THE DISCOVERY OF ELEMENTS

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http://www.excitingscience.org

SUPPORTED BY:

What are ELEMENTS?

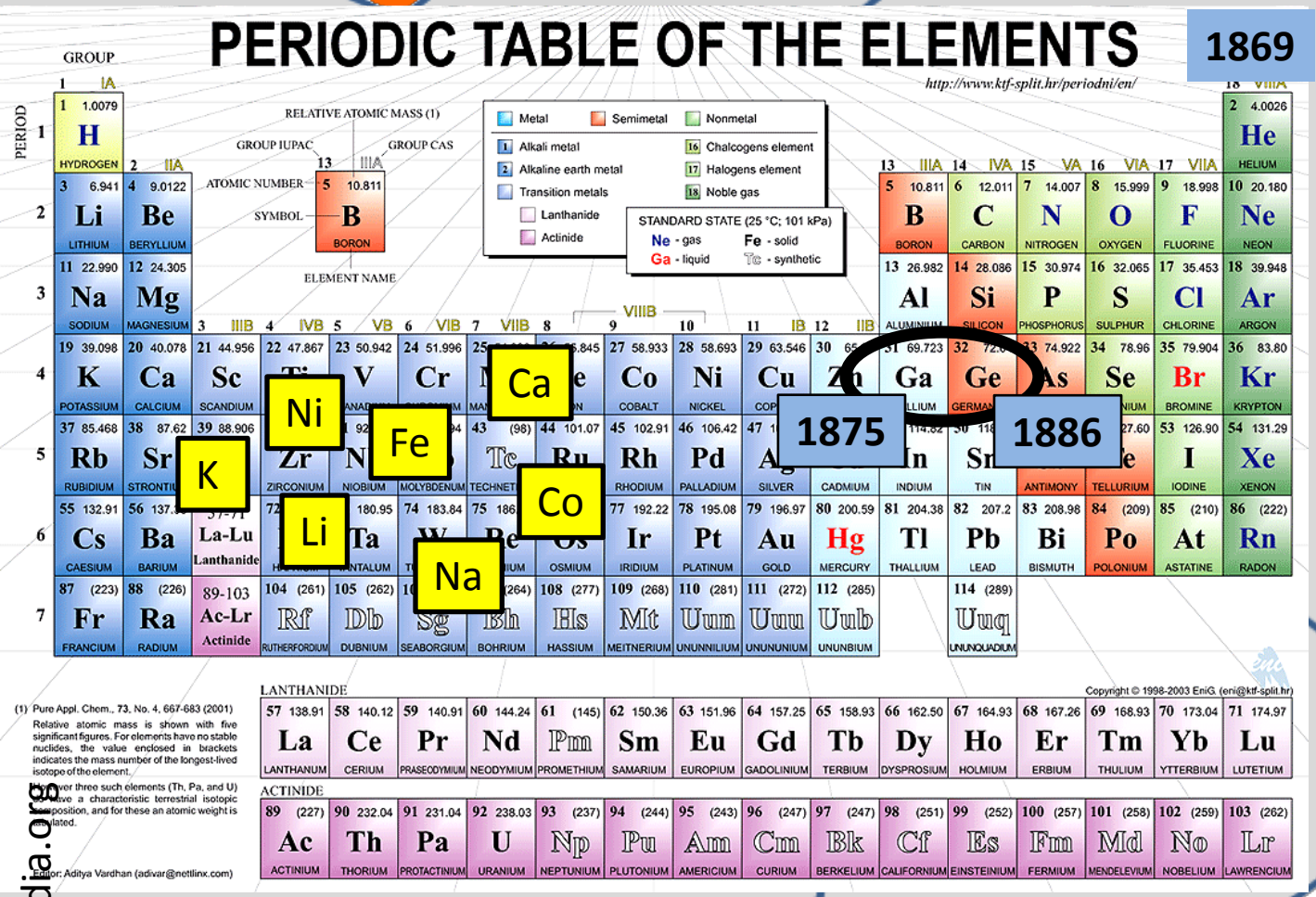
PURE chemical substances having ONE type of ATOM

Examples: Hydrogen, Carbon, Iron, Gold, Oxygen, Calcium, Zinc, Copper, etc. (Which is the lightest?)

118 elements discovered until now, of which 94 occur naturally on our planet.
Did we always know all 118? Not really…

