
Hydrogen to Copernicium: Postage Stamps as Cultural Icons in the IYC

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Once upon a time...

- Until the 1830's, letters were paid by the recipient not the sender.



- Sir Rowland Hill, an English teacher, inventor, and social reformer (1795-1879), introduced postage stamps in 1840.

Philately



Penny Black
1840

- From the Greek *phil-* “love” and *ateleia* “exempt from tax”.
- The collecting and study of postage stamps and other postal matter as a hobby or an investment.

and some are issued for a reason...

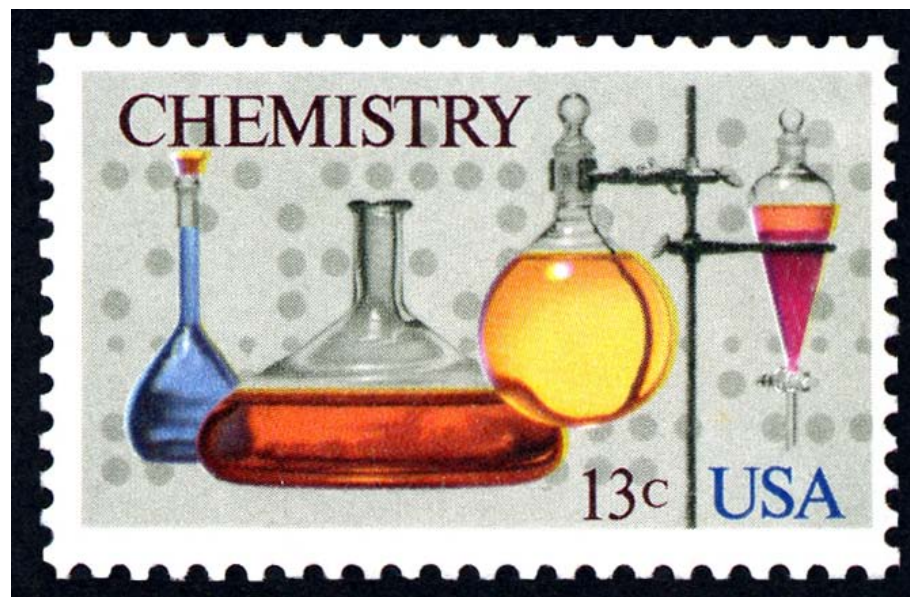
- Many stamps have been issued to commemorate events and educate the public: history, art, literature, *science*...



- Attractive way to illustrate oral presentations, papers, etc.
- Inexpensive and effective teaching tools!

Chemistry on Stamps

- *Chemophilately (chemical philately)*: the philatelic study of chemistry (Rappoport, Z. *Acc. Chem. Res.* **1992**, 25, 24-31).



Heilbronner, E.; Miller, F.A. *A Philatelic Ramble through Chemistry*; Wiley-VCH, 1998.

The Tree of Science



Once upon a time...

The Four Classical Elements in Greece



air

fire

water

earth

air

fire



earth

water



air



fire



earth



water

Democritus (460-370 BC)

Matter is made up of extremely small, indivisible particles: “atoms”.



Alchemy in the Middle Ages

Avicenna



Avicenna



Rhazes



Paracelsus

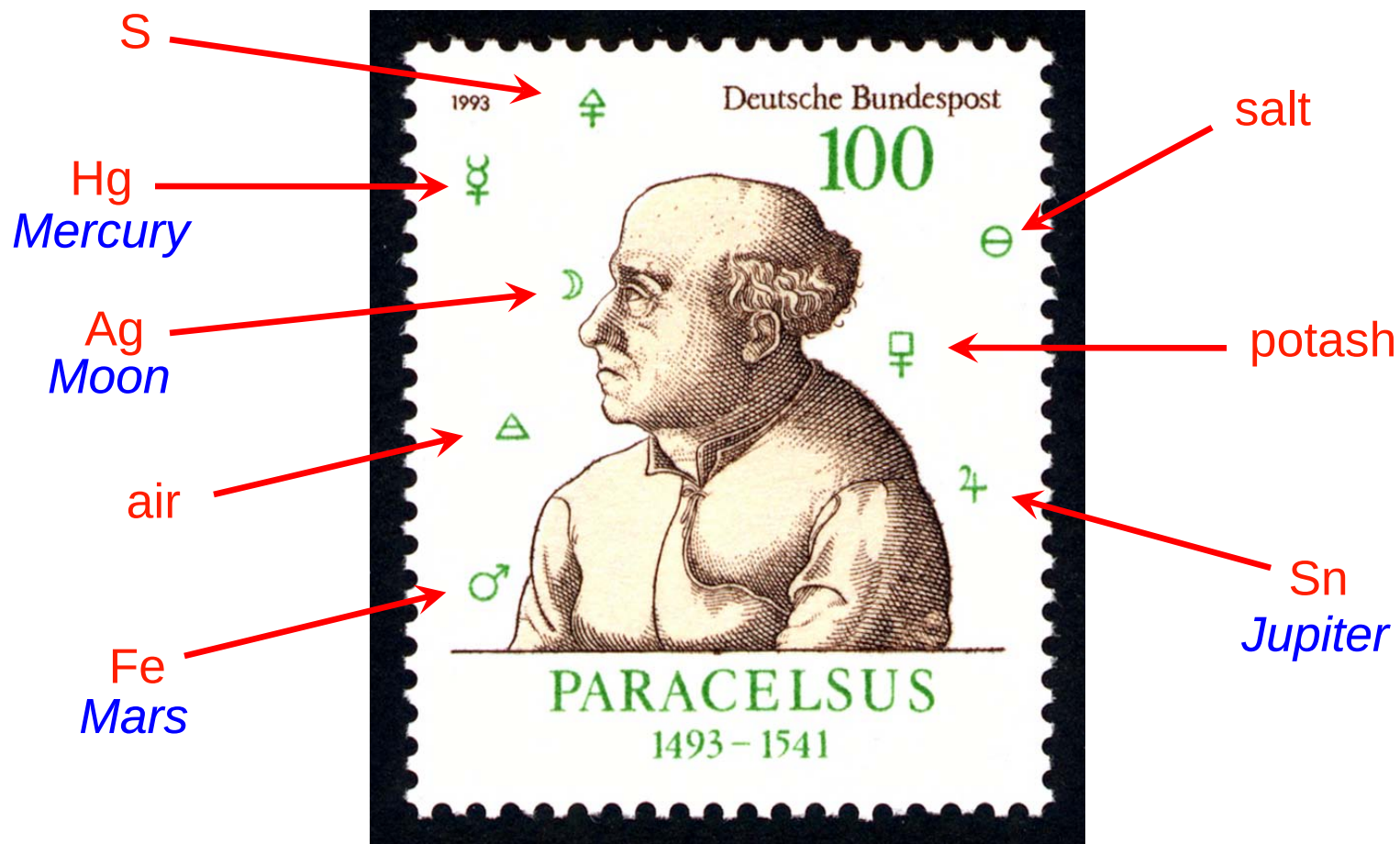


Agricola

Theophrastus Philippus Aureolus Bombastus von Hohenheim

Paracelsus

(1493-1541)



Robert Boyle (1627-1691)



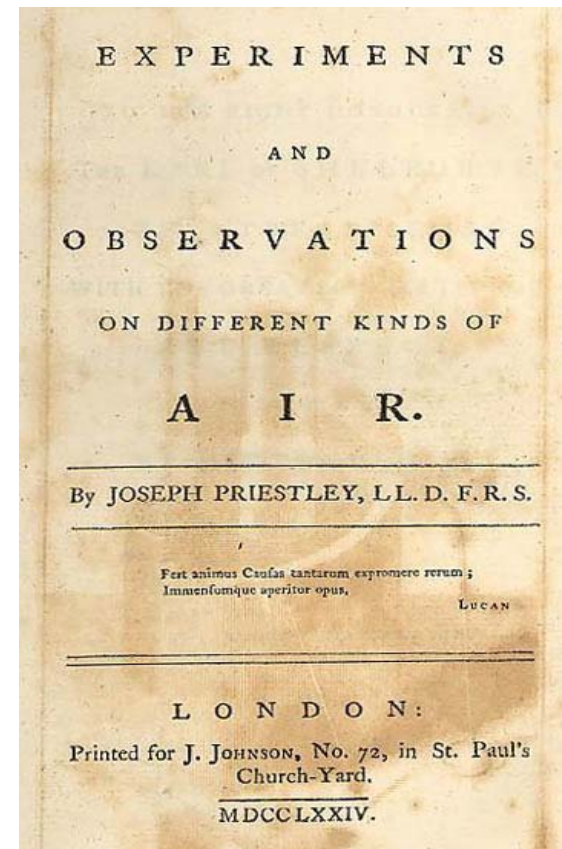
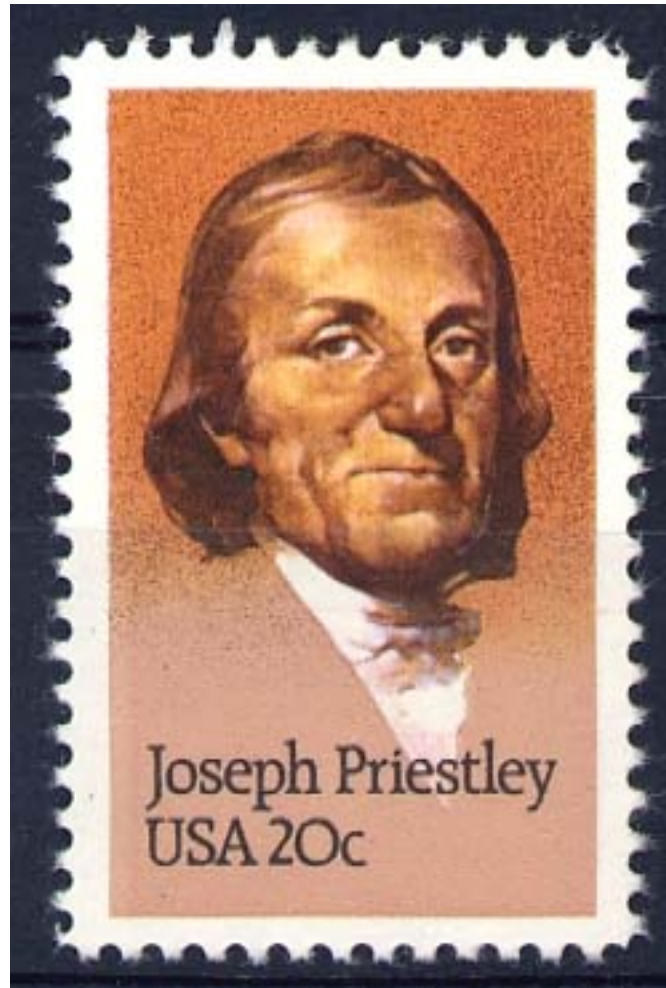
Issued on February 25, 2010: 350th anniversary of the Royal Society.

Antoine Lavoisier (1743-1794)

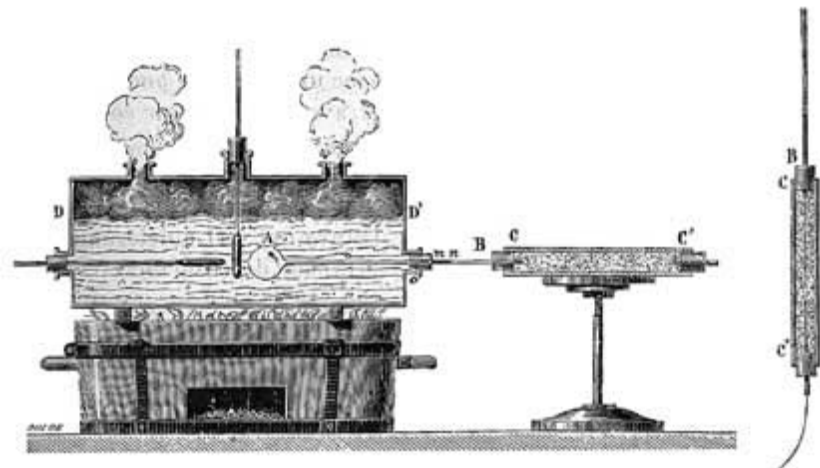
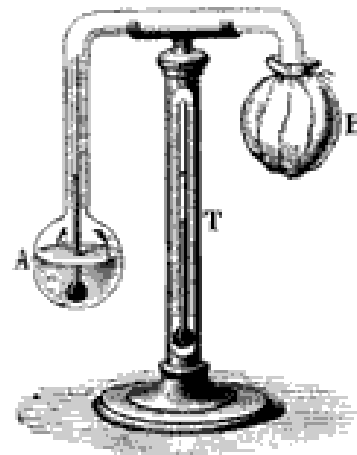


maximum card

Joseph Priestley (1733-1804)



Joseph Louis Gay-Lussac (1778-1850)



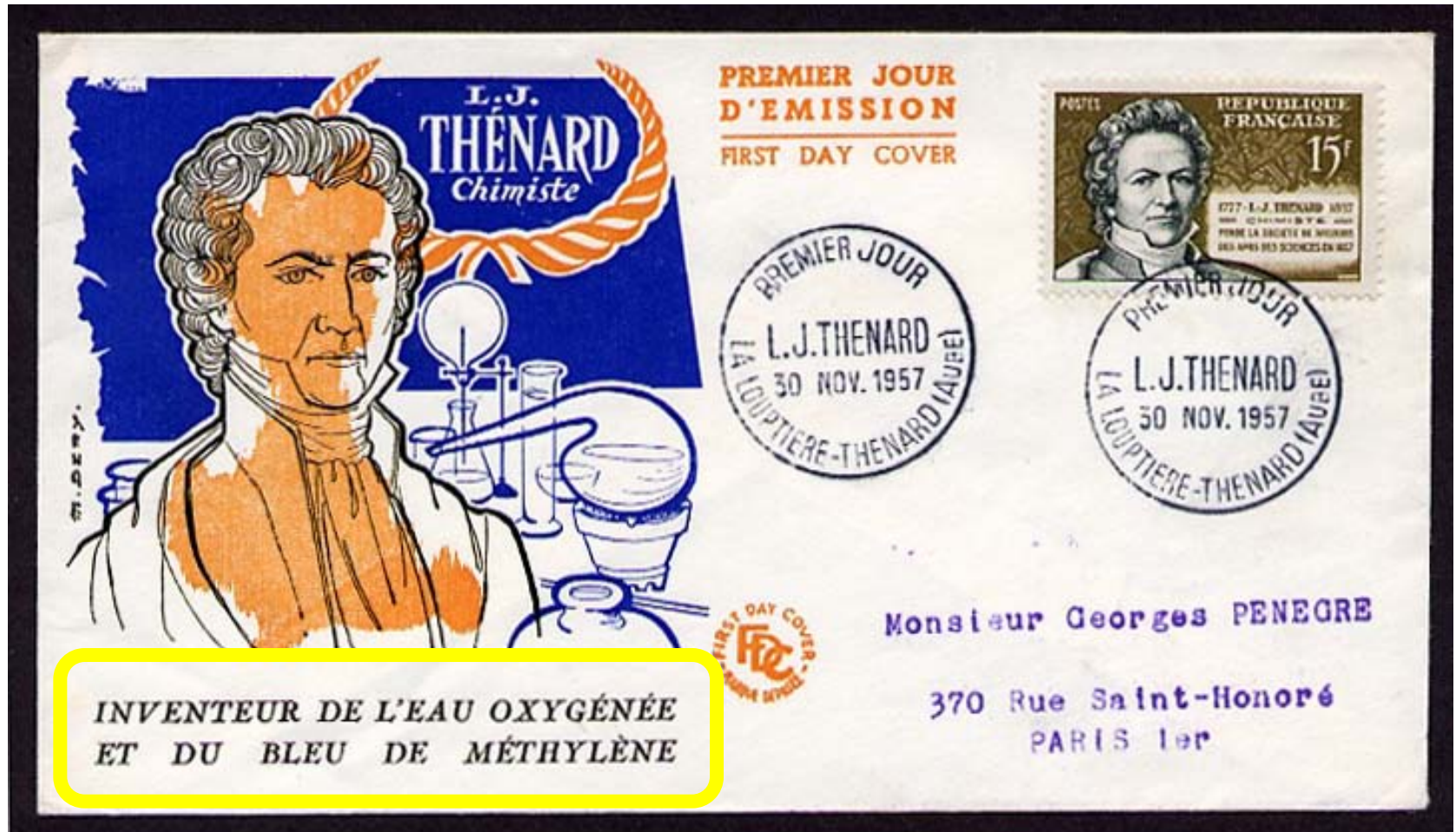
*Lorenzo Romano Amedeo Avogadro di Quaregna e Cerreto
(1776-1856)*



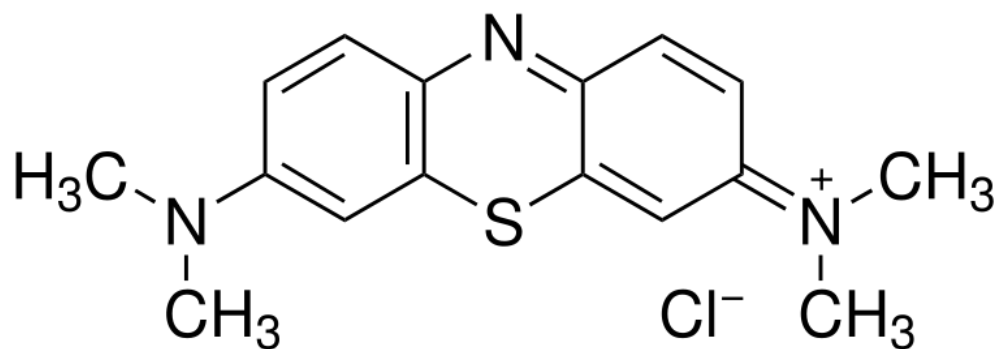
Avogadro's Law: "equal volumes of gases, at the same temperature and pressure, contain the same number of molecules".

