

Albert Einstein (/ˈaɪnˌstaɪn/ *EYEN-styne*;^[4] German: [ˈalbɛʁt ˈʔaɪnʃtaɪn] (listen); 14 March 1879 – 18 April 1955) was a German-born theoretical physicist^[5] who developed the [theory of relativity](#), one of the two pillars of modern physics (alongside [quantum mechanics](#)).^{[3][6]:274} His work is also known for its influence on the philosophy of science.^{[7][8]} He is best known to the general public for his [mass–energy equivalence](#) formula $E = mc^2$, which has been dubbed "the world's most famous equation".^[9] He received the 1921 [Nobel Prize in Physics](#) "for his services to theoretical physics, and especially for his discovery of the law of the [photoelectric effect](#)",^[10] a pivotal step in the development of [quantum theory](#).

The son of a salesman who later operated an electrochemical factory, Einstein was born in the [German Empire](#), but moved to Switzerland in 1895 and renounced his German citizenship in 1896. Specializing in physics and mathematics, he received his academic teaching diploma from the Swiss [Federal Polytechnic School](#) (German: *eidgenössische polytechnische Schule*) in [Zürich](#) in 1900. The following year, he acquired Swiss citizenship, which he kept for his entire life. After initially struggling to find work, from 1902 to 1909 he was employed as a [patent examiner](#) at the [Swiss Patent Office](#) in [Bern](#).

Near the beginning of his career, Einstein thought that [Newtonian mechanics](#) was no longer enough to reconcile the laws of classical mechanics with the laws of the [electromagnetic field](#). This led him to develop his [special theory of relativity](#) during his time at the [Swiss Patent Office](#). There is evidence—from Einstein's own writings—that he collaborated with his first wife, [Mileva Marić](#) on this work. The decision to publish only under his name seems to have been mutual, but the exact reason is unknown.^[11] In 1905, called his *[annus mirabilis](#)* (miracle year), he published [four groundbreaking papers](#), which attracted the attention of the academic world; the first outlined the theory of the [photoelectric effect](#), the second paper explained [Brownian motion](#), the third paper introduced [special relativity](#), and the fourth [mass–energy equivalence](#). That year, at the age of 26, he was awarded a PhD by the [University of Zurich](#).

Although initially treated with skepticism from many in the scientific community, Einstein's works gradually came to be recognised as significant advancements. He was invited to teach theoretical physics at the [University of Bern](#) in 1908 and the following year moved to the University of Zurich, then in 1911 to [Charles University in Prague](#) before returning to ETH (the newly renamed Federal Polytechnic School) in Zürich in 1912. In 1914, he was elected to the [Prussian Academy of Sciences](#) in [Berlin](#), where he remained for 19 years. Soon after publishing his work on special relativity, Einstein began working to extend the theory to gravitational fields; he then published a paper on [general relativity](#) in 1916, introducing his theory of gravitation. He continued to deal with problems of [statistical mechanics](#) and quantum theory, which led to his explanations of particle theory and the [motion of molecules](#). He also investigated the thermal properties of light and the quantum theory of radiation, the basis of the laser, which laid the foundation of the [photon](#) theory of light. In 1917, he applied the general theory of relativity to model the structure of the universe.^{[12][13]}

In 1933, while Einstein was visiting the United States, [Adolf Hitler](#) came to power. Because of his [Jewish](#) background, Einstein did not return to Germany.^[14] He settled in the United States and became an American citizen in 1940.^[15] On the eve of [World War II](#), he endorsed

a [letter](#) to [President Franklin D. Roosevelt](#) alerting FDR to the potential development of "extremely powerful bombs of a new type" and recommending that the US begin similar research. This eventually led to the [Manhattan Project](#). Einstein supported the [Allies](#), but he generally denounced the idea of using [nuclear fission](#) as a weapon. He signed the [Russell–Einstein Manifesto](#) with British philosopher [Bertrand Russell](#), which highlighted the danger of nuclear weapons. He was affiliated with the [Institute for Advanced Study](#) in [Princeton, New Jersey](#), until his death in 1955.