PERIODIC TABLE OF THE ELEMENTS

1869

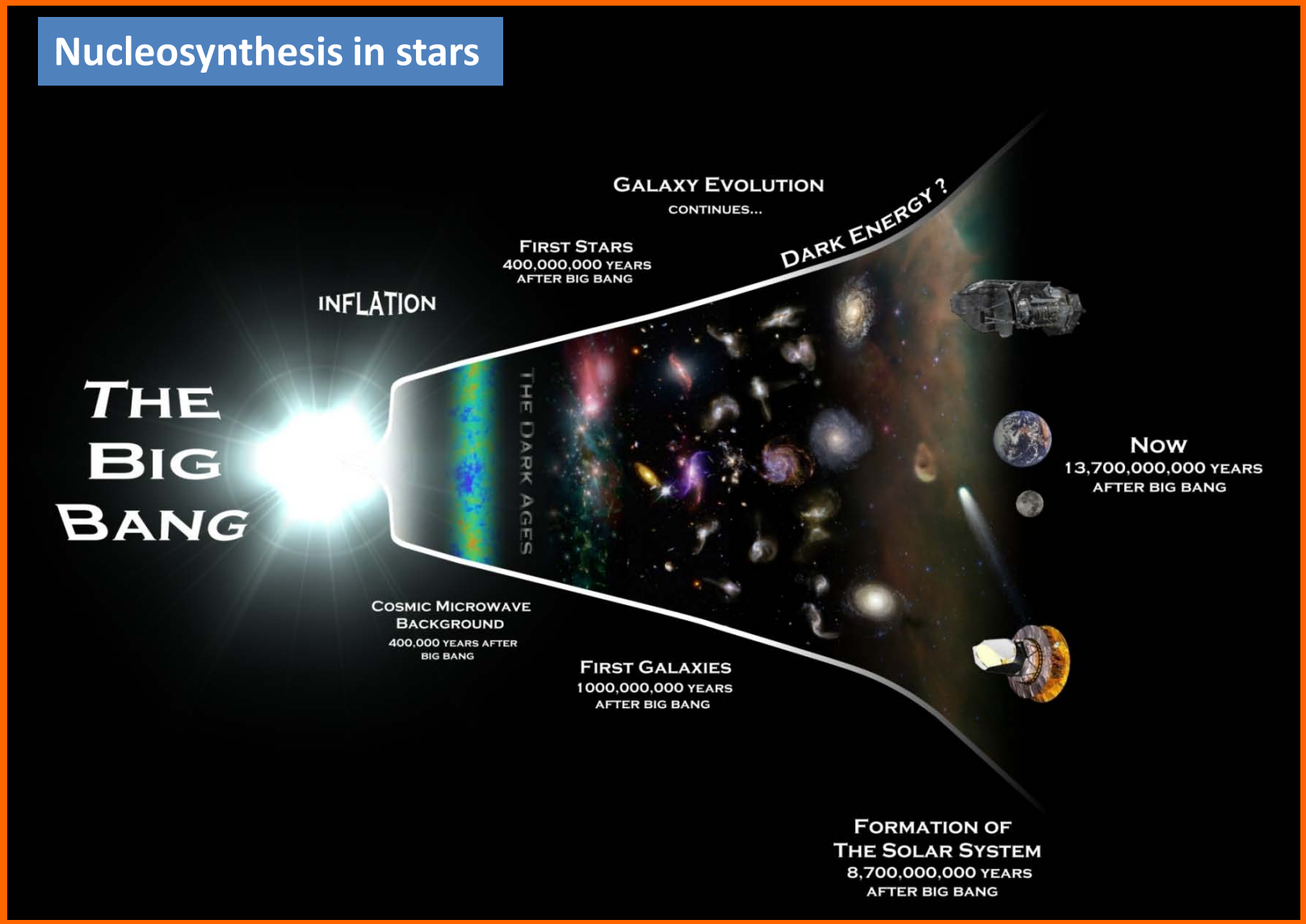


DMITRI MENDELEEV (1834 – 1907)

http://www.wikipedia.org

But first,
some even older history…

Let us start at the very beginning: All elements are born in stars

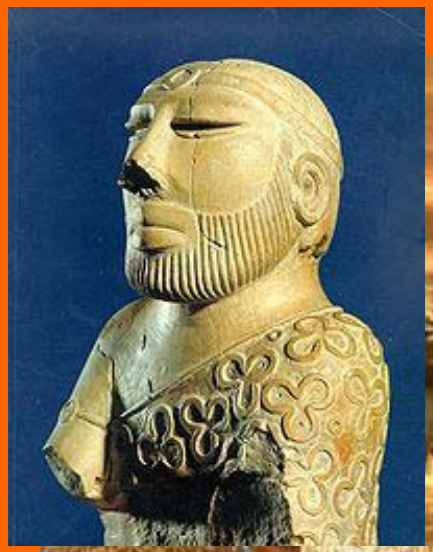


http://planck.cf.ac.uk/files/Timeline_portrait.jpg

Fast forward to a few thousand years ago: The ANCIENT times

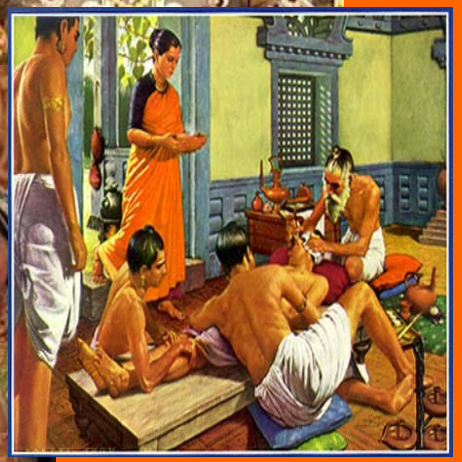
“Elements” in the Ancient World India/Greece/..

PRITHVI



AKASH

VAYU



JAL

AGNI

The Ancients Knew Some Elements

Gold, Silver, Copper, Carbon, Sulphur,
Mercury, Tin, Lead, Iron,

Known to Greeks, Romans,
Egyptians/Middle East, Chinese, Indians

CARBON – LIFE IS CARBON-BASED

THE CHEMISTRY OF CARBON-CARBON BONDS

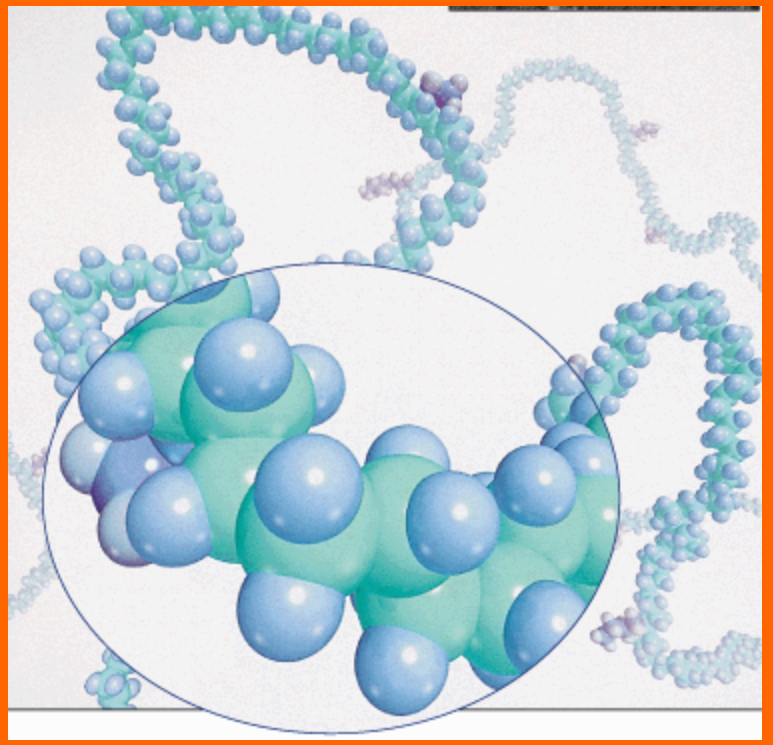
- Chemists want to control making/breaking C-C bonds
- Many NOBEL PRIZES for learning to make/break C-C bonds
- Nobel prize – MOST prestigious science prize