$$N_A = 6.022 \times 10^{23}$$

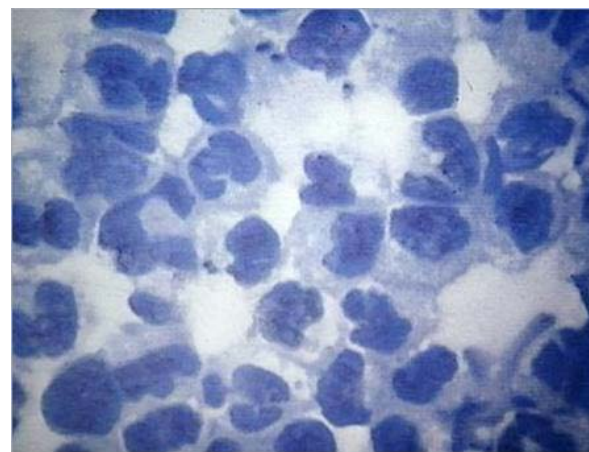
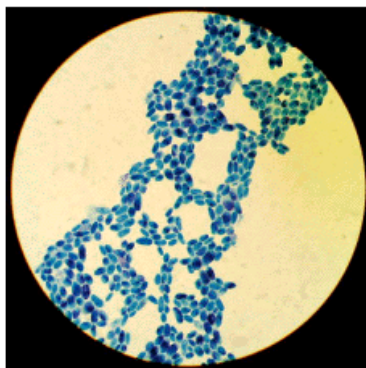
Louis Jacques Thénard (1777-1857)



Methylene Blue

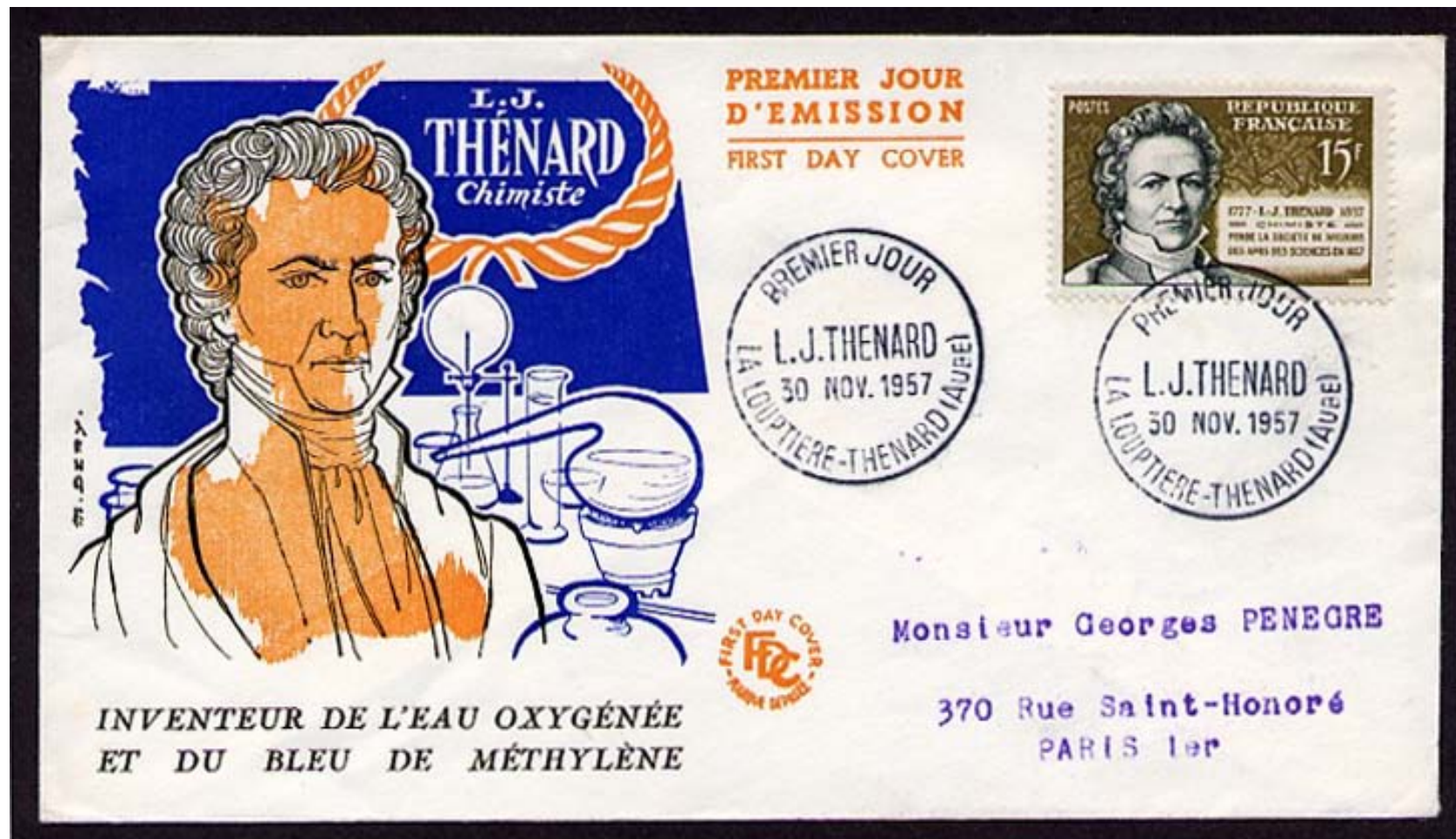


redox indicator



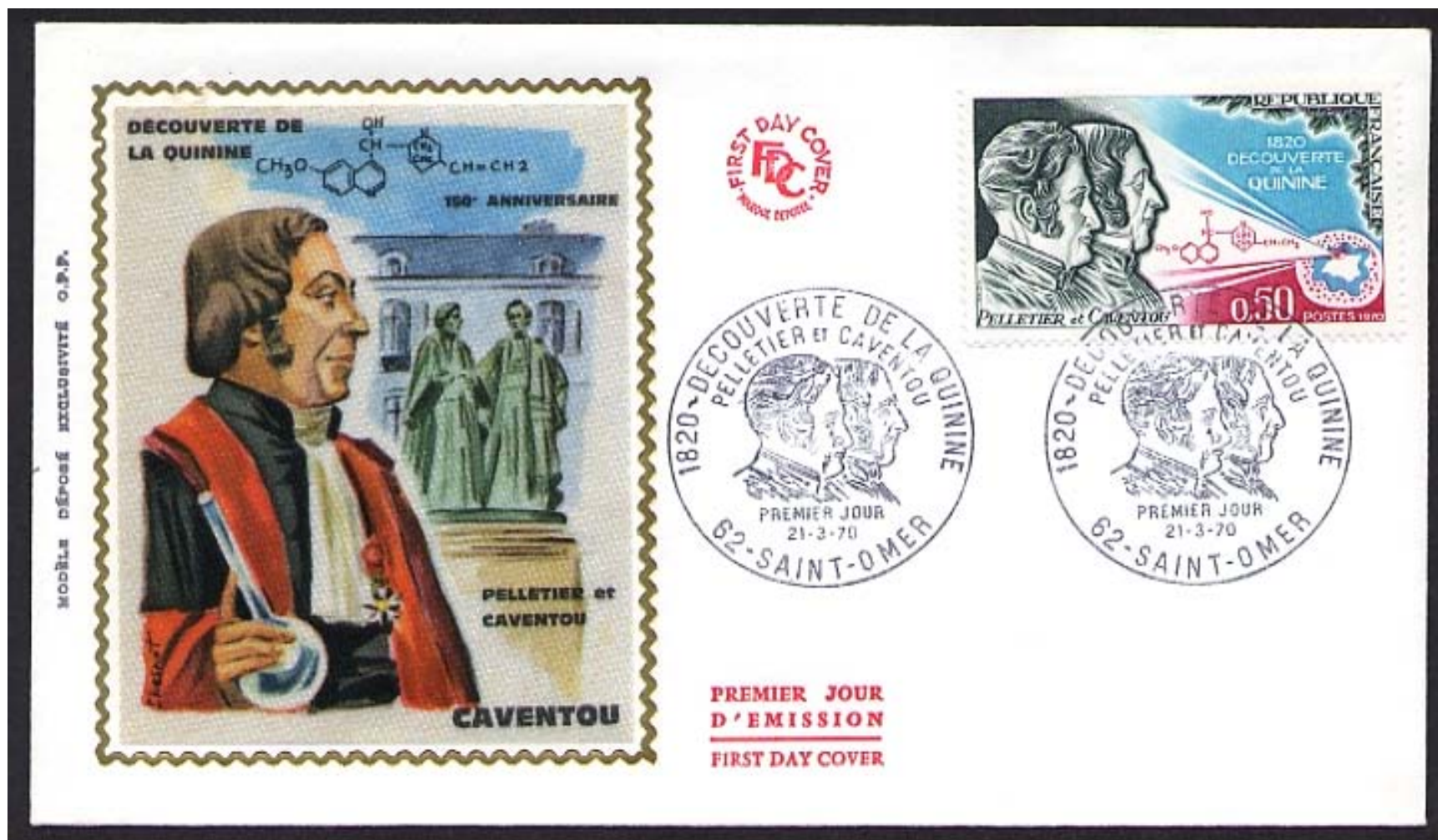
biological stain

Louis Jacques Thénard (1777-1857)



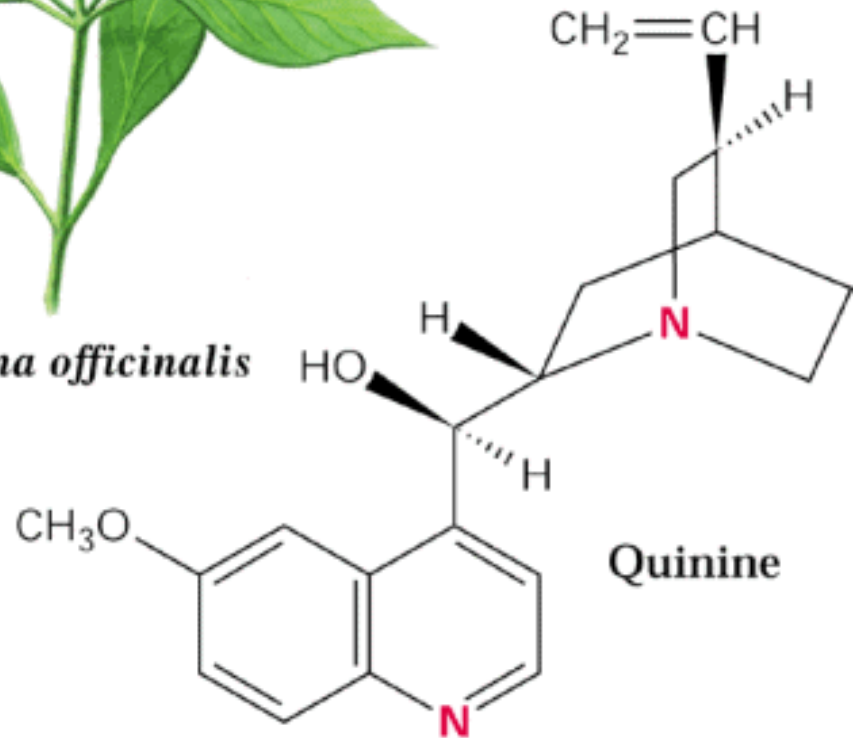
Cobalt blue (Thénard's blue): CoAl_2O_4 ...

Pelletier & Caventou: the discovery of quinine (1820)





Cinchona officinalis



Justus von Liebig (1803-1873)



Major contributions to agricultural, biological and organic chemistry.

Justus von Liebig (1803-1873)

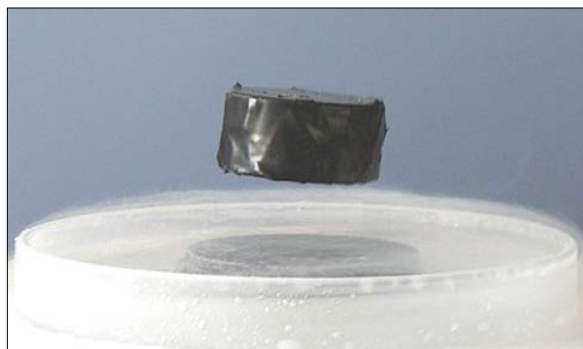


Franz-Joseph Müller von Reichenstein (1740-1825)



- Hungarian mineralogist who discovered tellurium (Te) in 1782.

Johan Gadolin
(1760-1852)



- Founder of Finnish chemistry & discoverer of yttrium (Y) ca. 1794

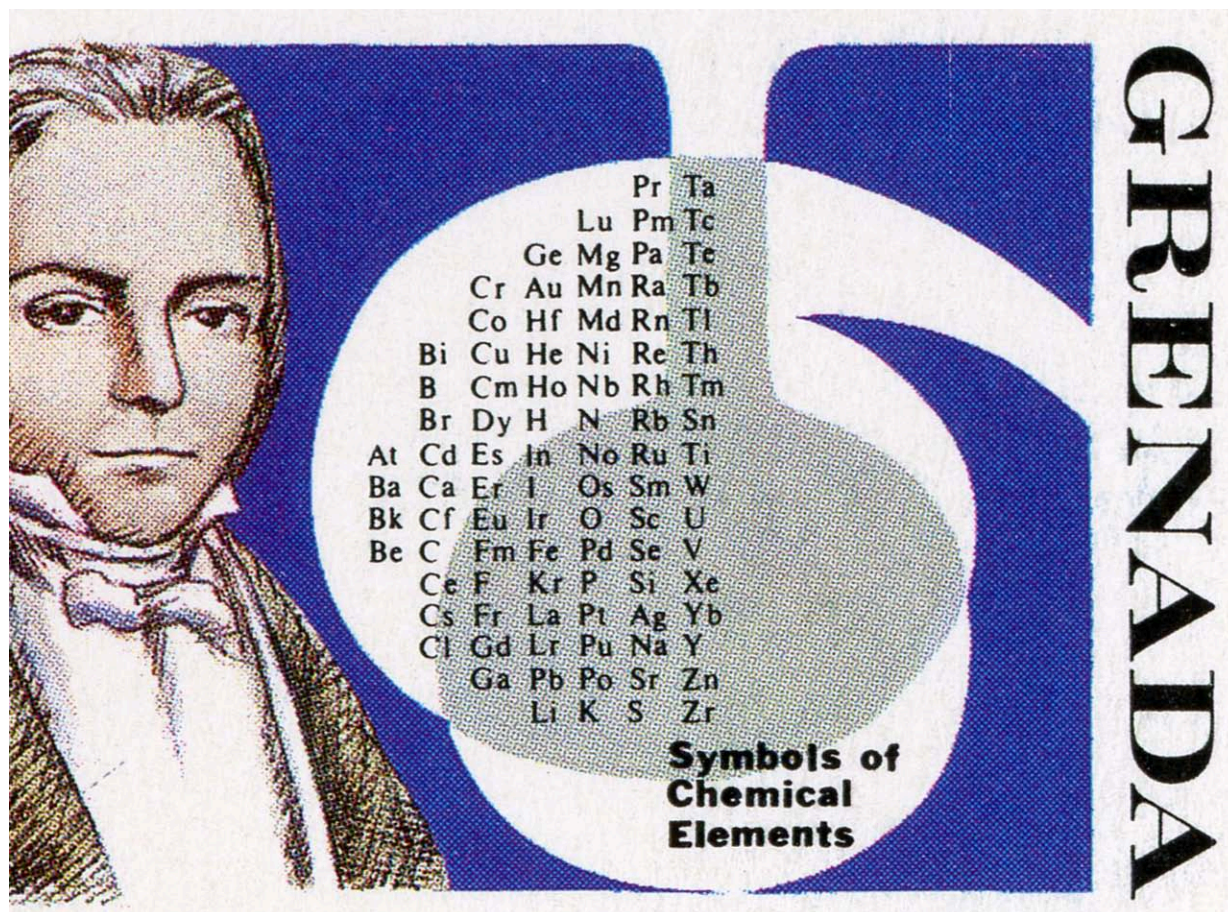
Jöns Jacob Berzelius (1779-1848)

- Developed a system of symbols for the chemical elements.



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Jöns Jacob Berzelius (1779-1848)



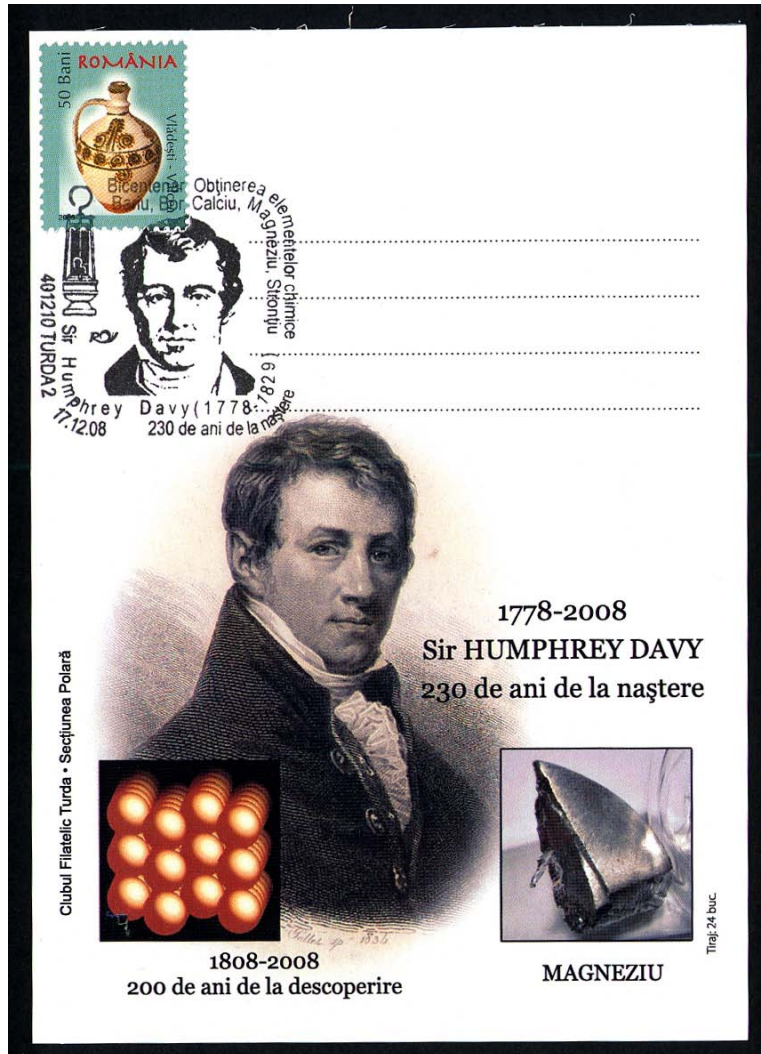
- Coined the terms “catalysis”, “polymer”, “isomer”, and “allotrope”.