He published [more than 300 scientific papers](#) and more than 150 non-scientific works.^{[12][16]} His intellectual achievements and originality have made the word "Einstein" synonymous with "genius".^[17] [Eugene Wigner](#) compared him to his contemporaries, writing that "Einstein's understanding was deeper even than [Jancsi von Neumann](#)'s. His mind was both more penetrating and more original than von Neumann's."^[18]



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Early life and education

See also: [*Einstein family*](#)



Einstein at the age of 3 in 1882



Albert Einstein in 1893 (age 14)



Einstein's [matriculation](#) certificate^[note 2]

Albert Einstein was born in [Ulm](#), in the [Kingdom of Württemberg](#) in the [German Empire](#), on 14 March 1879.^[5] His parents were [Hermann Einstein](#), a salesman and engineer, and [Pauline Koch](#). In 1880, the family moved to [Munich](#), where Einstein's father and his uncle Jakob founded *Elektrotechnische Fabrik J. Einstein & Cie*, a company that manufactured electrical equipment based on [direct current](#).^[5]

The Einsteins were non-observant [Ashkenazi Jews](#), and Albert attended a [Catholic elementary school](#) in Munich, from the age of 5, for three years. At the age of 8, he was transferred to the Luitpold Gymnasium (now known as the Albert Einstein Gymnasium), where he received advanced primary and secondary school education until he left the [German Empire](#) seven years later.^[19]

In 1894, Hermann and Jakob's company lost a bid to supply the city of Munich with electrical lighting because they lacked the capital to convert their equipment from the direct current (DC) standard to the more efficient [alternating current](#) (AC) standard.^[20] The loss forced the sale of the Munich factory. In search of business, the Einstein family moved to Italy, first to [Milan](#) and a few months later to [Pavia](#). When the family moved to Pavia, Einstein, then 15, stayed in Munich to finish his studies at the Luitpold Gymnasium. His father intended for him to pursue [electrical engineering](#), but Einstein clashed with authorities and resented the school's regimen and teaching method. He later wrote that the spirit of learning and creative thought was lost in strict [rote learning](#). At the end of December 1894, he traveled to Italy to join his family in Pavia, convincing the school to let him go by using a doctor's note.^[21] During his time in Italy he wrote a short essay with the title "On the Investigation of the State of the [Ether](#) in a Magnetic Field".^{[22][23]}

Einstein always excelled at math and physics from a young age, reaching a mathematical level years ahead of his peers. The twelve-year-old Einstein taught himself algebra and Euclidean geometry over a single summer.^[24] Einstein also independently discovered his own original proof of the [Pythagorean theorem](#) at age 12.^[25] A family tutor Max Talmud says that after he

had given the 12-year-old Einstein a geometry textbook, after a short time "[Einstein] had worked through the whole book. He thereupon devoted himself to higher mathematics... Soon the flight of his mathematical genius was so high I could not follow."^[26] His passion for geometry and algebra led the twelve-year-old to become convinced that nature could be understood as a "mathematical structure".^[26] Einstein started teaching himself calculus at 12, and as a 14-year-old he says he had "mastered [integral](#) and [differential calculus](#)".^[27]

At age 13, when he had become more seriously interested in philosophy (and music),^[28] Einstein was introduced to [Kant's Critique of Pure Reason](#), and Kant became his favorite philosopher, his tutor stating: "At the time he was still a child, only thirteen years old, yet Kant's works, incomprehensible to ordinary mortals, seemed to be clear to him."^[26]

In 1895, at the age of 16, Einstein took the entrance examinations for the [Swiss Federal Polytechnic School](#) in [Zürich](#) (later the Eidgenössische Technische Hochschule, ETH). He failed to reach the required standard in the general part of the examination,^[29] but obtained exceptional grades in physics and mathematics.^[30] On the advice of the principal of the polytechnic school, he attended the [Argovian cantonal school \(gymnasium\)](#) in [Aarau](#), Switzerland, in 1895 and 1896 to complete his secondary schooling. While lodging with the family of professor [Jost Winteler](#), he fell in love with Winteler's daughter, Marie. Albert's sister [Maja](#) later married Winteler's son Paul.^[31] In January 1896, with his father's approval, Einstein renounced his [citizenship in the German Kingdom of Württemberg](#) to avoid [military service](#).^[32] In September 1896, he passed the Swiss [Matura](#) with mostly good grades, including a top grade of 6 in physics and mathematical subjects, on [a scale of 1–6](#).^[33] At 17, he enrolled in the four-year mathematics and physics teaching diploma program at the Zürich polytechnic school. Marie Winteler, who was a year older, moved to [Olsberg](#), Switzerland, for a teaching post.^[31]

Einstein's future wife, a 20-year-old [Serbian](#) named [Mileva Marić](#), also enrolled at the polytechnic school that year. She was the only woman among the six students in the mathematics and physics section of the teaching diploma course. Over the next few years, Einstein's and Marić's friendship developed into romance, and they spent countless hours debating and reading books together on extra-curricular physics in which they were both interested. Einstein wrote in his letters to Marić that he preferred studying alongside her.^[11] In 1900, Einstein passed the exams in Maths and Physics and was awarded the Federal teaching diploma.^[34] There is eyewitness evidence and several letters over many years that indicate Marić might have collaborated with Einstein prior to his 1905 papers,^{[11][35][36]} known as the [Annus Mirabilis papers](#), and that they developed some of the concepts together during their studies, although some historians of physics who have studied the issue disagree that she made any substantive contributions.^{[37][38][39][40]}