POLYMERS – from C-C bonds

- PROTEINS, DNA are polymers

SYNTHETIC POLYMERS

- Polythene
- Nylon
- Rubber



C-C BOND FORMATION IN NYLON

DEMONSTRATION:
Synthesis of NYLON

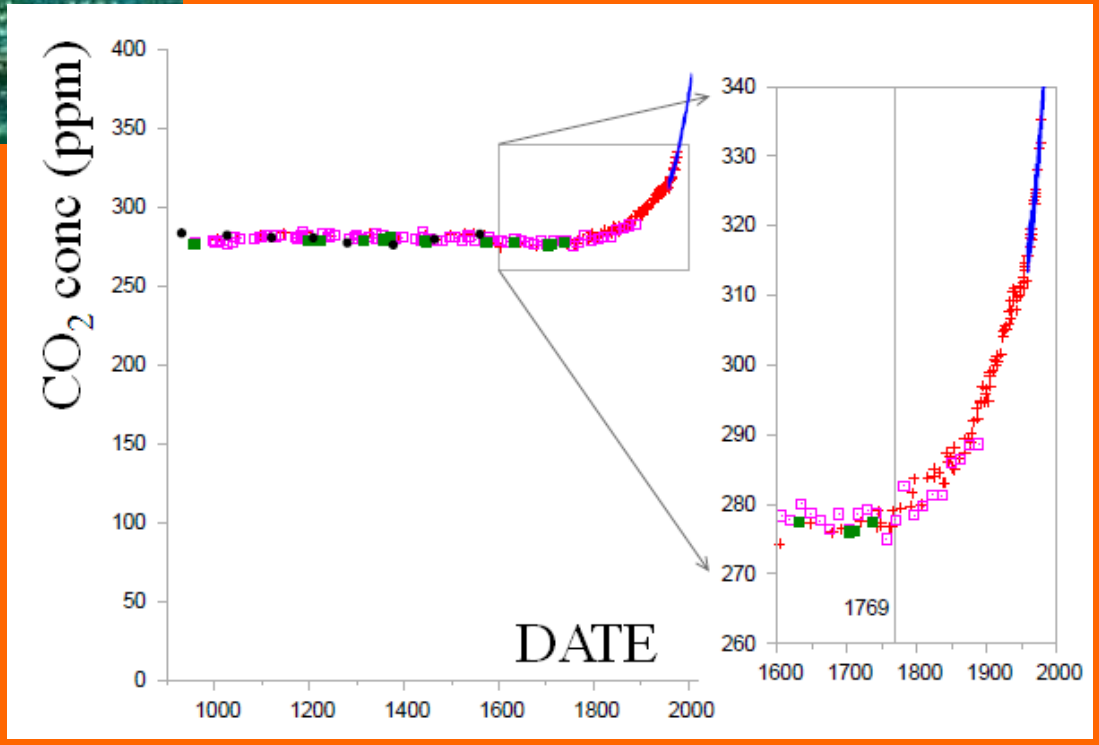
POLYACRYLIC ACID: Gelation

DEMONSTRATION:
Gelation

CARBON COMPOUNDS/CO_2

Oil: The starting point for polymers

Why I chose to get into science…



CO_2: Problems due to our extreme reliance on carbon based fossil fuels

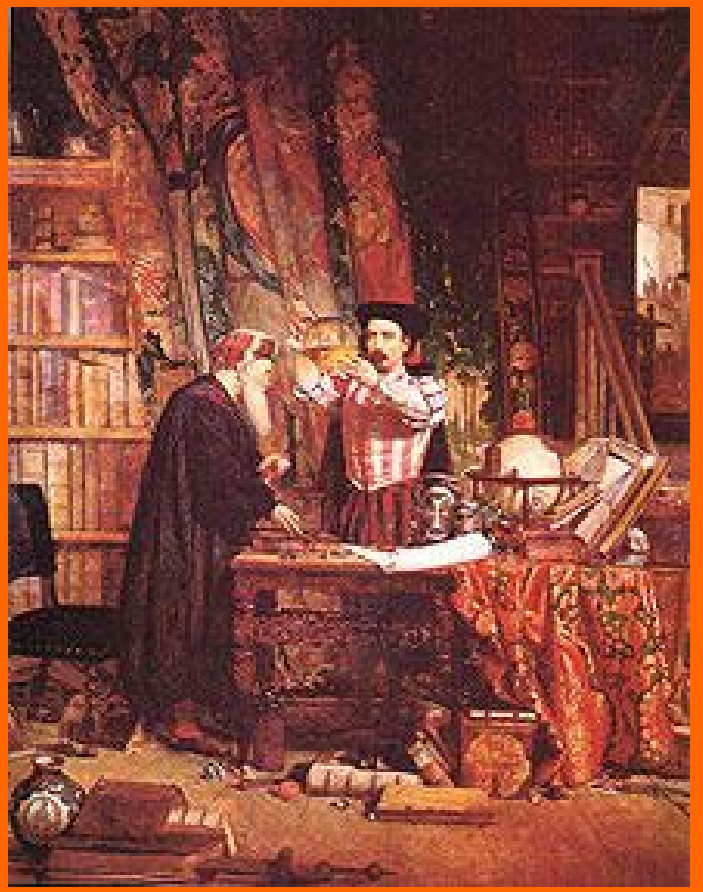
Fast forward from ancient times to a few hundred years ago: The MEDIEVAL times

