory.

In 1993, Cornell University historian of science [Margaret Rossiter](#) dubbed the denial of recognition to women scientists “the Matilda effect,” for suffragist and abolitionist Matilda Joslyn Gage, whose 1893 essay “[Woman as an Inventor](#)” protested the common assertion that “woman... possesses no inventive or mechanical genius.” Gage wrote that “even the United States census” failed “to enumerate her among the inventors of the country.” Such assertions, Gage proceeded to demonstrate, “are carelessly or ignorantly made... although woman’s scientific education has been grossly neglected, yet some of the most important inventions of the world are due to her.”

Over 100 years later, Rossiter’s tenacious work in unearthing the contributions of U.S. women scientists inspired the History of Science Society to [name a prestigious prize after her](#). The [Timeline series](#) profiles of the few of the women whom it describes as prime examples of the Matilda effect, including [Dr. Lise Meitner](#), the Austrian-born physicist and pioneer of nuclear technology who escaped the Nazis and became known in her time as “the Jewish Mother of the Bomb,” though she had nothing to do with the atomic bomb. Instead, “Meitner led the research that ultimately discovered nuclear fission.” But Meitner would become “little more than a footnote in the history of Nazi scientists and the birth of the Atomic age.”

Instead, Meitner’s colleague Otto Hahn received the accolades, a Nobel Prize in Chemistry and “renown as the discoverer of nuclear fission. Meitner, who directed Hahn’s most significant experiments and calculated the energy release resulting from fission, received a few essentialist headlines followed by decades of obscurity.” Likewise, the name of [Alice Augusta Ball](#) has been “all but scrubbed from the history of medicine,” though it was Ball, an African American chemist from Seattle, Washington, who pioneered what became known as the Dean Method, a revolutionary treatment for leprosy.

Doc 2 : nuclear fission

https://www.classzone.com/books/earth_science/terc/content/visualizations/es0702/es0702page01.cfm?chapter_no=visualization

Part two : Nuclear fusion in the Sun**Doc 3 : Nuclear fusion (animation)**

<https://www.youtube.com/watch?v=1n8OPDRsupw>

Doc 4 : how does fusion power the Sun?

<https://www.youtube.com/watch?v=W1ZQ4JBv3-Y>

Questions

1. Explain in your own words the difference between a nuclear reaction and a chemical reaction.
2. Which conservation laws should a nuclear reaction respect?

Part 1 : nuclear fission

3. Explain nuclear fission (cause, results).
4. Explain why a neutron is used to achieve fission (and not a proton or an electron for instance).
5. Using conservation laws, write the equation of the fission of the ^{235}U nucleus.
6. A) Who discovered nuclear fission?
B) Who got credited for this discovery?
C) Define the Matilda effect.
7. Give a real-life example of nuclear fission.

Part 2 : nuclear fusion

8. What is the difference between deuterium and tritium? What are these two nuclei called?
9. Explain nuclear fusion (cause , results).
10. Using conservation laws, write the equation of the fusion of deuterium and tritium.
11. Why does nuclear fusion occur in the Sun?
12. Which physical quantity is converted into Energy during fusion?