Marriages and children



Albert and [Mileva](#) Einstein, 1912

Early correspondence between Einstein and Marić was discovered and published in 1987 which revealed that the couple had a daughter named "[Lieserl](#)", born in early 1902 in [Novi Sad](#) where Marić was staying with her parents. Marić returned to Switzerland without the child, whose real name and fate are unknown. The contents of Einstein's letter in September 1903 suggest that the girl was either given up for adoption or died of [scarlet fever](#) in infancy.^{[41][42]}



Einstein with his second wife Elsa in 1921

Einstein and Marić married in January 1903. In May 1904, their son [Hans Albert Einstein](#) was born in [Bern](#), Switzerland. Their son [Eduard](#) was born in Zürich in July 1910. The couple moved to Berlin in April 1914, but Marić returned to Zürich with their sons after learning that despite their close relationship before,^[11] Einstein's chief romantic attraction was now his first and second cousin Elsa.^[43] They divorced on 14 February 1919, having lived apart for five years.^{[44][45]} Eduard had a breakdown at about age 20 and was diagnosed with [schizophrenia](#).^[46] His mother cared for him and he was also committed to asylums for several periods, finally being committed permanently after her death.^[47]

In letters revealed in 2015, Einstein wrote to his early love Marie Winteler about his marriage and his strong feelings for her. He wrote in 1910, while his wife was pregnant with their second child: "I think of you in heartfelt love every spare minute and am so unhappy as only a man can be." He spoke about a "misguided love" and a "missed life" regarding his love for Marie.^[48]

Einstein married [Elsa Löwenthal](#) in 1919,^{[49][50]} after having a relationship with her since 1912.^[51] She was a first cousin maternally and a second cousin paternally.^[51] They emigrated to the United States in 1933. Elsa was diagnosed with heart and kidney problems in 1935 and died in December 1936.^[52]

In 1923, Einstein fell in love with a secretary named Betty Neumann, the niece of a close friend, Hans Mühsam.^{[53][54][55][56]} In a volume of letters released by [Hebrew University of Jerusalem](#) in 2006,^[57] Einstein described about six women, including Margarete Lebach (a blonde Austrian), Estella Katzenellenbogen (the rich owner of a florist business), Toni Mendel (a wealthy Jewish widow) and Ethel Michanowski (a Berlin socialite), with whom he spent time and from whom he received gifts while being married to Elsa.^{[58][59]} Later, after the death of his second wife Elsa, Einstein was briefly in a relationship with Margarita Konenkova.^[60] Konenkova was a Russian spy, who was married to the noted Russian sculptor [Sergei Konenkov](#) (who created the bronze bust of Einstein at the [Institute for Advanced Study](#) at Princeton).^{[61][62]}

Friends

Among Einstein's well-known friends were [Michele Besso](#), [Paul Ehrenfest](#), [Marcel Grossmann](#), [János Plesch](#), [Daniel Q. Posin](#), [Maurice Solovine](#), and [Stephen Samuel Wise](#).^[63]

Patent office



Albert Einstein in 1904 (age 25)

After graduating in 1900, Einstein spent almost two frustrating years searching for a teaching post. He acquired [Swiss](#) citizenship in February 1901,^[64] but for medical reasons was not [conscripted](#). With the help of [Marcel Grossmann](#)'s father, he secured a job in [Bern](#) at the [Federal Office for Intellectual Property](#), the patent office,^{[65][66]} as an [assistant examiner – level III](#).^{[67][68]}

Einstein evaluated [patent applications](#) for a variety of devices including a gravel sorter and an electromechanical typewriter.^[68] In 1903, his position at the Swiss Patent Office became permanent, although he was passed over for promotion until he "fully mastered machine technology".^{[69]:370}

Much of his work at the patent office related to questions about transmission of electric signals and electrical–mechanical synchronization of time, two technical problems that show up conspicuously in the [thought experiments](#) that eventually led Einstein to his radical conclusions about the nature of light and the fundamental connection between space and time.^{[69]:377}



[Olympia Academy](#) founders: [Conrad Habicht](#), [Maurice Solovine](#) and Einstein

With a few friends he had met in Bern, Einstein started a small discussion group in 1902, self-mockingly named "[The Olympia Academy](#)", which met regularly to discuss science and philosophy. Sometimes they were joined by [Mileva](#) who attentively listened but did not participate.^[70] Their readings included the works of [Henri Poincaré](#), [Ernst Mach](#), and [David Hume](#), which influenced his scientific and philosophical outlook.^[71]