Fast Forward to the MEDIEVAL AGE in Europe

SEARCH FOR:
PHILOSOPHER'S STONE

Convert metals into GOLD

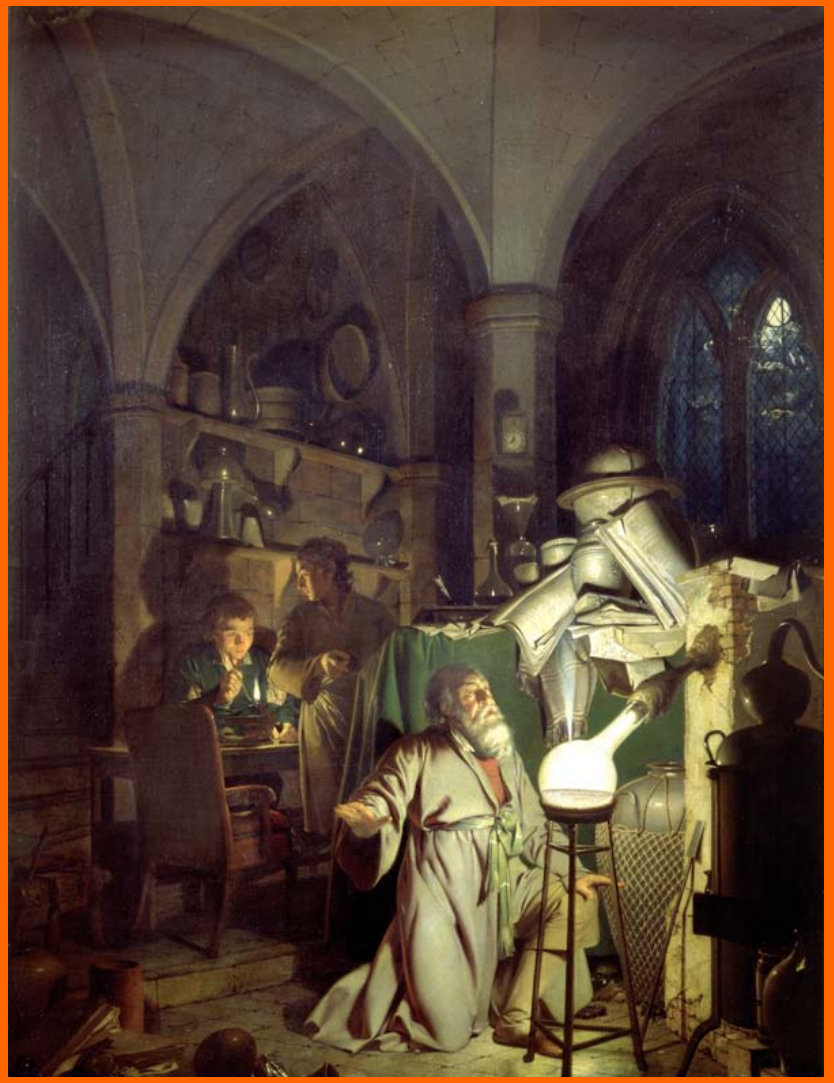
ELIXIR of LIFE



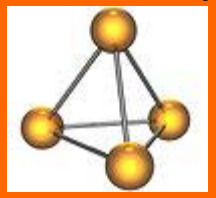
http://www.wikipedia.org

PHOSPHOROUS (P)

