

Planck & Einstein – Lesson Outline

Syllabus Reference

9.4.2.3.5 – Process information to discuss Einstein and Planck's differing views about whether science research is removed from social and political forces.

Resources

Video: Planck & Einstein
<http://www.hscphysics.edu.au/resource/PlaEin.flv>

Pre-video Activities

Divide students into groups of 4-5 then give each group a piece of A3 paper and some makers. Each group brainstorm either the ways science has affected society or the ways society has influenced science.

One representative presents the group's work to the rest of the class. Encourage class discussion and questioning. Collate all groups' responses on board or screen.

Lead discussion with the question: Is science and science research therefore removed from social and political forces?

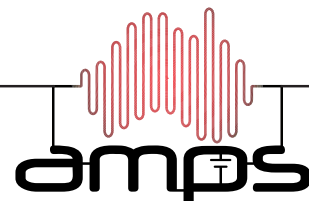
Pre-video resource: A chronology of significant event

Pre-video resource: Other important dates

Students are given the resources: A chronology of significant events and Other important dates. Students construct a scaled timeline incorporating all the information. Students should work in small groups and be provided with butcher's paper - they should make an effort to differentiate events into groups: Planck, Einstein, Social Political and Scientific Discoveries. Allow the student to think of creative ways to do this, but ensure groups are clearly distinguished and that the timeline is clearly scaled. A layout suggestion would be columns encompassing each group with a common timeline to the left or right.

View Video

Video: Planck & Einstein
<http://www.hscphysics.edu.au/resource/PlaEin.flv>



Post-Video Activities

Students divided up into groups of 3-4. Some groups take Planck, others take Einstein. Groups compare the actions of Planck or Einstein and the social/political view that such an action suggested.

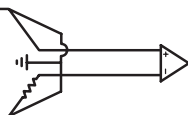
One representative presents the group's work to the rest of the class. Encourage class discussion and questioning. Collate all groups' responses on board or screen.

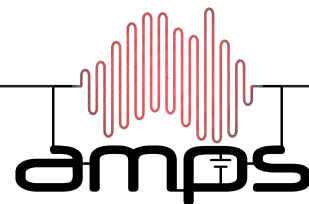
Pose the syllabus question to the class again. Initiate a class discussion on the dot point and what was learnt during the course of the lesson. Give students time to write their own summary on the dot point and lesson for further study.

An optional research task, in the library or a computer room, assign pairs of students to investigate questions such as:

- Did Germany ever build an atomic bomb?
- The facts behind Planck's anti-Semitism
- Which other Jewish scientists were affected by Nazi rule in Germany?
- Did Planck push for an atomic bomb?
- Why did Einstein leave Germany?
- What did Einstein and Planck do in WW1?
- How were Planck and Einstein seen by their colleagues?
- Why did Einstein settle in the United States?
- Did Einstein work on the Manhattan project?
- Which famous physicists worked on the Manhattan project?

Pairs should then report back to the whole class with their findings.