Bicentennial of the Karolinska Institute (1810-2010)

- Berzelius also discovered silicon, selenium, thorium, and cerium.



Humphry Davy (1778-1829)



- Discovered Na, K, Mg, Ca & Ba
- Developed miner's lamp



Johann Wolfgang Döbereiner (1780-1849)

Triads, triads everywhere...



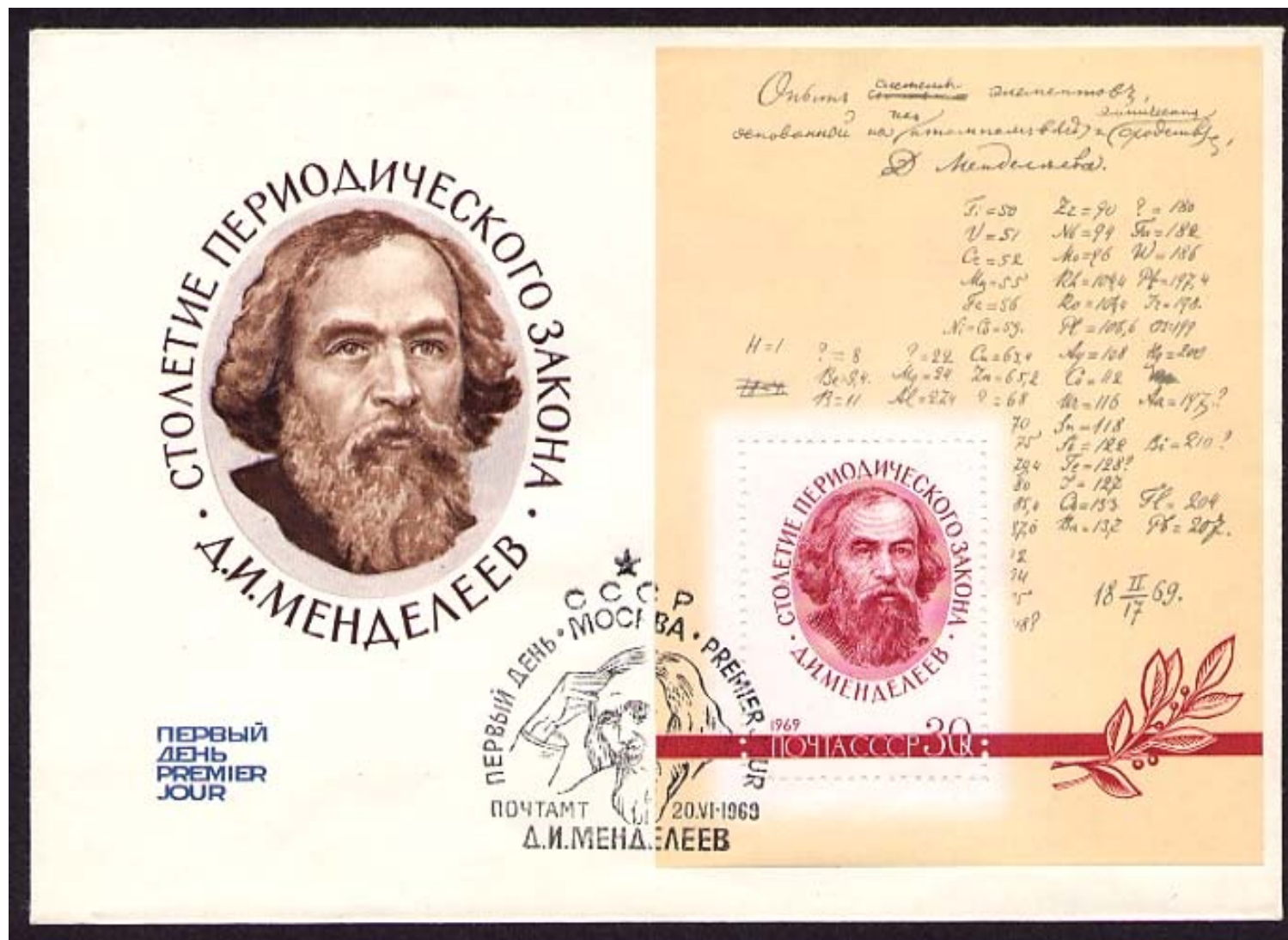
Leopold Gmelin (1788-1853)



Gmelin's "Periodic Table" (1843)

		O		N		H			
F	Cl	Br	I			Li	Na	K	
	S	Se	Te			Mg	Ca	Sr	Ba
	P	As	Sb			Be	Ce	La	
	C	B	Bi			Zr	Th	Al	
		Ti	Ta	W		Sn	Cd	Zn	
			Mo	V	Cr	U	Mn	Ni	Fe
				Bi	Pb	Ag	Hg	Cu	
			Os	Ir	Rh	Pt	Pd	Au	

Dmitri Mendeleev (1834-1907) and the Periodic Table



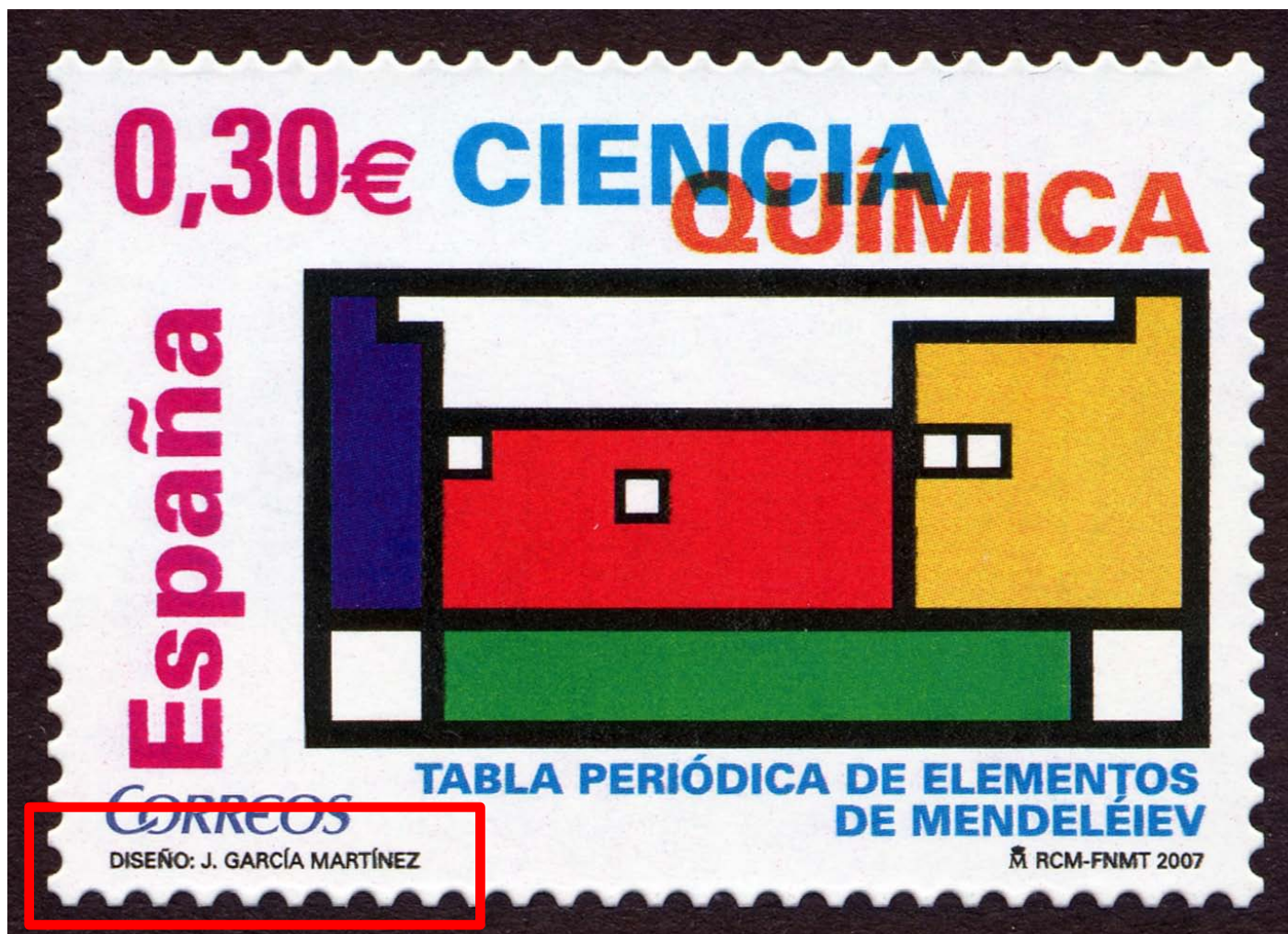
1869 Periodic Table

Ueber die Beziehungen der Eigenschaften zu den Atomgewichten der Elemente. Von D. Mendelejeff. — Ordnet man Elemente nach zunehmenden Atomgewichten in verticale Reihen so, dass die Horizontalreihen analoge Elemente enthalten, wieder nach zunehmendem Atomgewicht geordnet, so erhält man folgende Zusammenstellung, aus der sich einige allgemeinere Folgerungen ableiten lassen.

			Ti = 50	Zr = 90	? = 180
			V = 51	Nb = 94	Ta = 182
			Cr = 52	Mo = 96	W = 186
			Mn = 55	Rh = 104,4	Pt = 197,4
			Fe = 56	Ru = 104,4	Ir = 198
		Ni =	Co = 59	Pd = 106,6	Os = 199
H = 1			Cu = 63,4	Ag = 108	Hg = 200
	Be = 9,4	Mg = 24	Zn = 65,2	Cd = 112	
	B = 11	Al = 27,4	? = 68	Ur = 116	Au = 197?
	C = 12	Si = 28	? = 70	Sn = 118	
	N = 14	P = 31	As = 75	Sb = 122	Bi = 210?
	O = 16	S = 32	Se = 79,4	Te = 128?	
	F = 19	Cl = 35,5	Br = 80	J = 127	
Li = 7	Na = 23	K = 39	Rb = 85,4	Cs = 133	Tl = 204
		Ca = 40	Sr = 87,6	Ba = 137	Pb = 207
		? = 45	Ce = 92		
		?Er = 56	La = 94		
		?Yt = 60	Di = 95		
		?In = 75,6	Th = 118?		

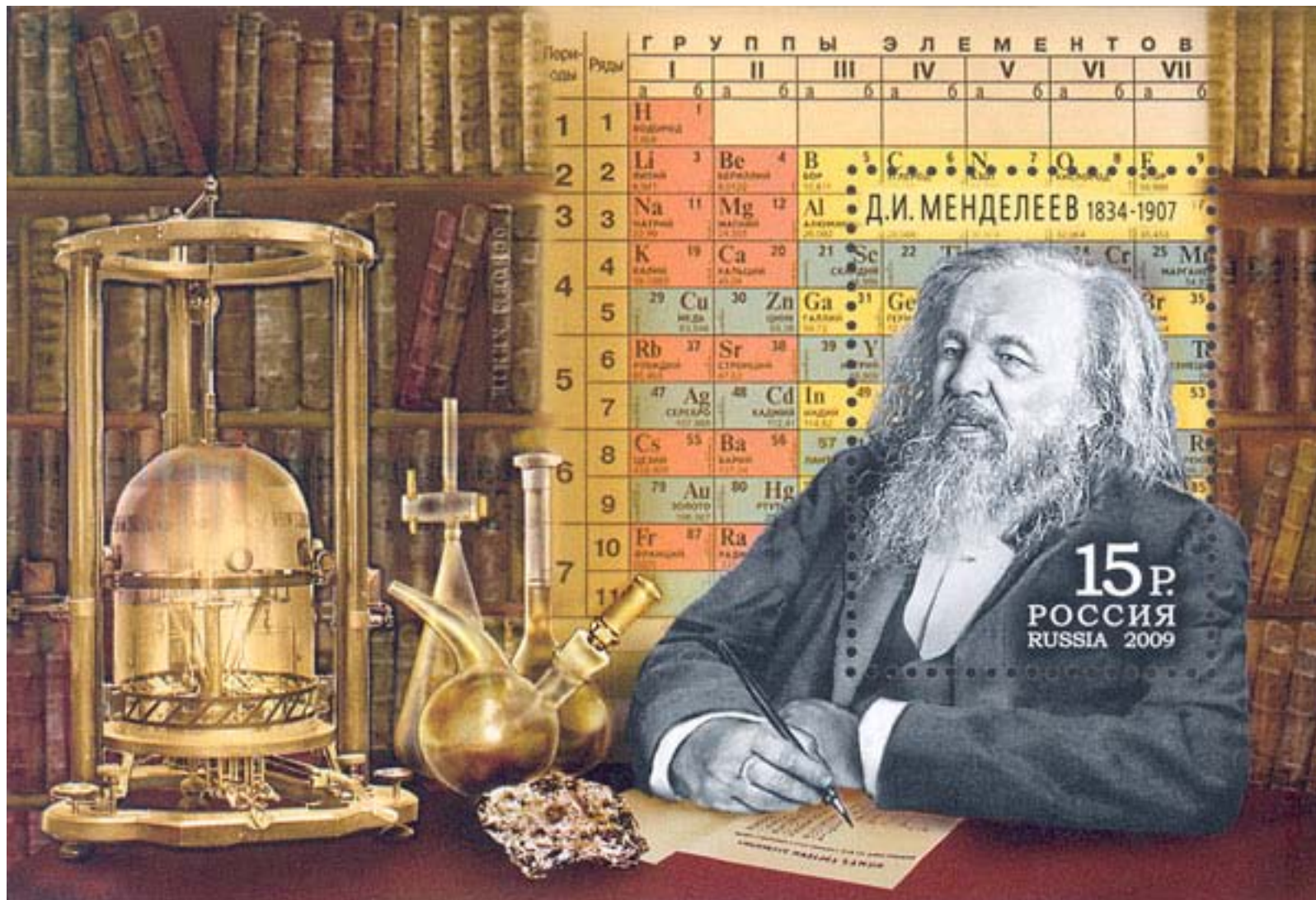
The elements Sc, Ga and Ge were all discovered within a few years...

100th Anniversary of Mendeleev's Death (2007)

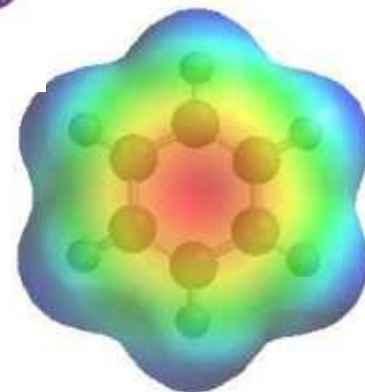
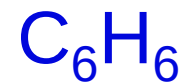
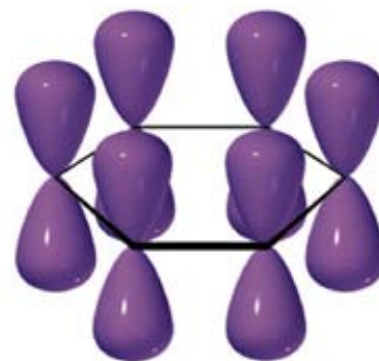
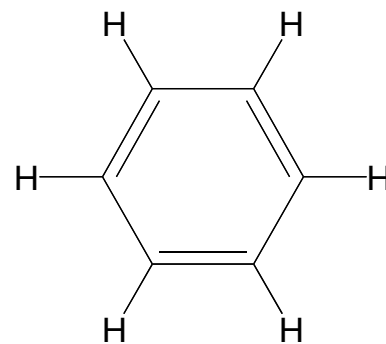


Design: Javier García-Martínez

175th Anniversary of Mendeleev's Birth (February 6, 2009)



Friedrich August Kekulé (1829-1896)

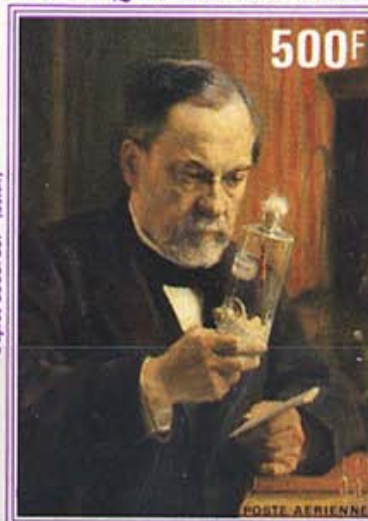


Louis Pasteur (1822-1895)





