

ALBERT EINSTEIN, MAN, SCIENTIST AND PHILOSOPHER

ALBERT EINSTEIN THE MAN

- Friday, March 14, 1879: Albert Einstein is born in the house of his parents in Bahnhofstrasse B135, Ulm, Germany.
- His father, Hermann, was a small businessman of no success. His mother was Pauline Koch.
- In 1880 his family moved to Munich and in 1881 his sister Maria (always called Maja) was born.
- The environment of his childhood was warm, stable and stimulating.
- At the age of five, his education began at home, with a private teacher.
- At age 7 he entered a public (meaning free and open to all) elementary school, where he did very well.
- In 1886, his mother wrote that her son “was once again first in his class”.
- In 1888 he entered secondary school, where also, he did very well.
- In 1894 his family moved to Milan (Italy) and left Albert in Germany with a Munich family, in order to continue his studies.
- This experience of loneliness depressed young Einstein.
- Six months later, he left the school and went to Milan under his own initiative.
- He studied alone, to prepare for the University entrance examination
- In October 1895, aged 16, or two years less than the minimum age for admittance, he took the examination for admittance to the Federal Institute of Technology in Zurich.
- He did well in the exams in mathematics, physics and chemistry. In literature, history and German, he did not do well. It was not that he was a poor student – he just never liked school.
- In September 1895 he finished his secondary school studies, and at year end, approved the final exam which allowed him to enter a University. At age 17, he was the youngest student admitted. The oldest was Mileva Maric, his future wife.
- Mileva was born in 1875 in the city of Titel (now, Serbia – then, Hungary). She was born with a faulty hip, and was not able to walk well during all her life.

- In 1900 they took their final exams. Albert passed, Mileva did not. She tried again in 1901, and failed again. She never tried again.
- In 1901 a daughter was born, Liesert, before they were married. Shortly thereafter, and before Einstein ever saw her, she was sent to distant relatives, far from Switzerland. She was never heard from again.
- In 1902 Einstein got a job as Assistant (2^o Degree) in the Patent Office in Berne.
- In January 1903, Albert and Mileva were married in a civil ceremony in Berne.
- In 1904, a son, Hans Albert, was born. He eventually became a well known civil engineer.
- In 1905 he received his Doctor of Philosophy degree, in Physics.
- In July 1909 a second son, Eduard, was born. He was a poor student, and showed signs of “dementia praecox”. His great interest was pornography, and he was hospitalized several times, showing signs of schizophrenia. He died in Germany in 1965.
- In 1919 Einstein is proposed for the Nobel Prize, for the first time.
- In 1914, Mileva and the two children leave Albert and go to Berlin to live. Their divorce is finalized in 1919.
- Since 1912, Einstein had been romantically involved with Elsa Einstein, one of his first cousins, who was divorced and had two children. They married in 1919.
- In 1920 Einstein falls in love with an unknown young woman. This affair lasted until 1924, and was followed by many more. None was serious or long lasting.
- However, in June 2006, the BBC in London made known the letters Einstein had written to his step-daughter Margot (daughter of Elsa) between 1912 and 1955. Margot had stipulated in her will that the letters should not be revealed until 20 years after her death.
- In 1931, Einstein wrote Margot about one of his conquests, Mrs. M. from Berlin (Ethel Michanowski) saying: “...she followed me to England and her stalking me was out of control.
- In the same letter, he says: “... Of all women, I am only attracted to Mrs. L. who is absolutely harmless, as well as decent.
- In another letter to Margot, he asks her to forward an attached letter to Margarita (known as his Russian spy mistress) to avoid inquisitive eyes.

- Another letter mentions that the Nobel Prize money was only partly sent to Mileva: the greater part was invested in the USA, and was essentially all lost in the depression of 1930.
- He mentions in yet another letter that it is hard for him to accept his son's schizophrenia, and says that it would have been better had he never been born.
- In a 1924 letter to Elsa, he says; "I love Margot as if she were my own daughter. Even more, for who knows what an unpleasant little girl she would have been, if I were her real father.
- In 1921, in a letter to Elsa he says: "Soon I will be sick and tired of Relativity. All things like that seem to disappear if one gets too involved".
- In 1921 he wins the Physics Nobel Prize for his work on the Photoelectric Effect.
- In 1933 the Nazis take power in Germany, confiscate all of Einstein's properties and make him decide to emigrate to the USA with his family. They make their home in Princeton, New Jersey, and he accepts a post in the Institute for Advanced Studies. Elsa dies in 1936.
- In 1939 they are joined by his sister Maja, who lived with them until her death in 1951.
- He always loved music, and played both the piano and the violin well. He especially appreciated Mozart, Shubert and Bach.
- Helen Dukas, Hungarian, 17 years younger than Einstein, was his private secretary from 1928 and lived in Princeton with Einstein, until he died. She inherited all his papers, some 60,000 pages. She dedicated herself to the organization and publication of these papers. Today part is in the University of Princeton, part in the Hebrew University in Israel and parts in various files and libraries all over the world.
- Einstein died in Princeton in April 1955, of an aneurism of the aorta, known and not operable. His last words, in German, were not understood by his American nurse.