Henning Brand, Hamburg, Germany
1669



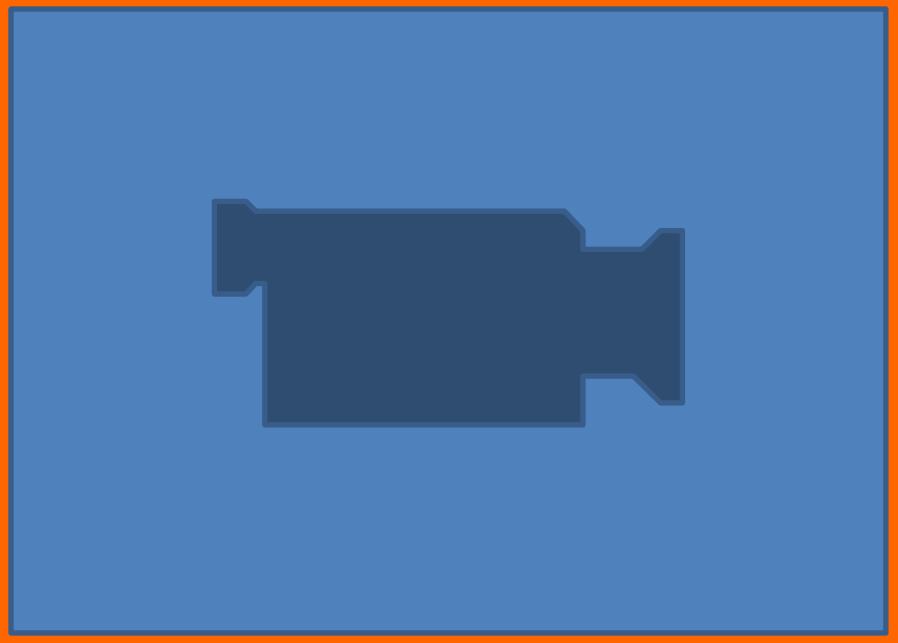
White phosphorous is DANGEROUS



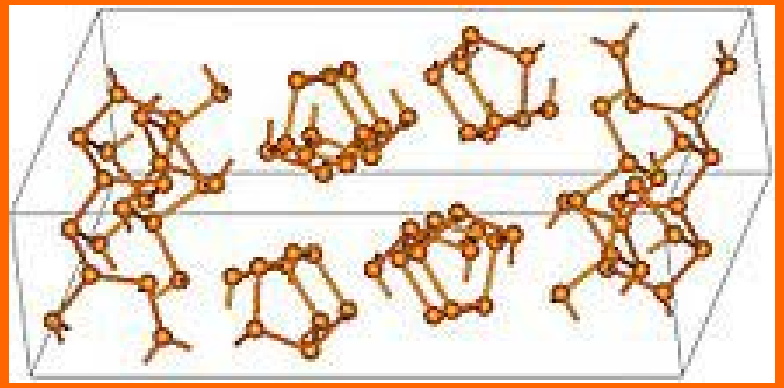
Volatile, Toxic (Phossy Jaw)
Highly inflammable