REPUBLIQUE DU CAMEROUN

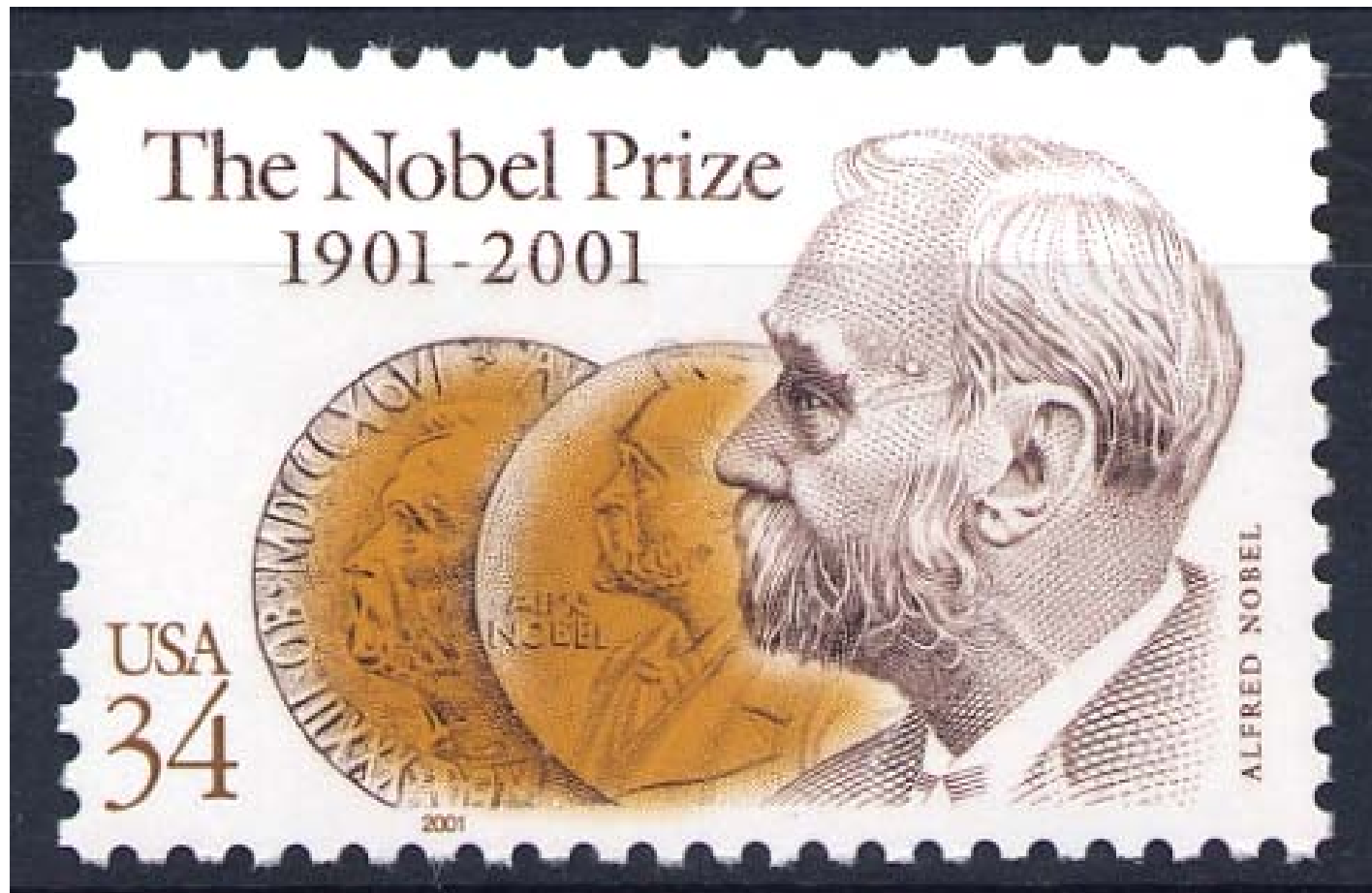


d'après EDELFEIT - (détail)

REPUBLIC OF CAMEROON



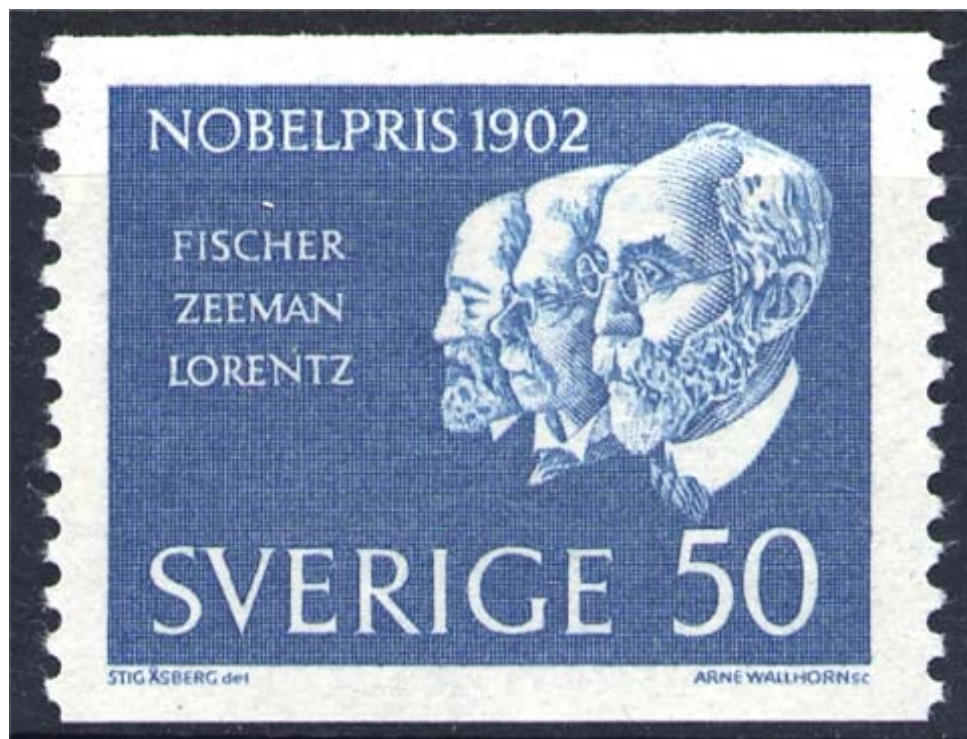
Alfred Nobel (1833-1896)

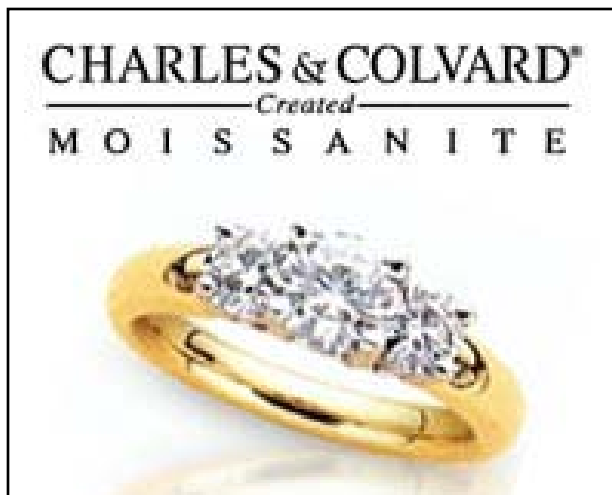




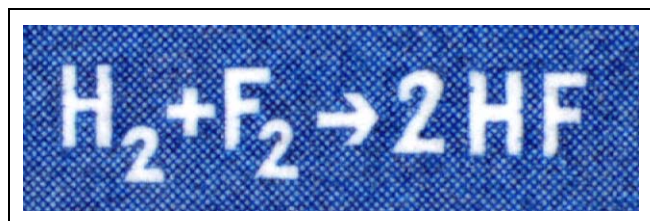
Emil Fischer (1852-1919)

“...for his work on sugar
and purine syntheses”





Henri Moissan (1852-1907)



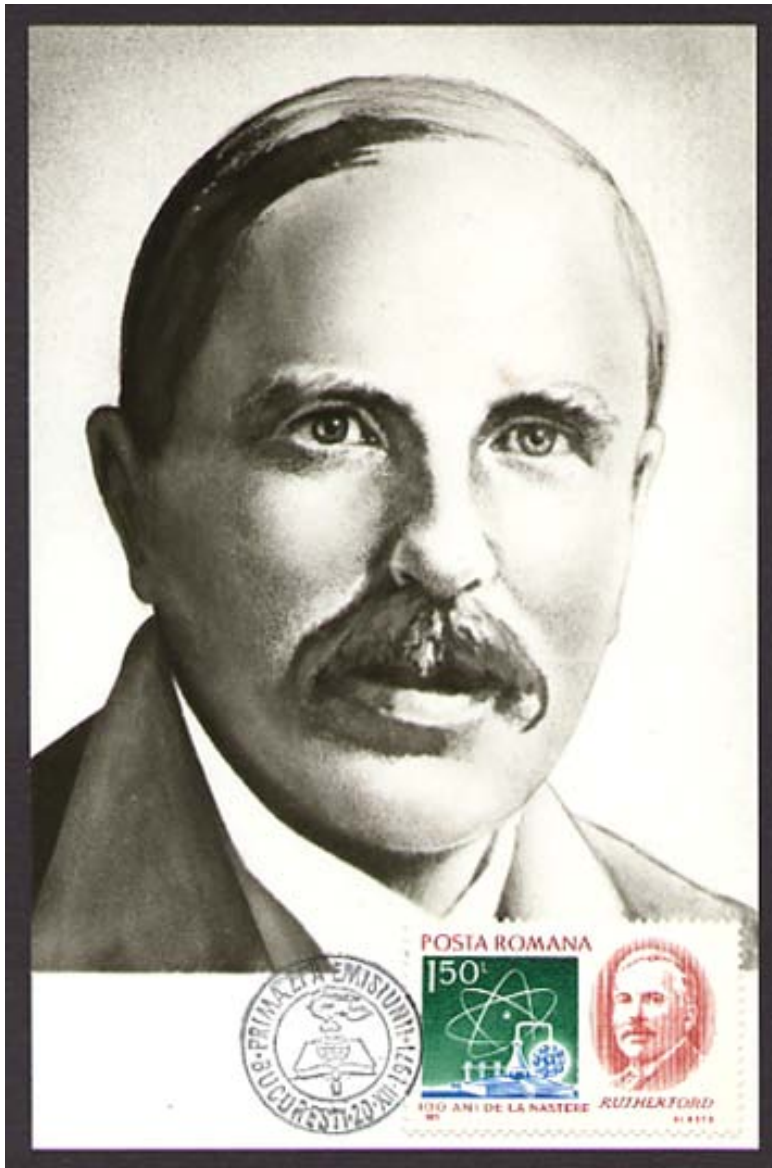
“...for his... isolation of the element fluorine... and his work on the electric furnace named after him”

Ernest Rutherford (1871-1937)



(Chemistry, 1908)

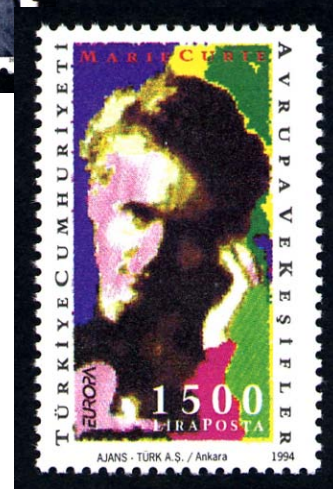
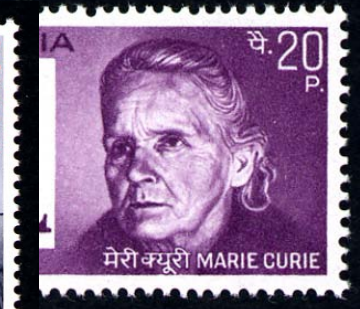
“The only science is physics.
All the rest is stamp collecting.”



Marie Curie (1867-1934)



[Physics, 1903 & Chemistry, 1911]



Marie *and* Pierre Curie



Irène and Frédéric Joliot-Curie



Nobel Prize in Chemistry (1935)

“for their synthesis of new radioactive elements”

IRÈNE ET FRÉDÉRIC JOLIOT-CURIE



*Stylus
J. Langevin*

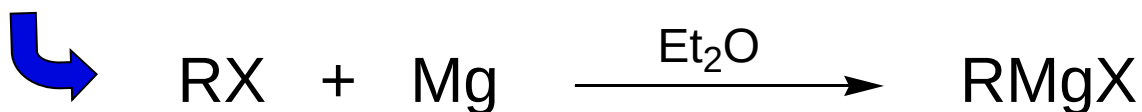
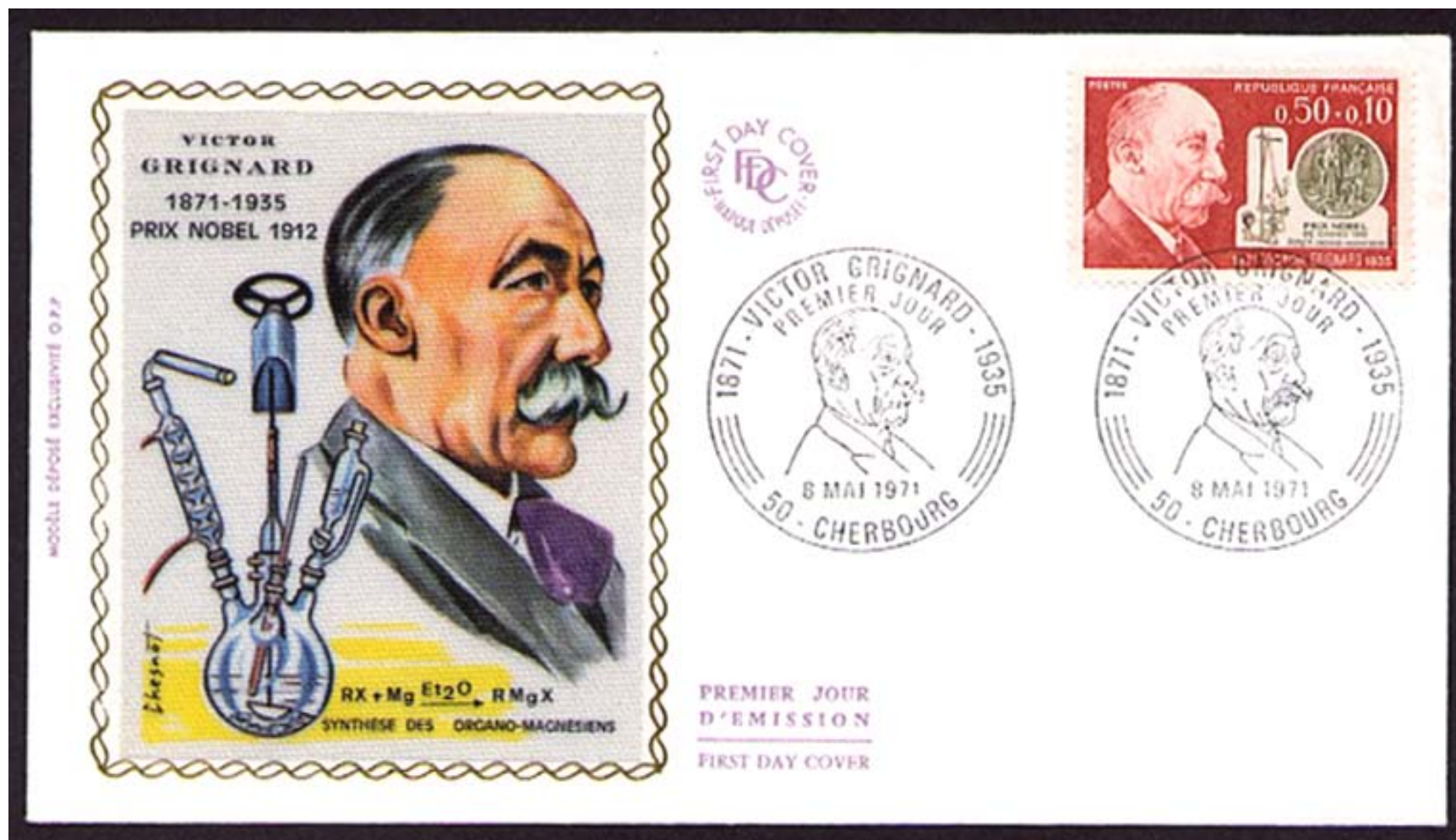


Pierre Joliot
(1932–)

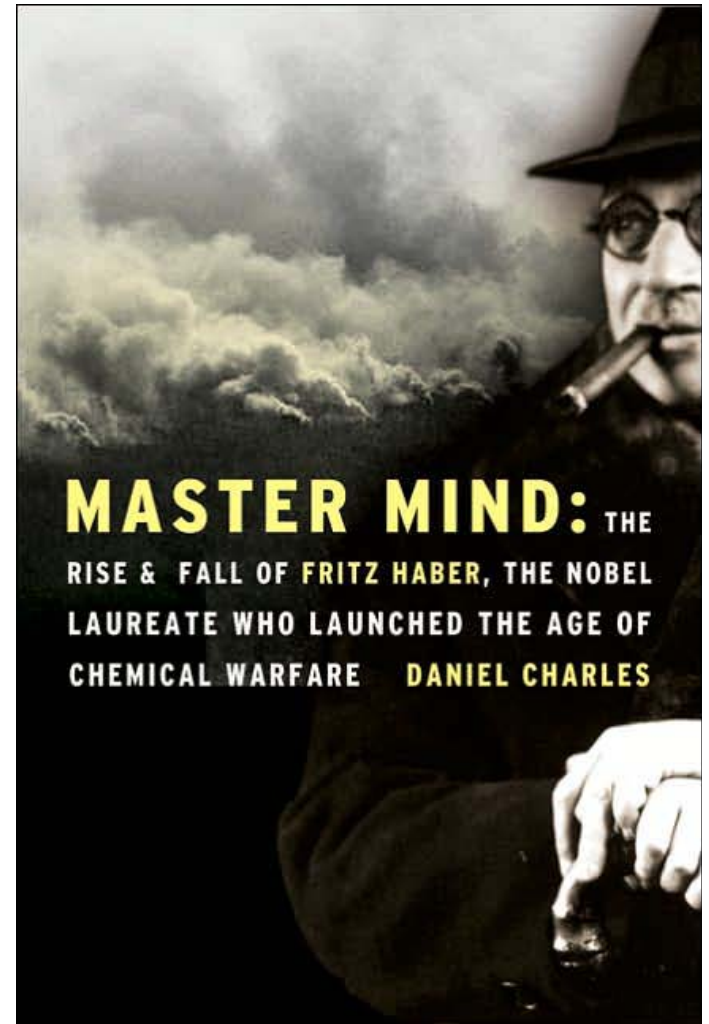


Hélène Langevin-Joliot
(1927–)