ALBERT EINSTEIN THE SCIENTIST

Albert Einstein, in only one year, changed physics and the existing cosmovision of his time. In that year of 1905, his ***anno mirabilis***, he produced a series of five papers (five of the most important of all physics to date). These are

mentioned below, and any one of them would have immortalized him as one of the greatest men in his field.

SPECIAL THEORY OF RELATIVITY

1. He χονσιδερσ τωσ οβσερβερσ ιν τωσ διφφερεντ συστεμσ ιν υνιφορμ μοωεμεντ (that is, with no acceleration) one with respect to the other. Here, he says, at great velocities they will not be in agreement in the measurement of distances and time intervals made in the other's system
2. The limiting velocity of all object having mass, is the speed of light, or some 300,000 km/sec.
3. Energy and mass are equivalent, or $E = mc^2$.

PHOTOELECTRIC EFFECT

He postulates "quanta" (particles) of light, called photons, to explain the photoelectric effect. When light impinges on a metal, this emits electrons. For each photon absorbed, there is one electron emitted. The formula is:

$$E = h\nu \quad \text{where: } E = \text{Energy, } h = \text{Plank's constant, } \nu = \text{Frequency}$$

This was the beginning of quantum physics.

BROWNIAN MOVEMENT

This is the irregular movement of very small particles of matter (like pollen), suspended in a liquid.

Einstein found that the speed of the particles is a function of the square root of the temperature. He gave mathematical treatment to this phenomenon, and the results were confirmed by experiments by Jean Perrin (1870 – 1942).

GENERAL THEORY OF RELATIVITY

Finished in 1916, it was started in 1905 as a corollary of the Special Theory, and says that the force of gravity determines the curvature of the Space – Time

continuum. His conclusions were confirmed by experiments on the curvature of light when this passes near a massive object like our sun.

UNIFIED FIELD THEORY (UFT) – THEORY OF EVERYTHING

The rest of Einstein's life was dedicated to the search for a theory that would explain gravity, electromagnetism and subatomic phenomena with one set of laws. He never succeeded. Neither has anyone else since.

QUANTUM THEORY OF PHYSICS

Einstein never wanted to accept the probabilistic part of quantum physics developed by Nils Bohr and others. He believed that explanations of the universe should be beautiful and simple. ("He does not play dice with the universe", referring to God, is one of his best known sayings).

His disagreement with Bohr delayed physics by an estimated 30 years.

NOBEL PRIZE

Most people believe that Einstein was awarded the Nobel Prize in Physics for his General Theory of Relativity. He actually received it in 1921 "*...for his services to theoretical physics, and especially for his discovery of the photoelectric effect.*" Nowhere in the citation was the Theory of Relativity mentioned – the Theory was still under discussion both scientifically and politically. The theory was thought to be very hard to understand, and had been attacked by many. Today it has triumphed in all its beauty.

LATER YEARS

Like most great scientists, in his later years he became a philosopher. Ilya Prigogine and Carl Sagan are two examples that come to mind. Einstein's later books show this to be so.

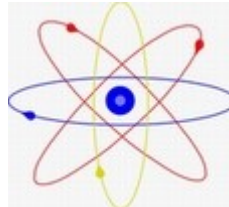
ALBERT EINSTEIN THE PHILOSOPHER – HIS COMMENTS

1. My scientific work is motivated by an irresistible desire to understand the secrets of nature, and by no other motive. My love of Justice and my efforts to improve the human condition are totally independent of my scientific interests. (1949)
2. I have no special talents. I am only passionately curious. (1952)
3. Arrows of hate have been shot at me, but they never hit the mark, because in some manner they belonged to another world, with which I have absolutely no relationship. (?)
4. I never obtained ethical values from my work. (?)
5. To enjoy the happiness of others and to suffer with them – these are the best guides for a man. (1931)
6. If we, the Jews, are unable to find a way towards honest cooperation and honest pacts with the Arabs, then we have learnt absolutely nothing from our 2.000 years of suffering, and we will deserve all that happens to us. (1929)
7. In our religion, “Serving God” simply means “Serving the living”. The best the Jewish people have produced, the Prophets and Jesus, worked without rest for this. (1934)
8. If you want a happy life, tie it to a goal, not to persons or things. ((?)
9. The State is made for Man, not Man for the State. That is: the State must be our servant, and not we its slaves. (1931)
10. I maintain that the cosmic religious feeling is the strongest and most noble motivation for scientific research. (1930)
11. When one reaches a high level of technical ability, science and art tend to unite in aesthetics, plasticity and form. The greatest scientists are always artists too. (1955)
12. The value of an achievement is in having achieved it. (?)
13. Morality is of the greatest importance, but for us, not for God. (1927)
14. My pacifism is an instinctive feeling, a feeling that overpowers me, because the killing of people is repugnant. (?)
15. Wisdom is not the result of study, but in the effort to obtain it. (1954)
16. I have finished my work here. (On his deathbed, 1955)

Banesh Hoffman, one of his collaborators and biographers said:

“The essence of the depth of Einstein was in his simplicity, and the essence of his science was in his artistic ability, in his phenomenal sense of beauty”.