http://www.wikipedia.org

White P_4 – Video



Red P_4 – Safety Matches



Red phosphorous + powdered glass

Potassium chlorate + binder

http://www.wikipedia.org

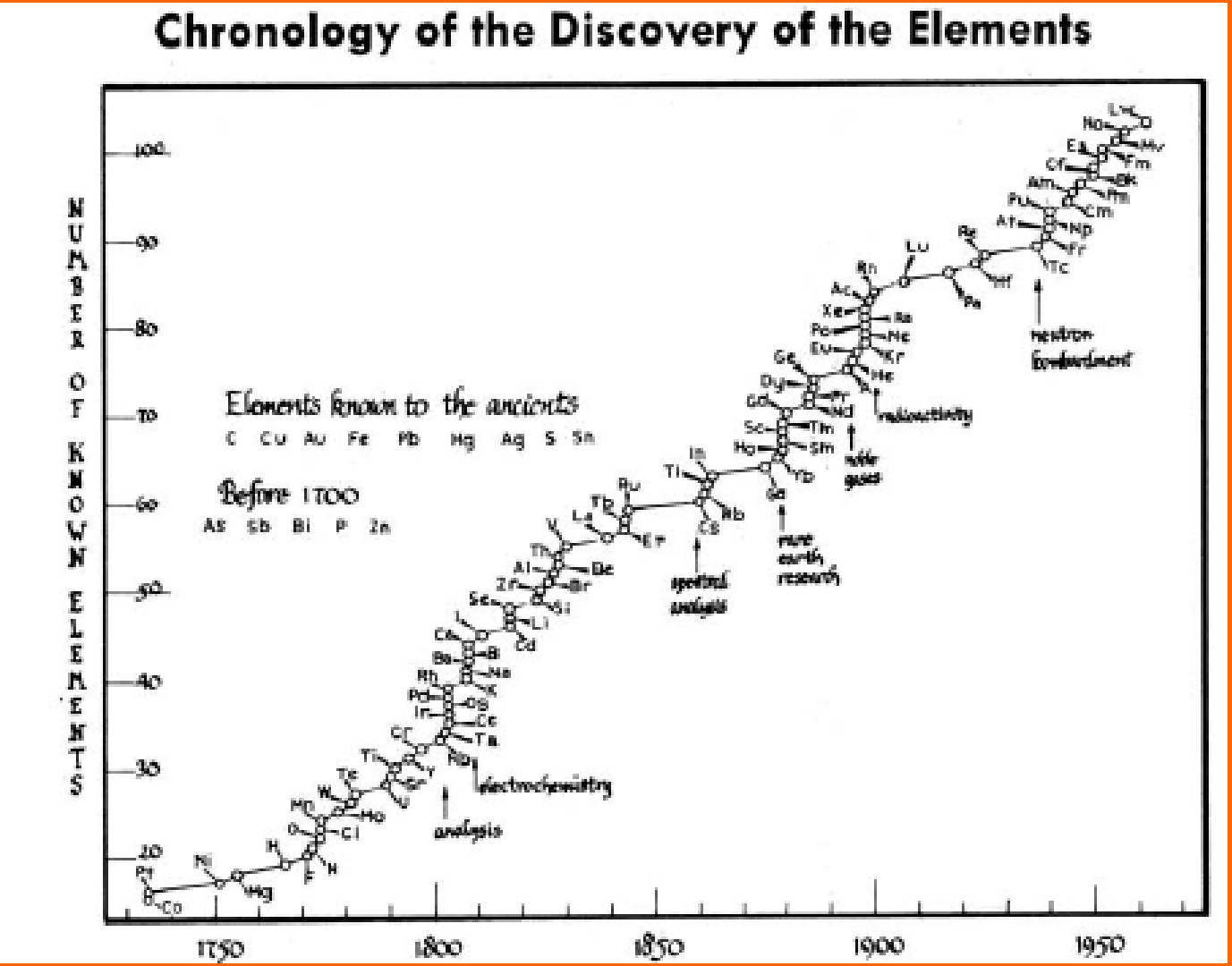
RED PHOSPHOROUS: The Match Experiment

Demonstration

Discovery of ELEMENTS

http://www.youtube.com

Discovery of ELEMENTS

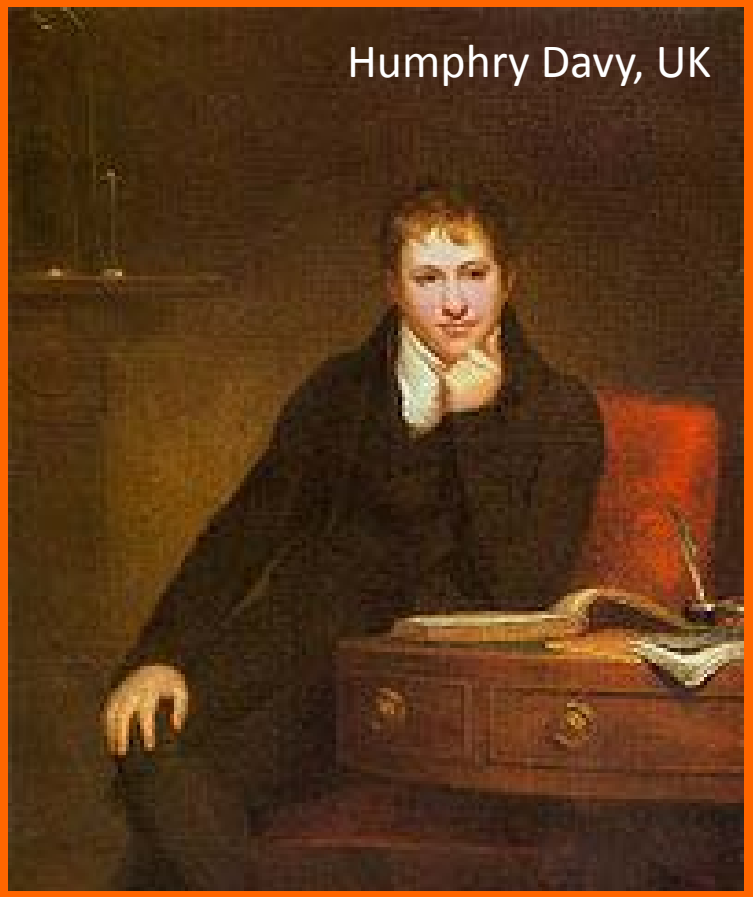


Goldwhite and Adams, J. Chem. Edu. (1970)

THE ERA OF ELECTROCHEMISTRY

In 1800, Volta invented the BATTERY

1.5 VOLT battery



Humphrey Davy discovered 5 elements (1807 – 1808): Strontium, Magnesium, Boron, Calcium, Barium

Davy's father was a woor carver. Davy came from a modest background, but attended school and taught himself philosophy, science and poetry.

Became the most famous chemist in UK

http://www.wikipedia.org

Humphry Davy: Demonstrations

DEMONSTRATION

Electrolysis

Magnesium

DEMONSTRATION

Mg burning

THE ERA OF ELECTROCHEMISTRY

Henri Moissan, Switzerland

USED ELECTROLYSIS OF HF (ACID) TO GET FLUORINE

PRIZE OF 10000 SWISS FRANCS WHEN HE COULD REPRODUCE THIS WORK (POTASSIUM FLUORIDE IMPURITY WAS REQUIRED)