Victor Grignard (1871-1935)



Fritz Haber (1868-1934)



Otto Hahn (1868-1934)



Chemistry (1944): discovery of nuclear fission

Lise Meitner (1878-1968)



Karl Ziegler (1898-1973) & Giulio Natta (1903-1979)



Dorothy Crowfoot Hodgkin (1910-1994)

Chemistry Nobel '64



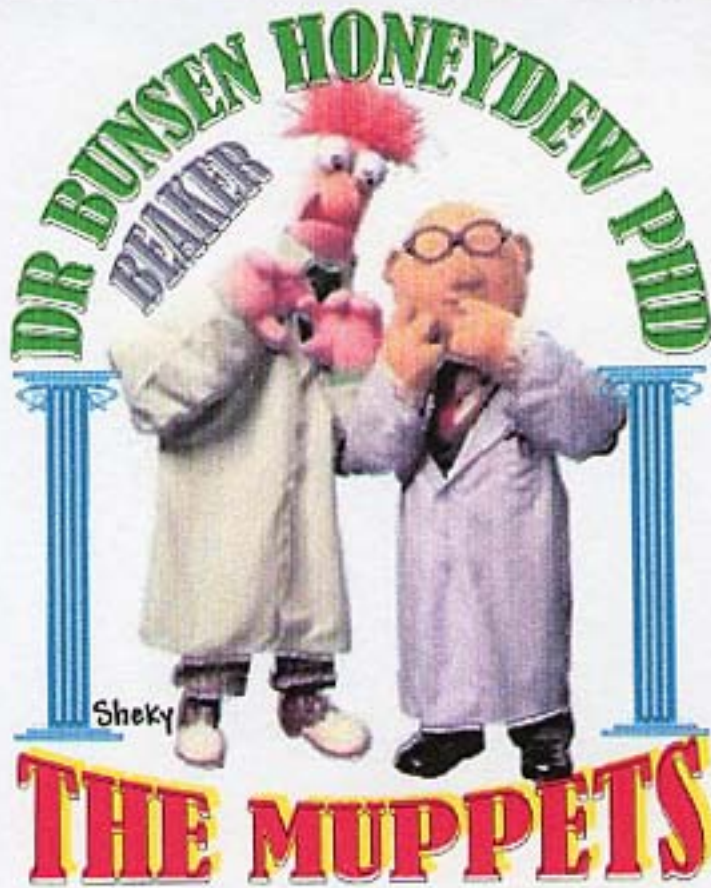
Issued on 25 February 2010: 350th anniversary of the Royal Society.

Mario J. Molina (1943–)



1995 Nobel Prize in Chemistry “for his work in atmospheric chemistry, particularly the formation and decomposition of ozone”

Dr. Bunsen Honeydew and Beaker



JIM HENSON & THE MUPPETS
FIRST DAY OF ISSUE

SEPT 28, 2005 • NORTH HOLLYWOOD, CA 91615

Atoms, molecules, minerals...

Atoms & Nuclear Energy



BUREAU INTERNATIONAL DES POIDS ET MESURES FRANCE

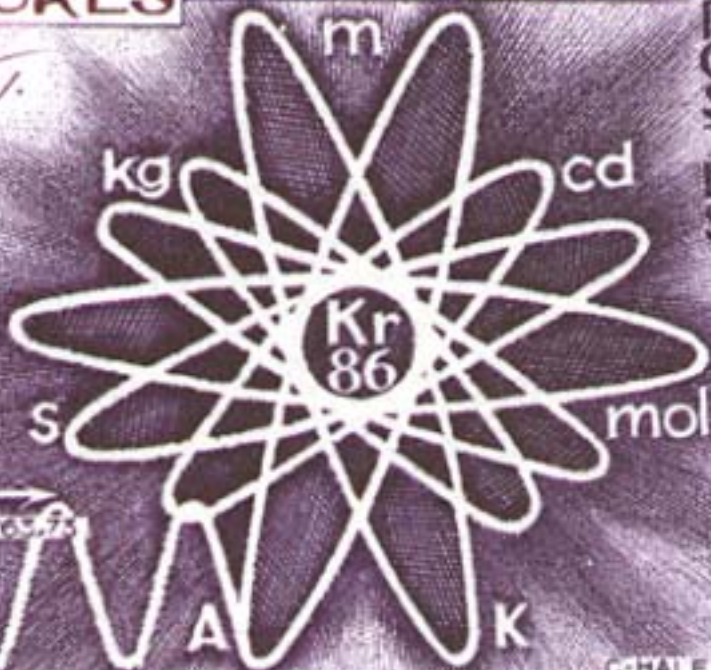
Fait à Paris le 20 Mai 1875.



*Hecard
C. de la Harpe
Mamag*

Wohlenbutz

100

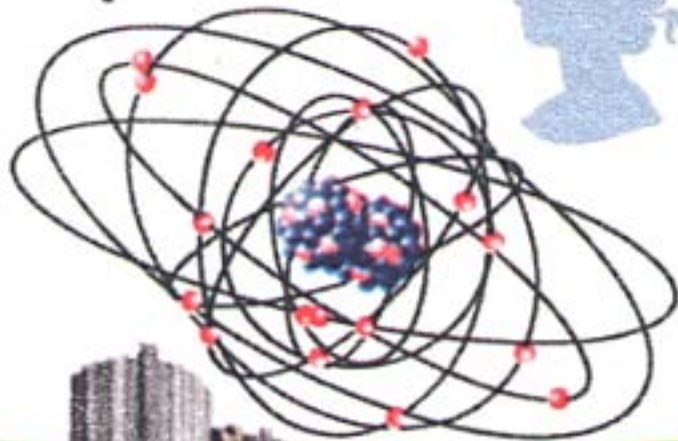


GAUTHIER

CHALEY

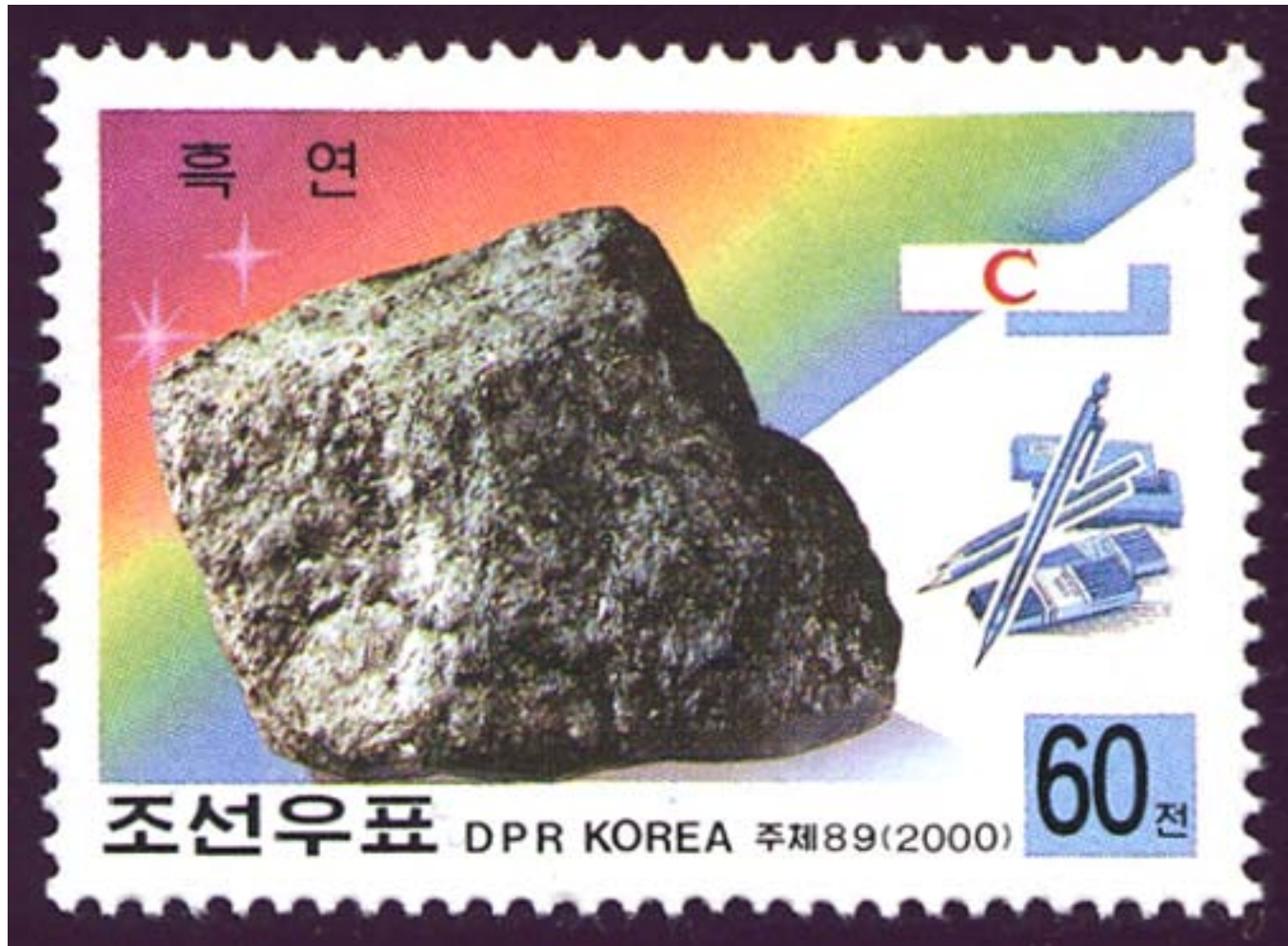
1875 ~ CONVENTION DU METRE ~ 1975

13p



ELECTRICITY

Elements & Minerals





2nd



CHEMISTRY

Nobel Prize 100th Anniversary

Tristan Da Cunha



SULPHUR

10p

SLOVENIJA



Cinabarit Idrija

80

Hg

M. UČAKAR - M. UDOVČ

1999

DELO - TISKARNA



1975
CORREOS



NIQUEL

CUBA MINERALES CUBANOS **3**

C A N A D A

GOLD/OR
Au



4 2

ZAÏRE

2K



MALACHITE

1983

COURVOISIER

ZAÏRE

6Z



DIOPTASE

1983

COURVOISIER

ZAÏRE

8Z



CUPRITE

1983

COURVOISIER

ZAÏRE

1.50Z



BOURNONITE

1983

COURVOISIER

ZAÏRE

45K



QUARTZ

1983

COURVOISIER

ZAÏRE

1Z



URANIUM ET PEBBLEND

1983

COURVOISIER

ZAÏRE

3Z



CASSITERITE

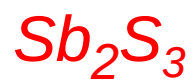
1983

COURVOISIER

stibnite

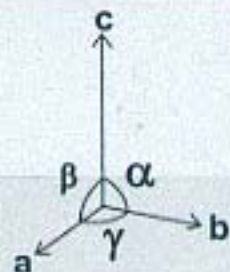
cinnabar

wolframite



PERÚ

S/. 1⁸⁰



$$a = b \neq c$$
$$\alpha = \beta = \gamma = 90^\circ$$

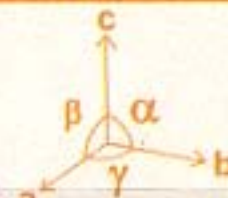
CALCOPIRITA

2001

CuFeS_2

PERÚ

S/. 3²⁰



$$a = b = c$$
$$\alpha = \beta = \gamma = 90^\circ$$

ESFALERITA

2001

ZnS

PERU

S/. 2⁷⁰



$$a = b = c$$
$$\alpha = \beta = \gamma = 90^\circ$$

GALENA

H. V.

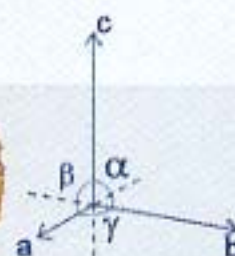
1999

THOMAS GREG & SONS

PbS

PERU

S/. 3³⁰



$$a = b \neq c$$
$$\alpha = \beta = \gamma = 90^\circ$$

SCHEELITA

H. V.

1999

THOMAS GREG & SONS

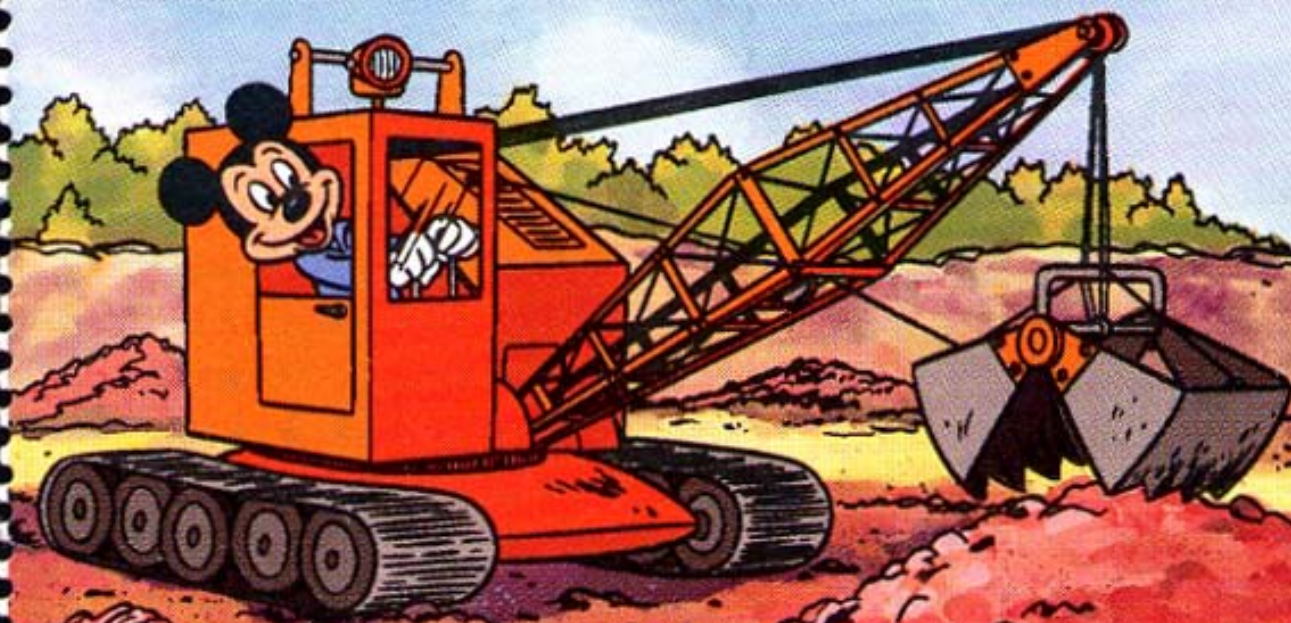
CaWO_4

Aluminum and Bauxite on Stamps...



