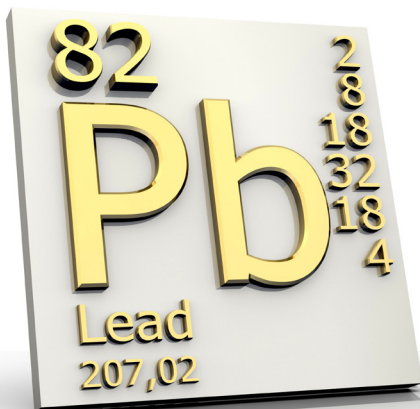
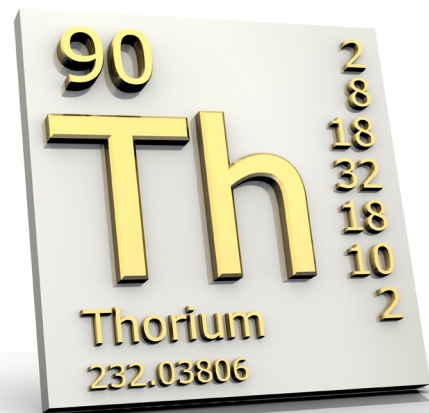


The Timeline of **Radioactive Decay for Uranium²³⁸ (U²³⁸)**

A Factfile provided by the Institution of **Engineering and Technology**



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Cover images (clockwise from top left)

- Uranium
- Thorium
- Bismuth
- Lead

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Summary

This Factsheet shows the radioactive decay chain of uranium²³⁸, the resulting products, the radiation emitted in the process and the timescales involved.

Uranium²³⁸ (U²³⁸) Radioactive Decay

Type of Radiation ⁽²⁾ (α , β , γ)		Nuclide	Half-Life
		Uranium ²³⁸ ⁽³⁾	4.47 billion years ⁽¹⁾
α γ		Thorium ²³⁴	24.1 days
β γ		Protactinium ^{234m}	1.17 minutes
β γ		Uranium ²³⁴	245000 years
α γ		Thorium ²³⁰	80000 years
α γ		Radium ²²⁶	1600 years
α γ		Radon ²²²	3.823 days
α		Polonium ²¹⁸	3.05 minutes
α β		Lead ²¹⁴	26.8 minutes
β γ		Bismuth ²¹⁴	19.7 minutes
α β γ		Polonium ²¹⁴	0.000164 seconds
α		Lead ²¹⁰	22.3 years
β γ		Bismuth ²¹⁰	5.01 days
α β		Polonium ²¹⁰	138.4 days
α γ		Lead ²⁰⁶	stable

α – Alpha Radiation
 β – Beta Radiation
 γ – Gamma Radiation

Notes

1. The half-life of Uranium²³⁸ is 4.47 billion years. Given that the estimated age of the Earth is also about 4.5 billion years, in this time period, about half of the Uranium present when the Earth was formed has decayed and about half still exists today.

2. Radioactivity is the emission of particles or electromagnetic energy from the nucleus of an atom. The three types of radioactive decay are alpha (α), beta (β) and gamma (γ).

Alpha particles are helium nuclei each made up of two protons and two neutrons.

Taking the example:

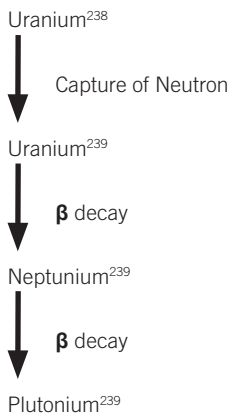


the daughter nucleide, Thorium has two fewer protons and two fewer neutrons than the parent nucleide.

Beta particles are electrons, the mass of which are negligible on the atomic weight scale. In beta emissions, the parent and daughter elements have virtually the same atomic weights.

Gamma rays are very high frequency electromagnetic radiation emitted in many radioactive changes irrespective of whether alpha or beta particles are emitted.

3. Uranium²³⁸ is also fertile in that it can capture a neutron transforming, following radioactive decay, into Plutonium which is fissile and can be used as fuel in a nuclear reactor.



Further Information

- **IET Energy related factfiles**
<http://www.theiet.org/factfiles/energy/>

IET nuclear factfile series

- **The principles of nuclear power**
<http://www.theiet.org/factfiles/energy/nuc-prin-page.cfm>
- **Nuclear reactor types**
<http://www.theiet.org/factfiles/energy/nuc-reac-page.cfm>
- **Nuclear safety**
<http://www.theiet.org/factfiles/energy/nuc-safety-page.cfm>
- **Legal framework of nuclear power in the UK**
<http://www.theiet.org/factfiles/energy/legal-frame-nuc-page.cfm>
- **Nuclear decommissioning**
<http://www.theiet.org/factfiles/energy/nuc-dec-page.cfm>
- **Nuclear waste disposal and transport of spent fuel**
<http://www.theiet.org/factfiles/energy/nuc-waste-page.cfm>
- **The nuclear fuel cycle**
<http://www.theiet.org/factfiles/energy/nuc-fuel-page.cfm>
- **The radioactive decay of uranium²³⁸**
<http://www.theiet.org/factfiles/energy/uranium238-page.cfm>
- **Glossary of nuclear terms**
<http://www.theiet.org/factfiles/energy/nuc-terms-page.cfm>

Further Reading

- Wood, J. **Nuclear Power** (IET Power and Energy Series 52); Institution of Engineering and Technology (2007) ISBN 0863416683



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