1906 NOBEL PRIZE IN CHEMISTRY
(MENDELEEV WAS NOMINATED BUT DIDN'T GET IT)

http://www.wikipedia.org

SPECTROSCOPY

Kirchhoff

Bunsen

Kirchhoff:
Physicist, Laws for electrical circuits

Bunsen:
Chemist

Shine light through intense, hot, nonluminous flame. Analyze the SPECTRUM

Identified Cesium and Rubidium

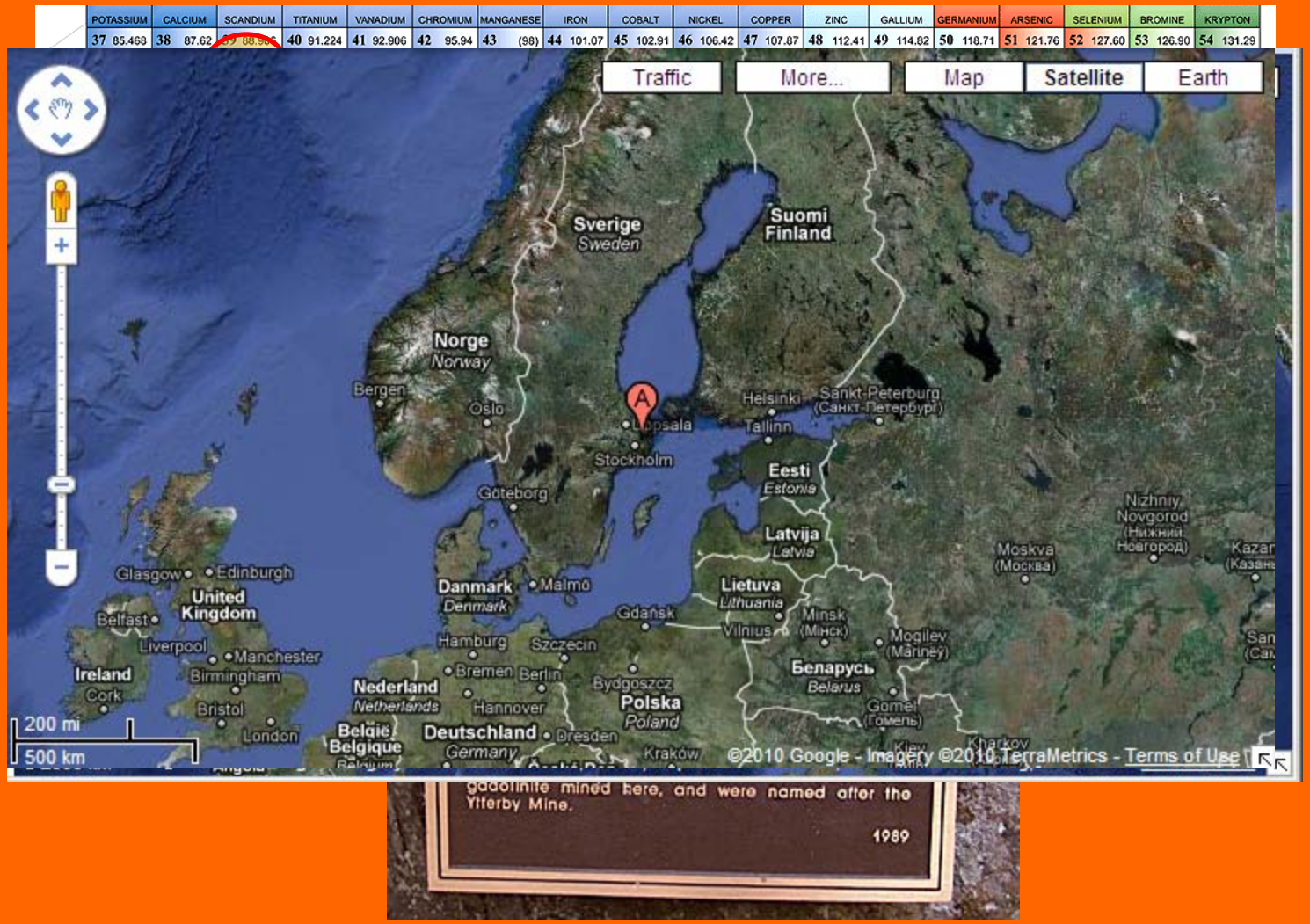
Bunsen burner

http://www.wikipedia.org

SPECTROSCOPY – FLAME TEST

DEMONSTRATION:
Flame Test

SPECTROSCOPY – RARE EARTHS



RARE EARTH

Are not really RARE

Exist in high concentrations in the earth's crust

Difficult to mine

VERY IMPORTANT APPLICATIONS
Neodymium; Samarium: POWERFUL MAGNETS (ELECTRONICS, COMPUTERS, MOTORS/GENERATORS), LASERS
Yttrium: MICROWAVE RESONATORS
PHOSPHORS for TV SCREENS, SUPERCONDUCTORS

Today, CHINA produces 95% of all RARE EARTH MINERALS

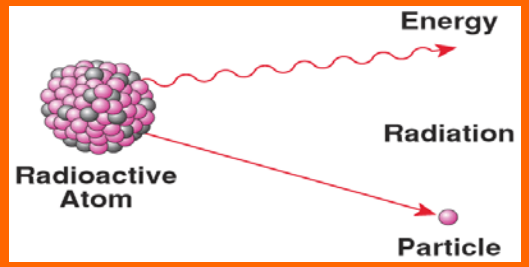
RARE EARTH MAGNETS

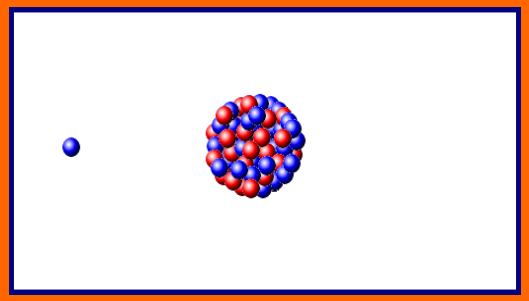
Demonstration

Magnetic Braking

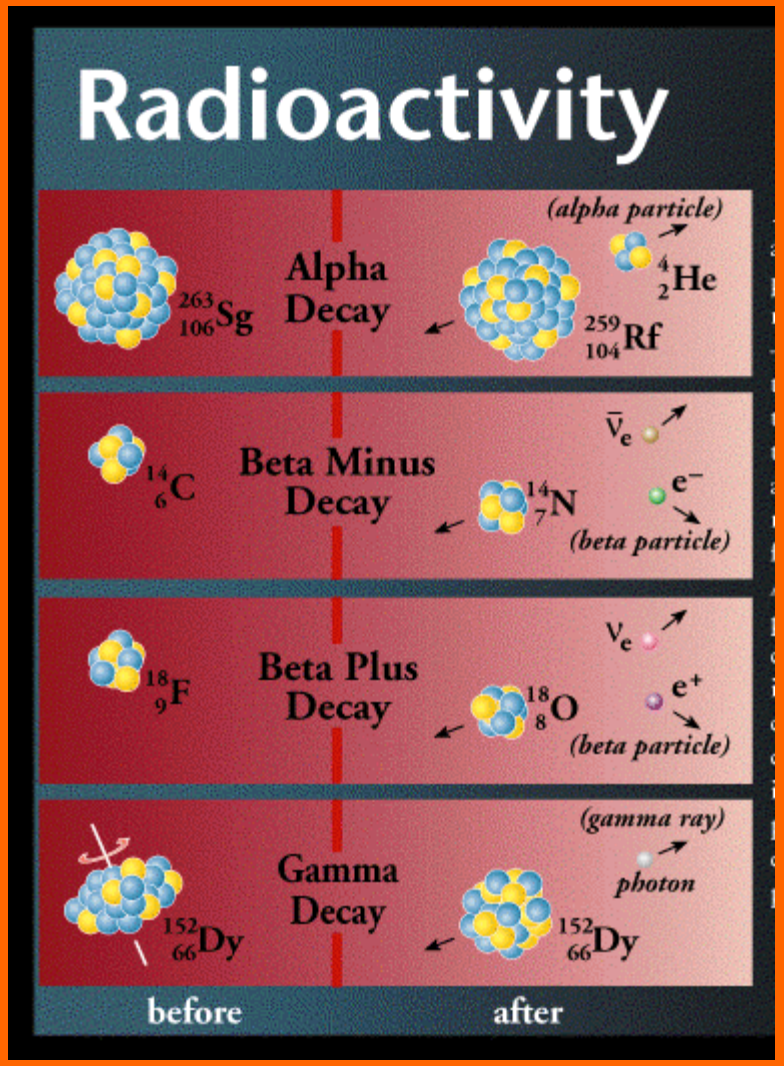
NATURAL RADIOACTIVITY

Unstable nuclei emit light or particles (like alpha particles, electrons) and rearrange to form a less excited state