SIERRA LEONE

Le 16



© DISNEY

MICKEY MINING BAUXITE

Chemical Symbols & Formulas

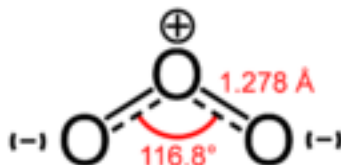
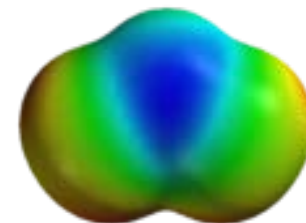


*International Union of Pure and Applied Chemistry
20th Congress: Moscow, 1965*



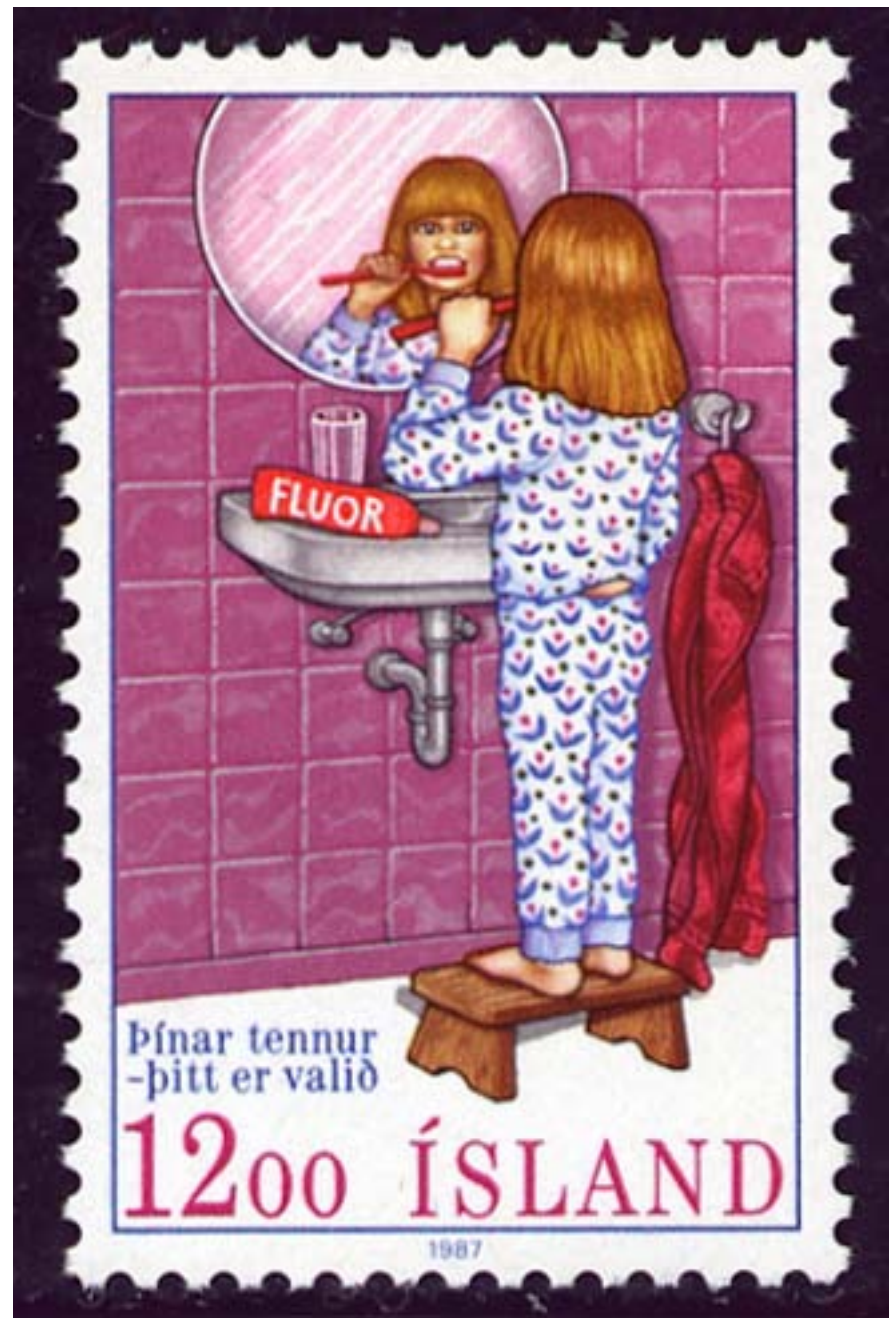


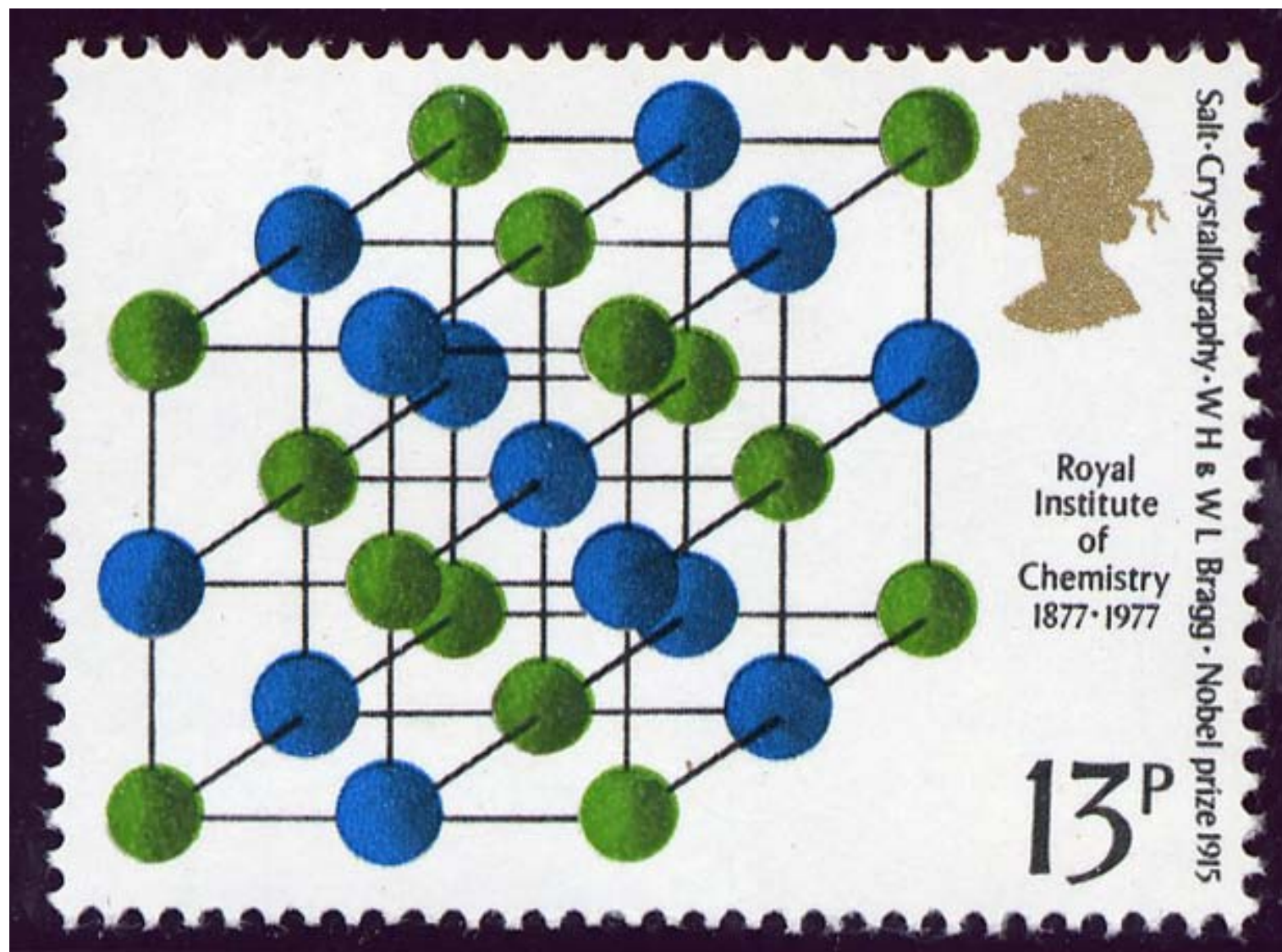
Ozone, O_3



C. F. Schönbein (1799-1868)

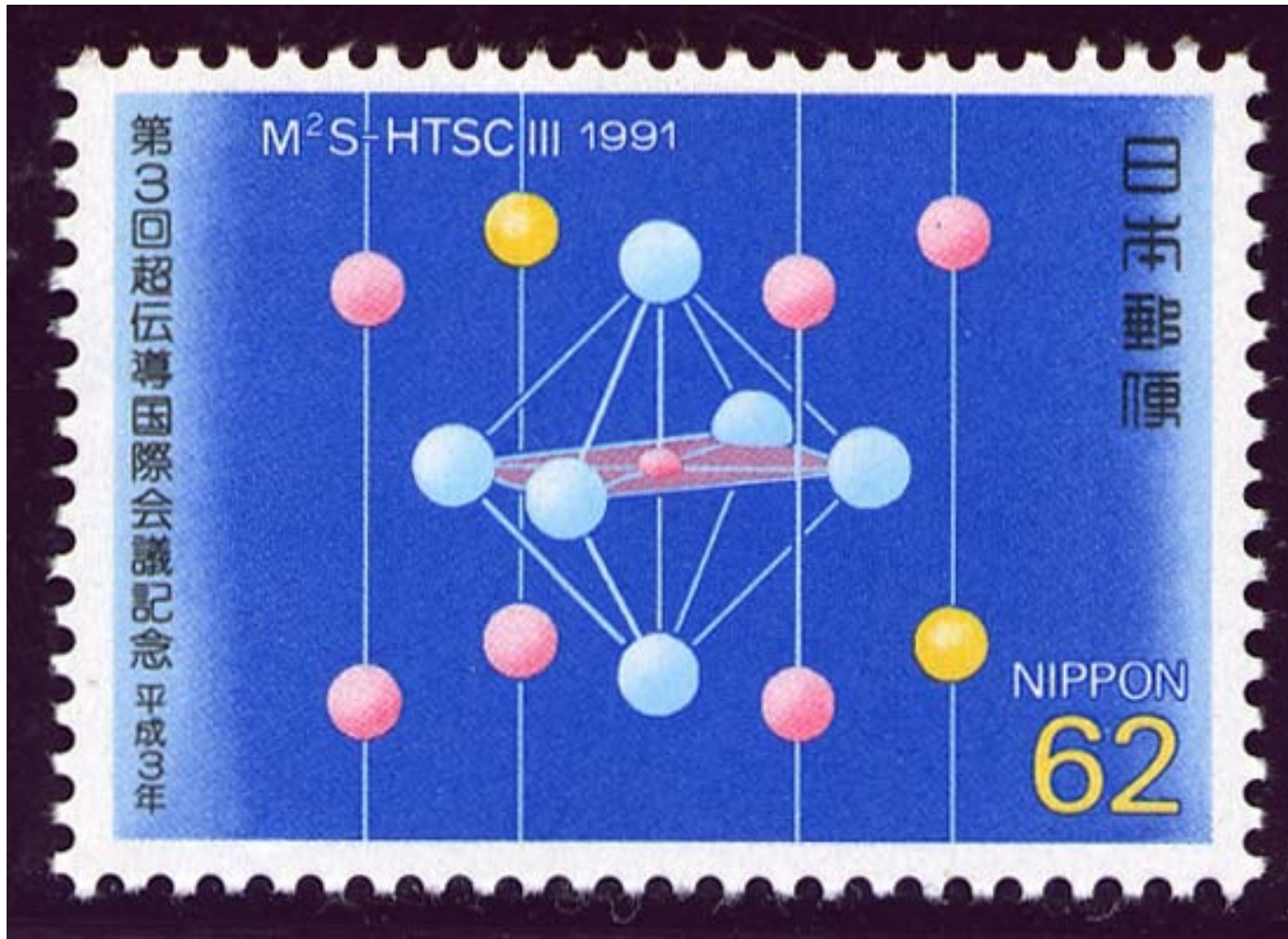
Fluoride & toothpaste



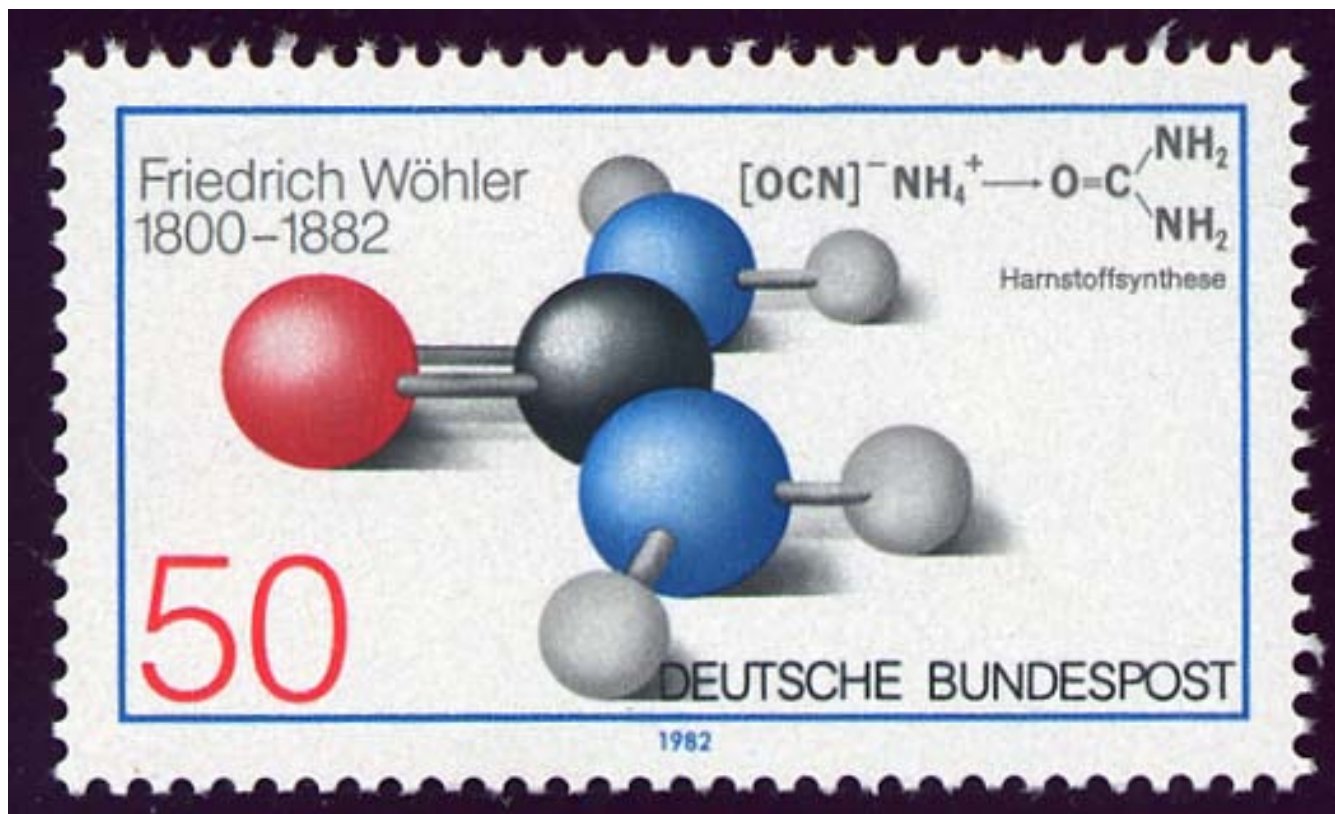


NaCl

High Temperature SuperConductors



Friedrich Wöhler and the synthesis of urea

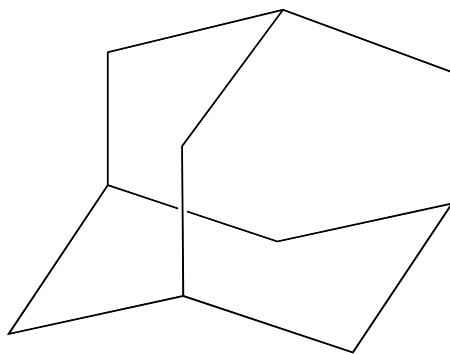


- First isolation of pure aluminum.
- Co-discoverer of beryllium, silicon, titanium and yttrium.
- Synthesis of acetylene from calcium carbide.



Vladimir Prelog (1906-1998)
Chemistry Nobel '75

adamantane



See: *Chemistry International* **2008**, 30 (1), 7.

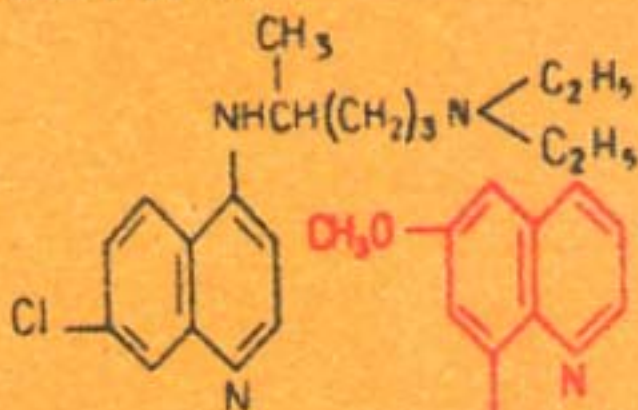
2,2-difluorobutane



100th anniversary of Geneva Conference (1892)

EL MUNDO UNIDO CONTRA LA MALARIA

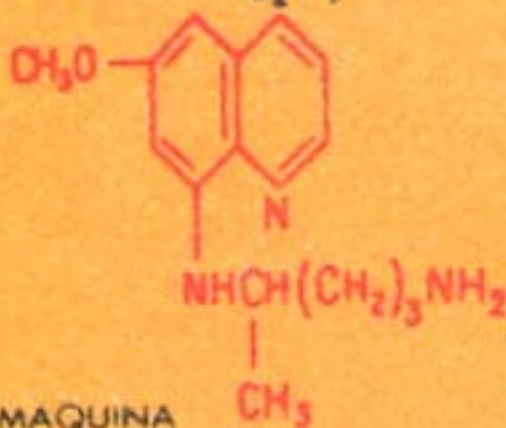
CLOROQUINA



Chinchona

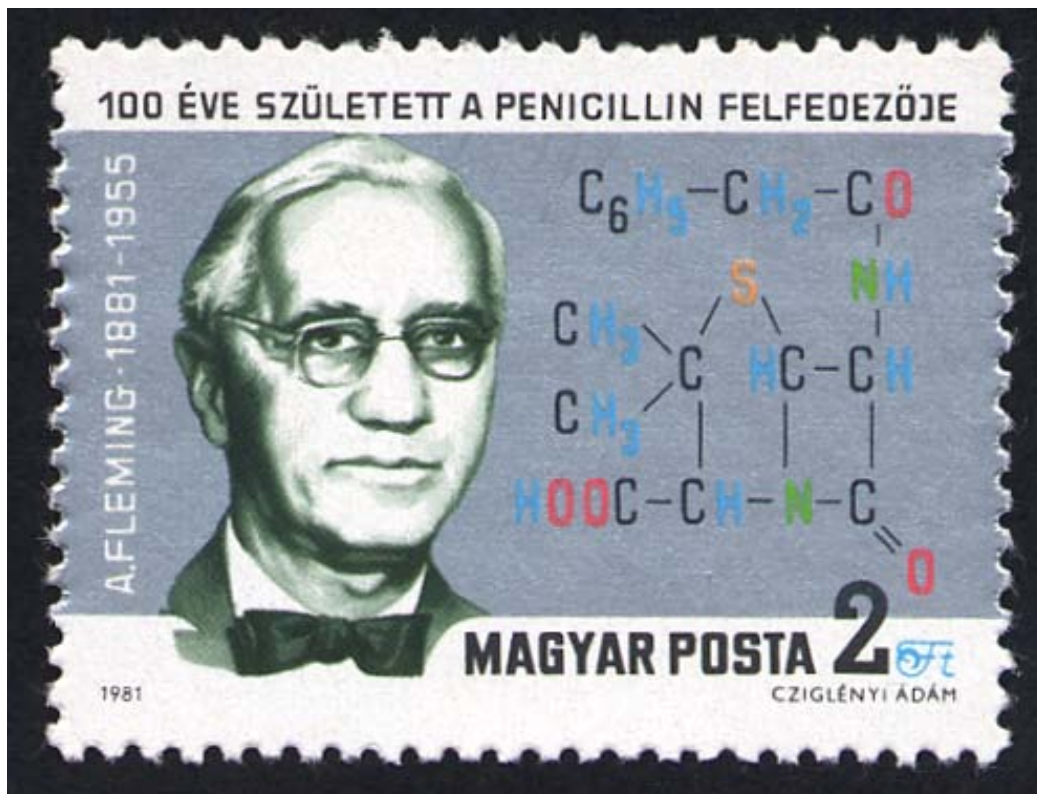


PRIMAQUINA

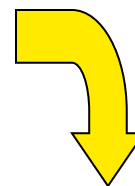


3c

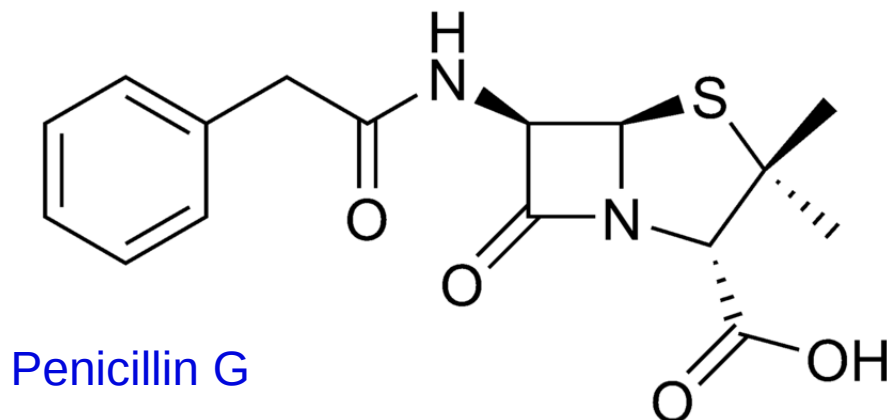
CORREOS DE CUBA



*Alexander Fleming
(1881-1955)*



(Medicine, 1945)