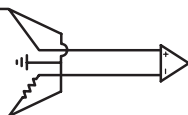


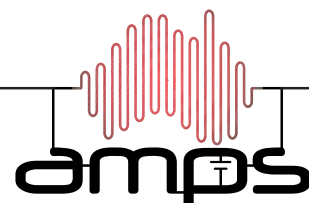


Planck & Einstein-

Other Important Dates

- 1831 - Michael Faraday discovers **electromagnetic induction**
- 1859 - Charles Darwin publishes *On the Origin of Species*, the foundation of **evolution**
- 1884 - James Clerk Maxwell's publishes 4 equations which explain all of electromagnetism and proposing the idea of **electromagnetic waves**, with light being such a wave
- 1886 - Heinrich Hertz conducts his 'spark gap' experiment, discovering the **photoelectric effect**, and also producing the first experimental evidence for Maxwell's **electromagnetic waves**.
- 1887 - The **Michelson Morley experiment** to detect the 'aether wind'
- 1897 - J.J. Thompson's discovers the **electron**, and determines its charge/mass ratio
- 1900 - Around this period, Phillip Lenard investigates experimentally the behaviour of the **photoelectric effect**.
- 1901 - Australian **federation**
- 1918 - Ernest Rutherford discovers the **proton**
- 1927 - Neils Bohr and Werner Heisenberg put forward the Copenhagen interpretation of **Quantum mechanics**
- 1932 - James Chadwick discovers the **neutron**
- 1936 - In Britain first ever broadcast television
- 1938 - Otto Hahn and Fritz Strassmann '**split**' the **uranium atom** in a German university identifying nuclear fission. Their Jewish associate Lise Meitner, integral in this discovery had fled to Sweden earlier in the year to escape Nazi persecution
- 1913 - Bohr's proposes his model of the atom (combining quantum theory with Rutherford's 1911 model, it is often called the Rutherford-Bohr model)
- 1941 - The Japanese attack Pearl Harbour, bring the United States into WWII
- 1950 - In the United States, the first colour television (Australia 1975)
- 1953 - Watson and Crick publish the double helical model of **DNA**
- 1958 - The first **silicon chip** (an integrated circuit, using **transistor** technology)
- 1961 - Russian cosmonaut Yuri Gagarin first man in space.
- 1969 - Neil Armstrong from Apollo 11 becomes the first man to land on the moon





Planck & Einstein-

A Chronology of Important Dates

- 1858 → Max Planck born in Kiel, Germany
- 1879 → Albert Einstein born in Ulm, Germany
- 1892 → Planck becomes professor of theoretical physics at the University of Berlin
- 1896 → Einstein renounces German citizenship, in opposition to German militarism, remains stateless until 1901 when granted Swiss citizenship
- 1900 → Planck publishes his famous account of the problem of blackbody radiation, proposing his own formula for the radiation of energy ($E = hf$), the foundation of
 - Einstein graduates from ETH, and takes a job at the Swiss patent office
- 1905 → Einstein publishes three groundbreaking papers on the photoelectric effect, special relativity and Brownian motion
- 1914 → ● World War I begins, Germany greatly affected
 - Planck signs the *Manifesto of the Ninety-three Intellectuals* supporting German military. Einstein signs a counter manifesto.
- 1915 → Einstein first publishes the definitive version of his theory of General Relativity
- 1918 → Planck receives the Nobel Prize in Physics for his work on energy radiation
- 1919 → ● World War I ends with Germany's signing of the Treaty of Versailles
- 1921 → Einstein receives the Nobel Prize in Physics for the Photoelectric effect
- 1930 → Planck appointed as president of the Kaiser Wilhelm Institute
- 1933 → ● Germany becomes a Nazi dictatorship, Adolf Hitler appointed Chancellor of Germany
 - Planck meets with Hitler in an attempt to influence policy change in regards to the welfare of his Jewish scientist colleagues.
 - Einstein resigns from the Kaiser Wilhelm institute, and takes up a professorship at Princeton in the United States
- 1937 → Planck resigns as president of the Kaiser Wilhelm Institute in protest against Nazi policy
- 1939 → ● World War II begins with the invasion of Poland by Nazi Germany
 - Einstein first writes to President Roosevelt, warning of the potential for a German atomic bomb and urging the United States to develop one first
- 1942 → ● The official Manhattan Project, to developing the atomic bomb, begins
- 1945 → Planck's son, advisor and close friend, Erwin, dies at the hands of the Gestapo after being implicated in an assassination attempt on Hitler in 1944, destroying Planck's will to live
 - ● Atomic bombs dropped on Hiroshima and Nagasaki by the United States
 - World War II ends with the surrender of Japan
- 1947 → Planck saves the Kaiser-Wilhelm Society from post-WWII disbandment
- 1947 → Planck dies on the 4th of October, in Göttingen, Germany, aged 89
- 1955 → Einstein dies on the 19th of April, at Princeton, New Jersey, aged 76