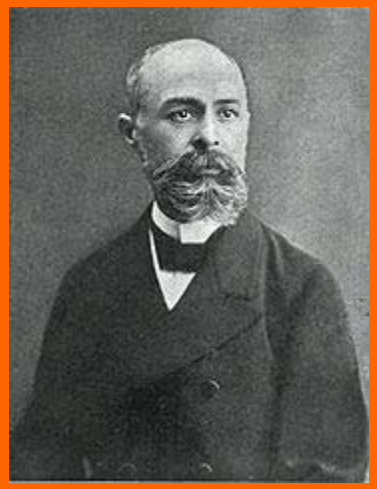


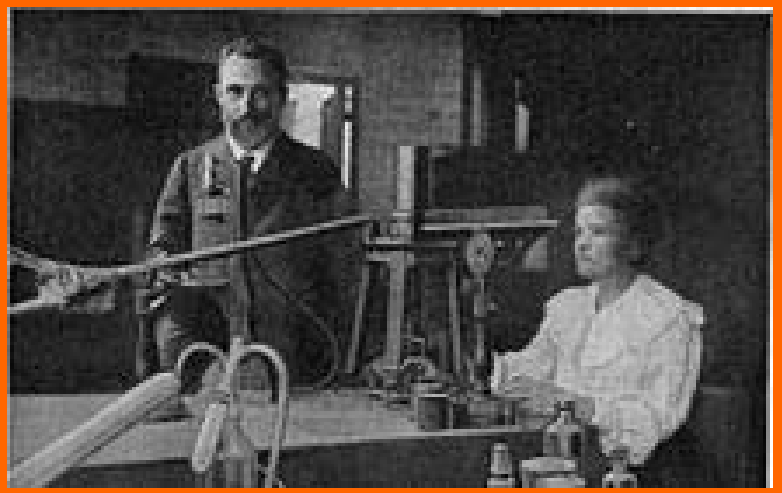
Fission/ Fissile break up is the basis of nuclear power/weapons



http://www2.egat.co.th/ned/
http://laplace.physics.ubc.ca

MARIE CURIE





Nobel Prize in Physics – 1903
Becquerel, Pierre and Marie Curie

Research on “radiation phenomena”

Nobel Prize in Chemistry – 1911 (IYC:2011 in honour of this)
Discovery of radium and polonium

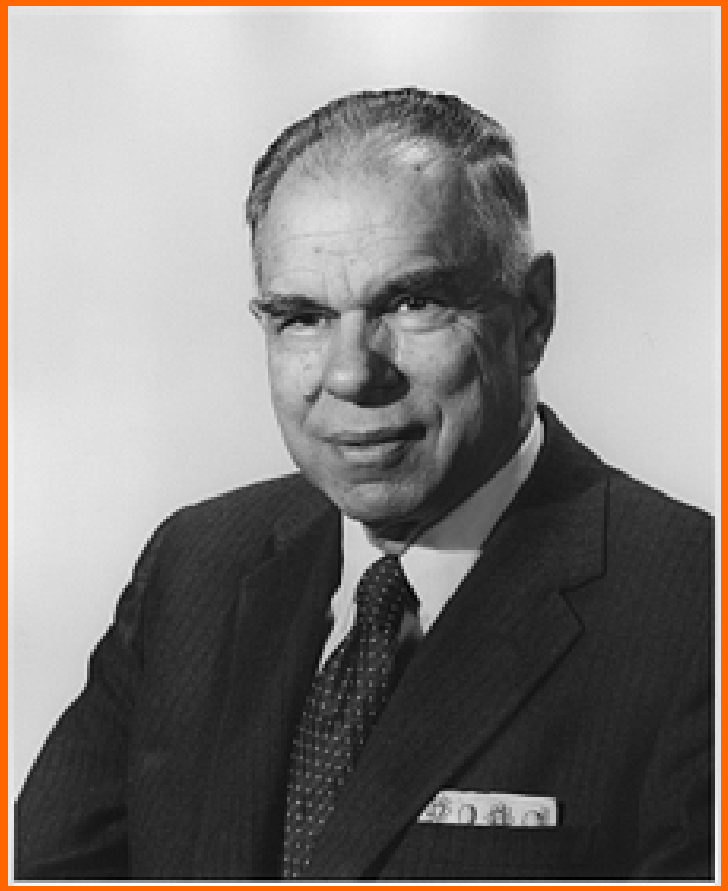
Could not find a position at Krakow University in Poland
Did not get elected to the French Academy of Sciences

Marie Curie grew up poor, but was well educated. Her father was a teacher of mathematics and physics in Poland.

http://www.wikipedia.org

ARTIFICIALLY-MADE ELEMENTS

Discovered /MADE 10 new elements
1951 Nobel Prize in Chemistry



Glenn T. Seaborg, USA

http://www.wikipedia.org

THE LATEST ELEMENT: 117

RESOURCES

http://en.wikipedia.org/wiki/Timeline_of_chemical_elements_discoveries
http://chemistry.about.com/od/elementfacts/a/timeline-element-discovery.htm
http://*education.jlab.org/qa/discover_ele.html*
http://www.rsc.org/education/teachers/learnnet/periodictable/pre16/discover.doc
http://elements.vanderkrogt.net/
http://www.webelements.com/
http://en.wikipedia.org/wiki/Periodic_table
http://www.rsc.org/chemsoc/visualelements/pages/pertable_fla.htm
http://www.chemheritage.org/
http://www.aip.org/history/curie/periodic.htm
VIDEOS from: http://www.youtube.com and http://arvindguptatoys.com
117 video from the Livermore Lab, taken from www.youtube.com

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