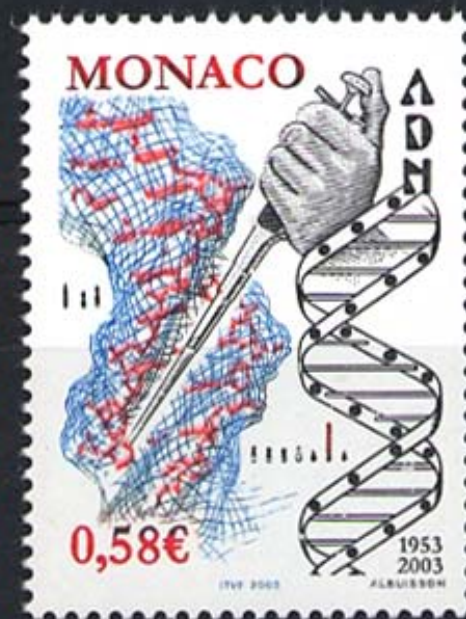


Penicillin G

Biochemistry...

The DNA double helix





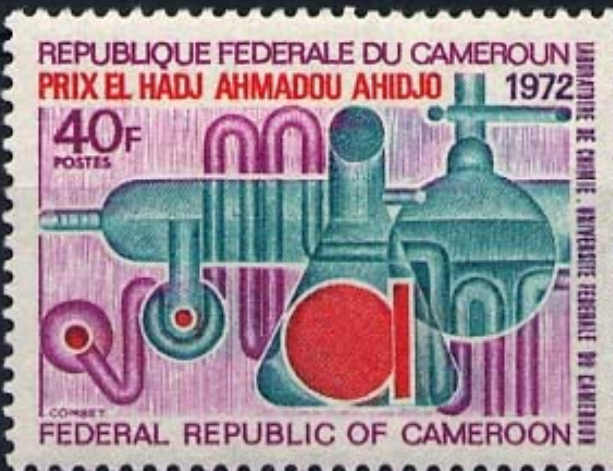
Base pairs in DNA: $G \rightleftharpoons C$ and $A \rightleftharpoons T$



Glassware...

Glassware





Chemistry students and chemists...

Chemistry Students



International
Year
of the Child
1979

MAURITIUS R1.50



1966 - INAUGURATION NOUVEAU SIEGE O.M.S.



RÉPUBLIQUE DE GUINÉE 30 F

Chemists



Chemical industry...

Chemical Industry



Fertilizers



Petrochemistry



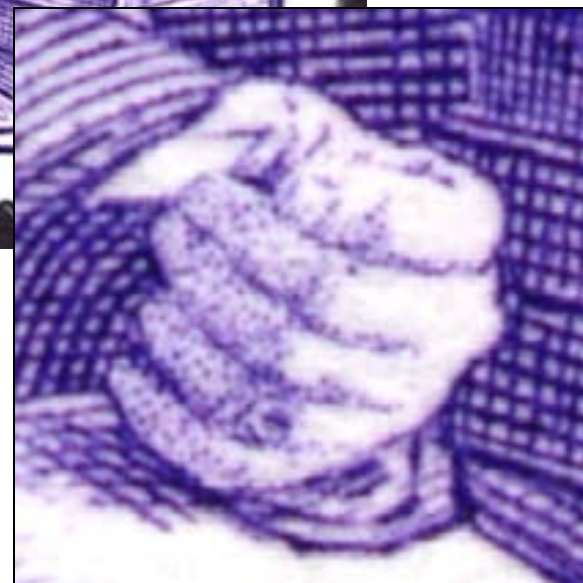
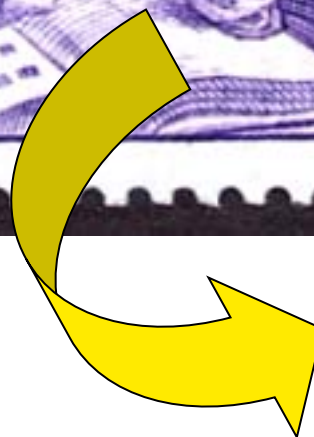
Plastics



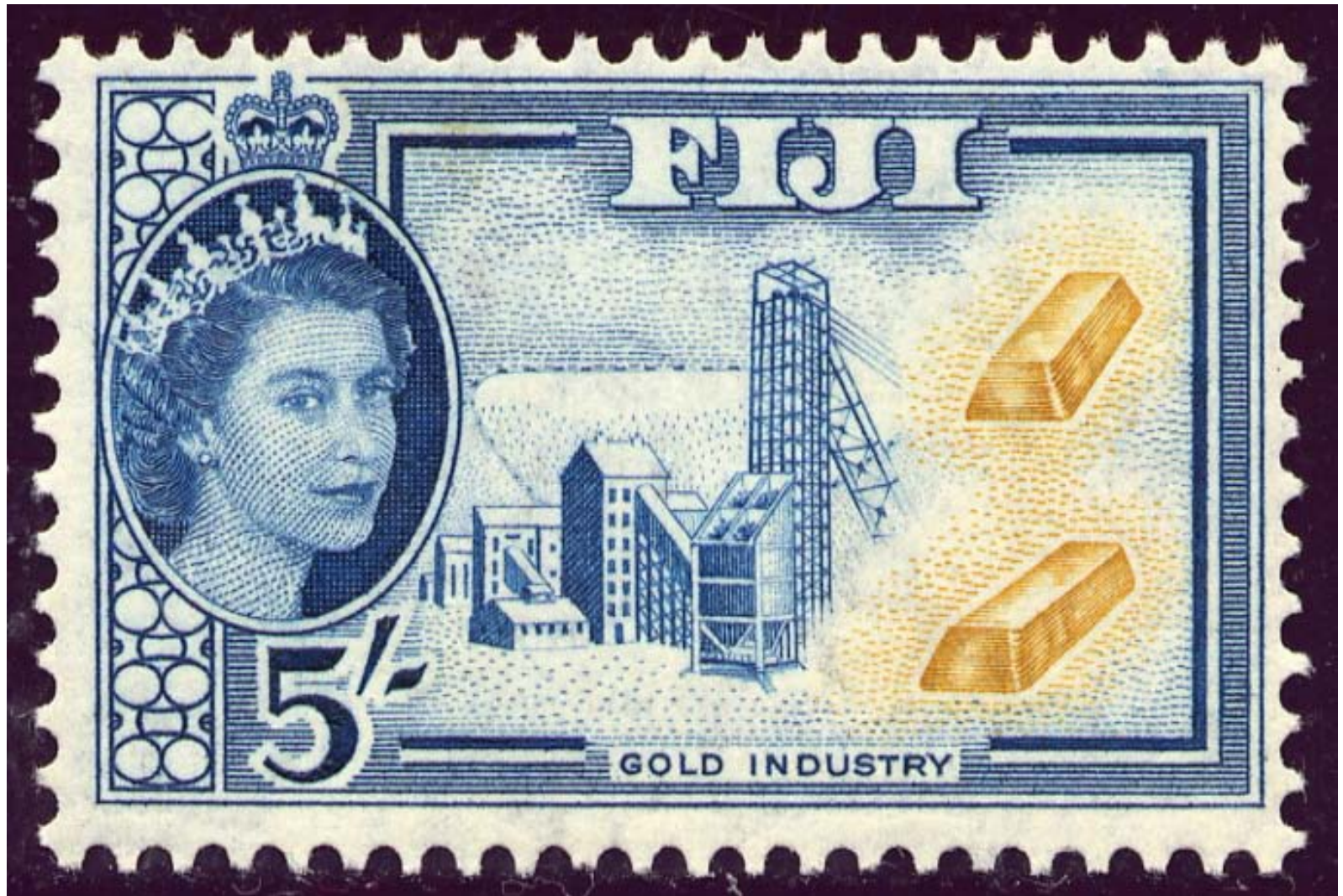
methane: CH_4



FDR, stamp collector



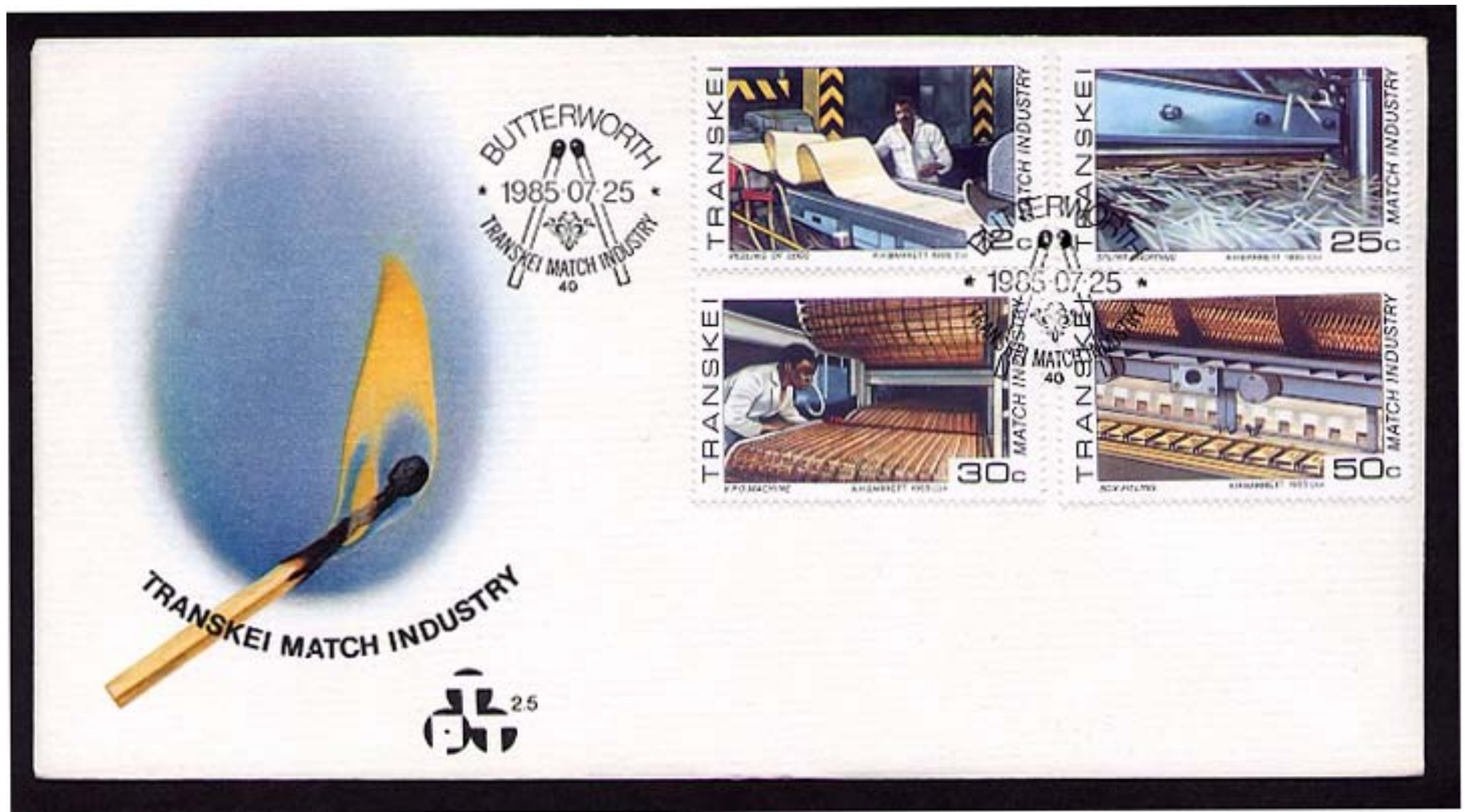
Gold



Salt



Matches



And a few special items...

Hydrogen balloons...

May 6th, 1936

Via Airship "HINDENBURG"

from: FRANKFURT / MAIN, GERMANY

to: LAKEHURST, N. J., U. S. A.



VIA AIR MAIL

EINSCHREIBEN

Gus Nichols
R. 3 Box 254
Petaluma
California

U. S. A.



*The crash of the “Hindenburg” in Lakehurst, NJ
May 6th, 1937*



Element 112: Copernicium

- Name proposed by Sigurd Hofmann *et al.* (Center for Heavy Ion Research) was accepted at the 45th General Assembly of IUPAC (Aug. '09)
- The proposed chemical symbol (Cp) was initially rejected... and then changed to Cn.



2011 Periodic Table of the Elements (IUPAC)

1

H

hydrogen

[1.007, 1.009]

2

He

helium

4.003

3

Li

lithium

[6.938, 6.997]

4

Be

beryllium

9.012

11

Na

sodium

22.99

12

Mg

magnesium

24.31

atomic number

Symbol

name

standard atomic weight

13

B

boron

[10.80, 10.83]

14

C

carbon

[12.00, 12.02]

15

N

nitrogen

[14.00, 14.01]

16

O

oxygen

[15.99, 16.00]

17

F

fluorine

19.00

18

Ne

neon

20.18

13

Al

aluminium

26.98

14

Si

silicon

[28.08, 28.09]

15

P

phosphorus

30.97

16

S

sulfur

[32.05, 32.08]

17

Cl

chlorine

[35.44, 35.46]

18

Ar

argon

39.95

19

K

potassium

39.10

20

Ca

calcium

40.08

21

Sc

scandium

44.96

22

Ti

titanium

47.87

23

V

vanadium

50.94

24

Cr

chromium

52.00

25

Mn

manganese

54.94

26

Fe

iron

55.85

27

Co

cobalt

58.93

28

Ni

nickel

58.69

29

Cu

copper

63.55

30

Zn

zinc

65.38(2)

31

Ga

gallium

69.72

32

Ge

germanium

72.63

33

As

arsenic

74.92

34

Se

selenium

78.96(3)

35

Br

bromine

79.90

36

Kr

krypton

83.80

37

Rb

rubidium

85.47

38

Sr

strontium

87.62

39

Y

yttrium

88.91

40

Zr

zirconium

91.22

41

Nb

niobium

92.91

42

Mo

molybdenum

95.96(2)

43

Tc

technetium

44

Ru

ruthenium

101.1

45

Rh

rhodium

102.9

46

Pd

palladium

106.4

47

Ag

silver

107.9

48

Cd

cadmium

112.4

49

In

indium

114.8

50

Sn

tin

118.7

51

Sb

antimony

121.8

52

Te

tellurium

127.6

53

I

iodine

126.9

54

Xe

xenon

131.3

55

Cs

caesium

132.9

56

Ba

barium

137.3

57-71

lanthanoids

72

Hf

hafnium

178.5

73

Ta

tantalum

180.9

74

W

tungsten

183.8

75

Re

rhenium

186.2

76

Os

osmium

190.2

77

Ir

iridium

192.2

78

Pt

platinum

195.1

79

Au

gold

197.0

80

Hg

mercury

200.6

81

Tl

thallium

[204, 204.4]

82

Pb

lead

207.2

83

Bi

bismuth

209.0

84

Po

polonium

85

At

astatine

86

Rn

radon

87

Fr

francium

88

Ra

radium

89-103

actinoids

104

Rf

rutherfordium

105

Db

dubnium

106

Sg

seaborgium

107

Bh

bohrium

108

Hs

hassium

109

Mt

meitnerium

110

Ds

darmstadtium

111

Rg

roentgenium

112

Cn

copernicium

57

La

lanthanum

138.9

58

Ce

cerium

140.1

59

Pr

praseodymium

140.9

60

Nd

neodymium

144.2

61

Pm

promethium

62

Sm

samarium

150.4

63

Eu

europium

152.0

64

Gd

gadolinium

157.3

65

Tb

terbium

158.9

66

Dy

dysprosium

162.5

67

Ho

holmium

164.9

68

Er

erbium

167.3

69

Tm

thulium

168.9

70

Yb

ytterbium

173.1

71

Lu

lutetium

175.0

89

Ac

actinium

90

Th

thorium

232.0

91

Pa

protactinium

231.0

92

U

uranium

238.0

93

Np

neptunium

94

Pu

plutonium

95

Am

americium

96

Cm

curium

97

Bk

berkelium

98

Cf

californium

99

Es

einsteinium

100

Fm

fermium

101

Md

mendelevium

102

No

nobelium

103

Lr

lawrencium



Notes

- IUPAC 2009 Standard atomic weights abridged to four significant digits [Table 4 published in *Pure Appl. Chem.* 83, 359-396 (2011); doi:10.1351/PAC-REP-10-09-14]. The uncertainty in the last digit of the standard atomic weight value is listed in parentheses following the value. In the absence of parentheses, the uncertainty is one in that last digit. An interval in square brackets provides the lower and upper bounds of the standard atomic weight for that element. No values are listed for elements with no stable isotopes. See PAC for more details.