One of the most beautiful things that Einstein said is given below. Please note when and where this was said.



MY CREDO

Our situation on this planet appears to be very strange. Each one of us appears here unwillingly and without invitation, for a short stay, without knowing the whys and the wherefores. In our daily life we only feel that man is here on behalf of others, for those we love, and for the many more whose destiny is tied to ours.

I am often worried by the thought that my life is based, to such an extent, on the work of my fellow human beings, that I realize my great debt towards them.

I don't believe in free will. The words of Schopenhauer: "Man can do what he wants, but he cannot say what he wants" accompany me in all situations and in all my life, and they reconcile me with the actions of others if these are painful for me. This consciousness of the lack of free will takes care that I do not take myself and others too seriously as individuals that act and decide, and takes care that I do not lose my equanimity.

I have never coveted opulence and luxury, and I even despise them somewhat. My passion for social justice often has led me into conflict with persons, as also my aversion to any obligation or dependence that I do not consider to be absolutely necessary. I always keep the individual in high esteem and I have an insuperable aversion to violence and its apology. All these reasons have made of me a passionate pacifist and anti – militarist. I am against any nationalism, even when it is disguised as patriotism. Privileges based on position and property have always seemed to me unjust and pernicious, as also any exaggerated cult to personality. I

follow the ideal of Democracy, even clearly knowing the weakness of the democratic form of government. Social equality and the economic protection of the individual have always seemed to me, the most important community goals of the State.

Although I am a typical solitary person in daily life, my understanding that I belong to the invisible community of those who fight in favour of truth, of beauty and of justice has preserved me from feeling isolated.

The most beautiful and deepest experience that a man can have is a sense of the mysterious. It is the underlying principle of religion as well as all serious efforts in the arts or sciences. He who has never had this experience, seems to me, if not dead, at least blind. Having the feeling that behind everything that can be experienced there is something our mind cannot grasp, and whose beauty and sublimeness reach us only indirectly, and as a weak reflection, this is religiosity. In this sense, I am religious. For me it is enough to ponder about these secrets and to humbly attempt to reach with my mind a mere image of the lofty structure of all that there is.

Albert Einstein
Speech to the German League of Human Rights
Berlin, autumn 1932.

In closing, I would like to tell you that my late father met Helen Dukas in Vienna in the late 1920s. When I arrived in Princeton in 1954, after having studied in the Universities of Oxford, Manchester and Massachusetts with three Bachelor's and a Master of Science Degrees to begin my studies for a Doctor of Philosophy in Physical Chemistry and Physics, my father telephoned Ms. Dukas to tell her that his son was in Princeton. She called me at the Graduate College to invite me to have dinner with the Professor. At first I thought my new friends and fellow students were playing a joke on me. Fortunately I said nothing stupid, only that it was an honour to accept. That is why in October 1954 and again in January 1955 I found myself ringing the bell of the house at 112 Mercer Street, where Einstein lived.

He received me correctly, while I was very nervous indeed, and had a dry mouth to prove it. We talked of many things, all but Physics. He showed me his chemistry lab, in the cellar of the house, where he liked to “fool around” as he put it. He told me he no longer played the violin, and asked questions about my life, and my religious beliefs. We had a frugal dinner, vegetable soup, boiled chicken with mashed squash, apfelstrudel for me, fruit for him. I expected coffee, knowing he liked it, but none came. He did not light his famous pipe, although there were several in sight.

Einstein gave me a photograph of himself with Charles Chaplin (1887 – 1977) taken at the premiere of Chaplin’s film *City Lights*, in 1931 in Caltech. Both are dressed in tuxedos – a very rare occurrence for Einstein, who preferred baggy sweaters and sandals with no socks. It hangs on the wall in my study.

On my second visit, he gave me a book of his “*Out Of My Later Years*” (1950), dedicated “To Joe, Albert Einstein, 1955”. In 1958 a friend asked to borrow it in order to photocopy it. These were the early days of photocopies in Argentina, and he returned the book essentially destroyed. Of course I still have it in my collection of books on Einstein.

It is interesting that in the final written exam for the Ph.D. (8 hours, then) there was only one question, for the first time in decades. It was “Discuss the contributions of Einstein to Physical Chemistry”. My fellow students looked at me with hate as I wrote blue book after blue book, only occasionally resting my cramped hand. Luck? All I know I received an excellent grade, and in December 1957 finished my thesis and final oral exam.

In September 1954 I attended a Seminar Einstein gave in Princeton on the Special Theory of Relativity. I happened to be sitting next to Professor Wallace, Chair of the Organic Chemistry department of Princeton University. During a break I told him I was getting 10 to 15% of what Einstein was saying. He told me he was getting 30 – 35% and that 15% was not too shabby for a First Year Ph.D. student!

Einstein was close to his death. It was a very great honour to have had the chance to meet him.

NOTES:

Plank's Constant = $h = 6.63 \times 10^{-34}$ Joules-second

Joule is a unit of work or energy that arises from a force of 1 Newton over one meter.

1 Newton = force that accelerates 1 kilogram at 1 meter/second/second



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