- "Aluminum" and "caesium" are commonly used alternative spellings for "aluminium" and "caesium."

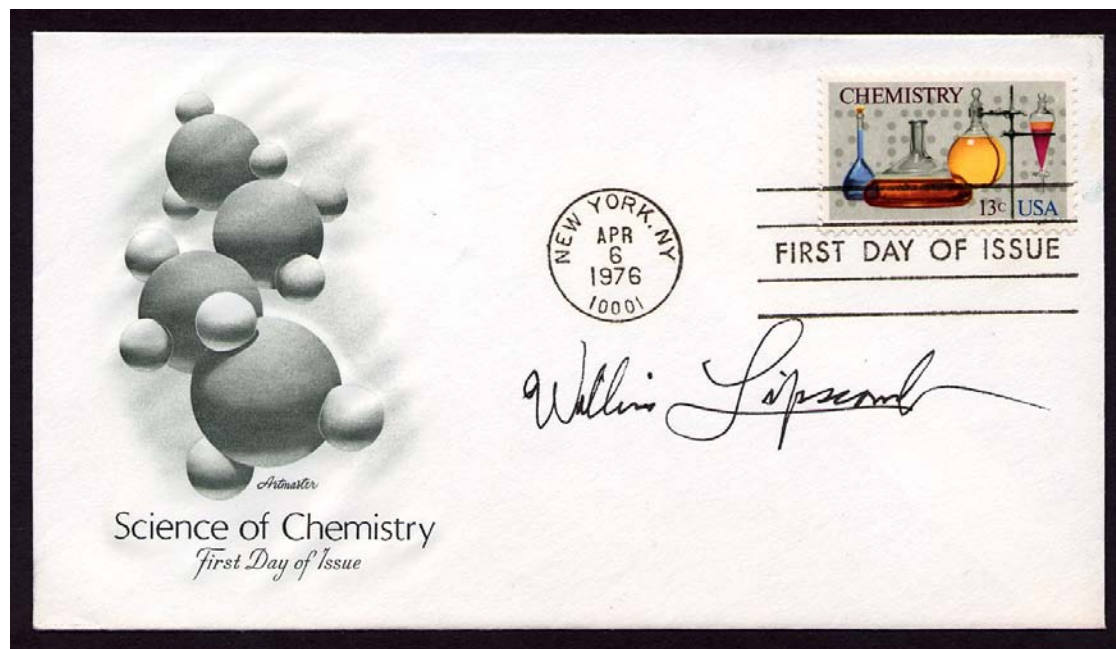
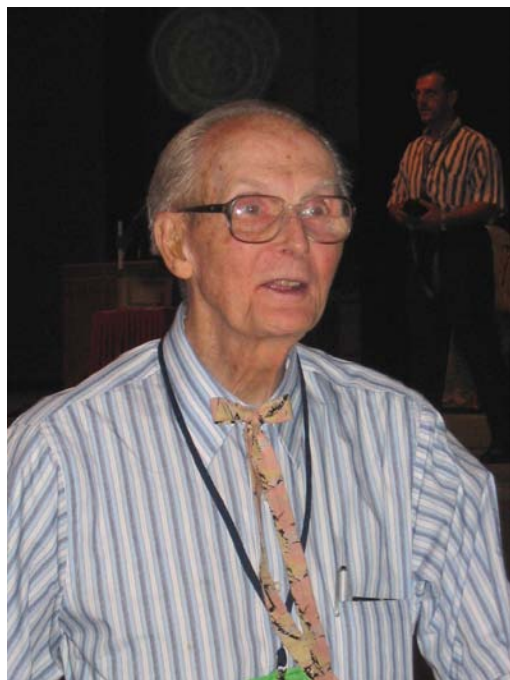
For updates to this table, see iupac.org/reports/periodic_table/. This version is dated 21 January 2011.

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International Year of
CHEMISTRY
2011

William N. Lipscomb and the 40th IUPAC Congress in Beijing (Aug. '05)



1976 Nobel Prize in Chemistry “for his studies on the structure of boranes illuminating problems of chemical bonding”

Found on eBay:

a Collection of Chemistry Nobel Laureate Signatures



Christian Anfinsen
Chemistry '72
1916-1995

William F. GIAUQUE
Chemistry '49
1895-1982

Robert S. Mulliken
Chemistry '66
1896-1986

Glenn T. Seaborg
Chemistry '51
1912-1999



William N. Lipscomb
Chemistry '76
1919-2011

John Cornforth
Chemistry '75
1917-

Geoffrey Wilkinson
Chemistry '73
1921-1996

Vladimir Prelog
Chemistry '75
1906-1998

Gerhard Herzberg
Chemistry '71
1904-1999

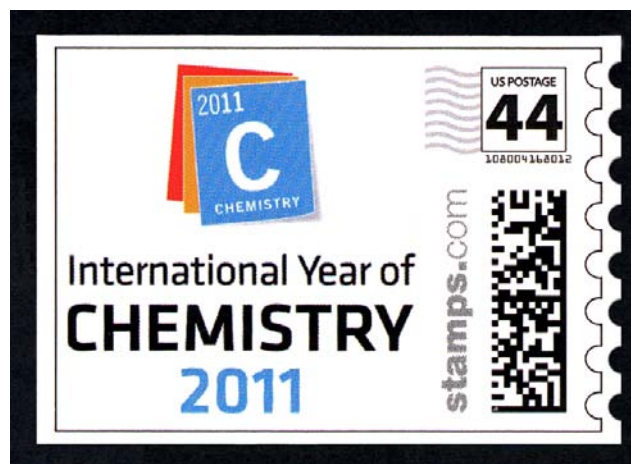
Harold C. Urey
Chemistry '34
1893-1981

IYC Stamps

2011

The International Year of Chemistry (IYC)

www.chemistry2011.org

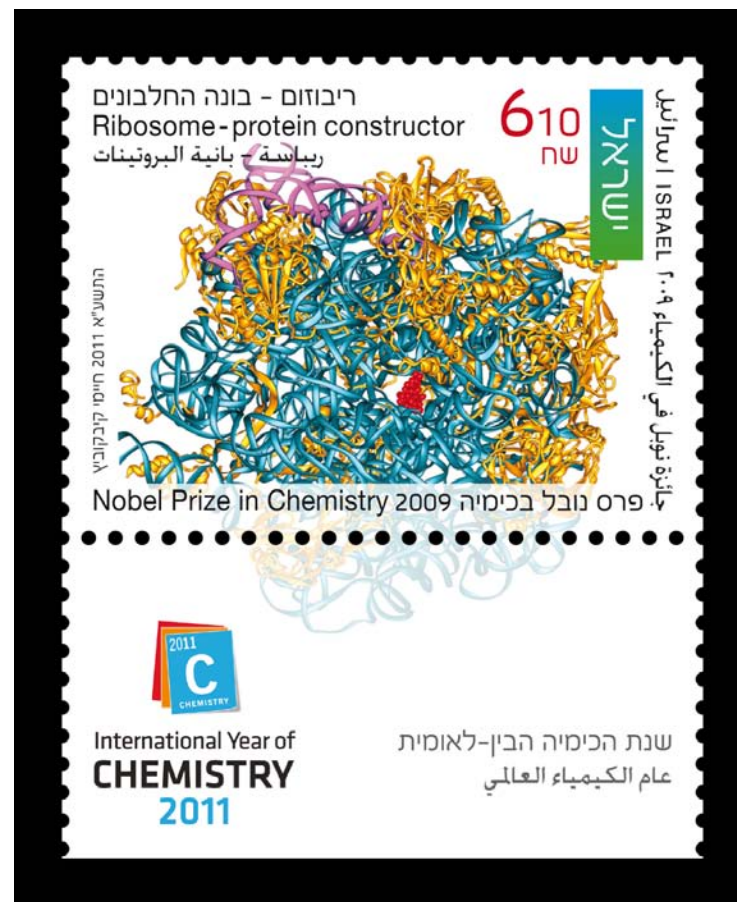


- IUPAC Project: *Global Stamp Competition*.
- “Chemistry on Stamps” *Symposium and Stamp Exhibition* at the 242nd National ACS meeting in Denver, CO (Fall '11).

First IYC '11 Stamps (4 January 2011): Israel



ubiquitin – protein destructor
Ciechanover & Hershko (Technion)
Chemistry Nobel '04



ribosome – protein constructor
Ada Yonath (WIT)
Chemistry Nobel '09

IYC '11 Stamps: Slovakia



Date of issue:
17 January 2011

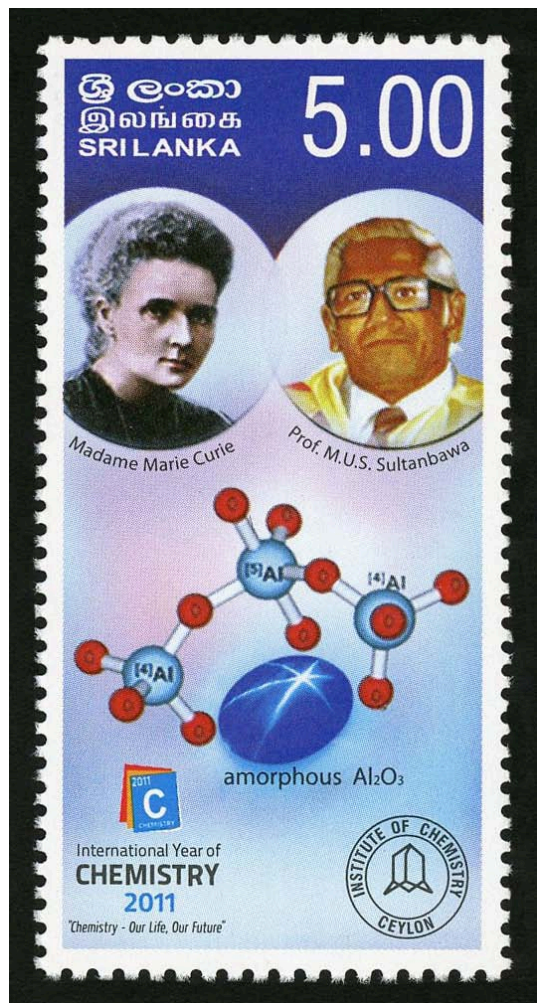
IYC '11 Stamps: Belgium & France



Date of issue:
17 January 2011



Date of issue:
27 January 2011



Date of issue:
30 January 2011

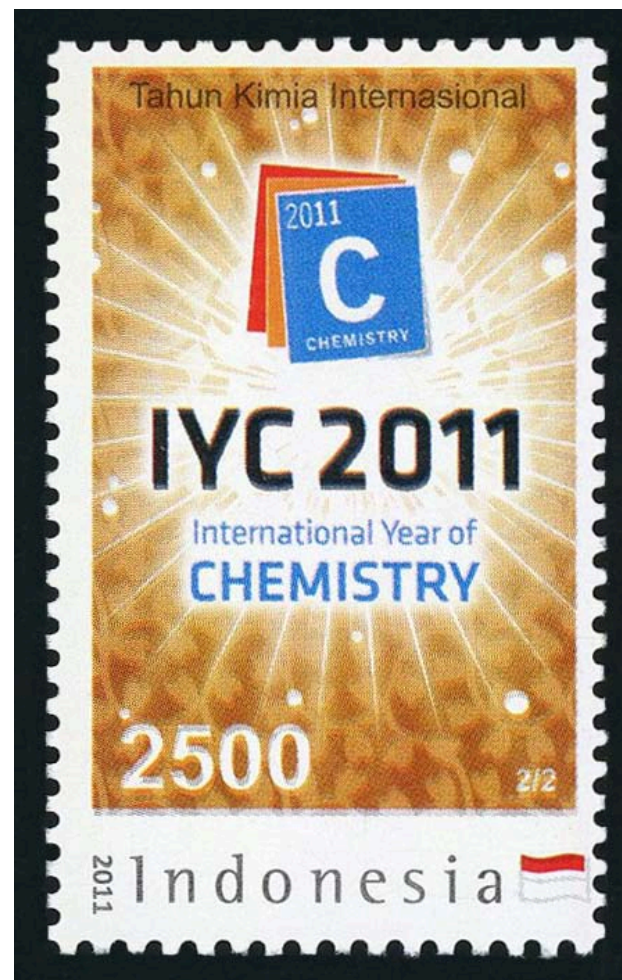
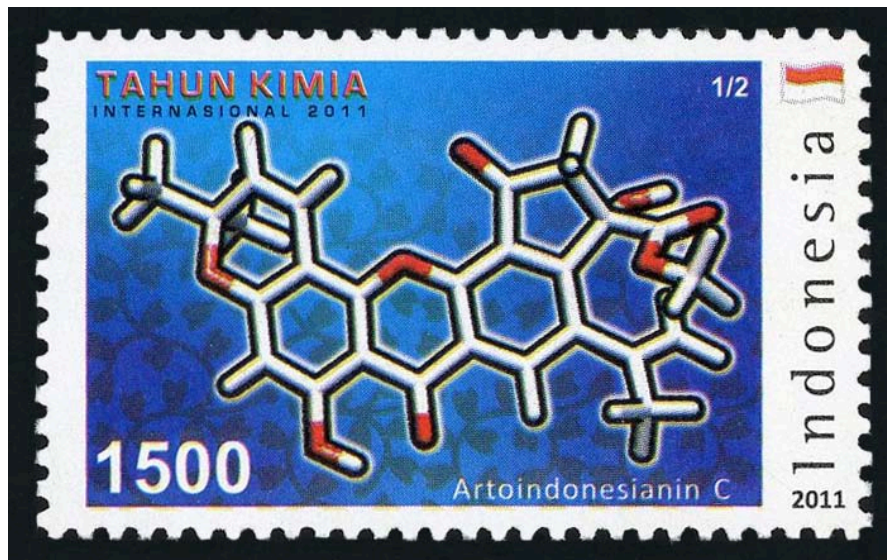
IYC '11 Stamps: Sri Lanka & Spain



Date of issue:
7 February 2011

IYC '11 Stamps: Indonesia

Date of issue:
1 March 2011

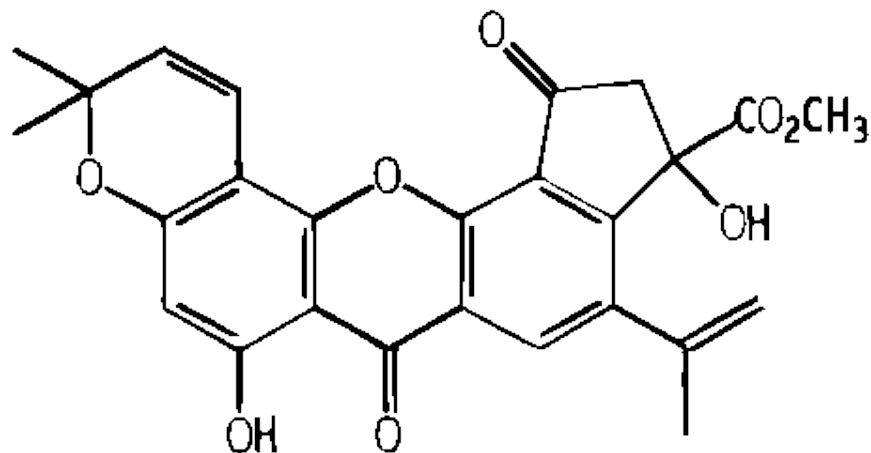
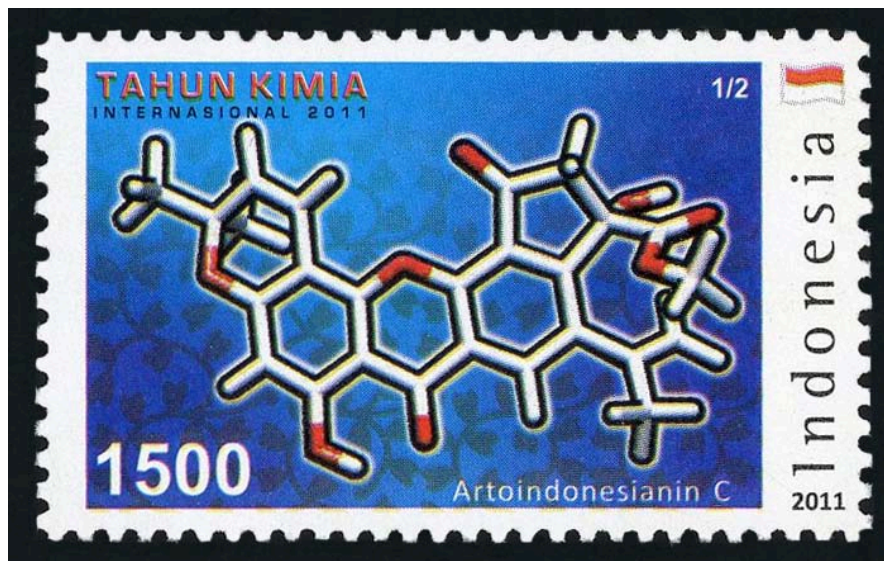


IYC '11 Stamps: Indonesia

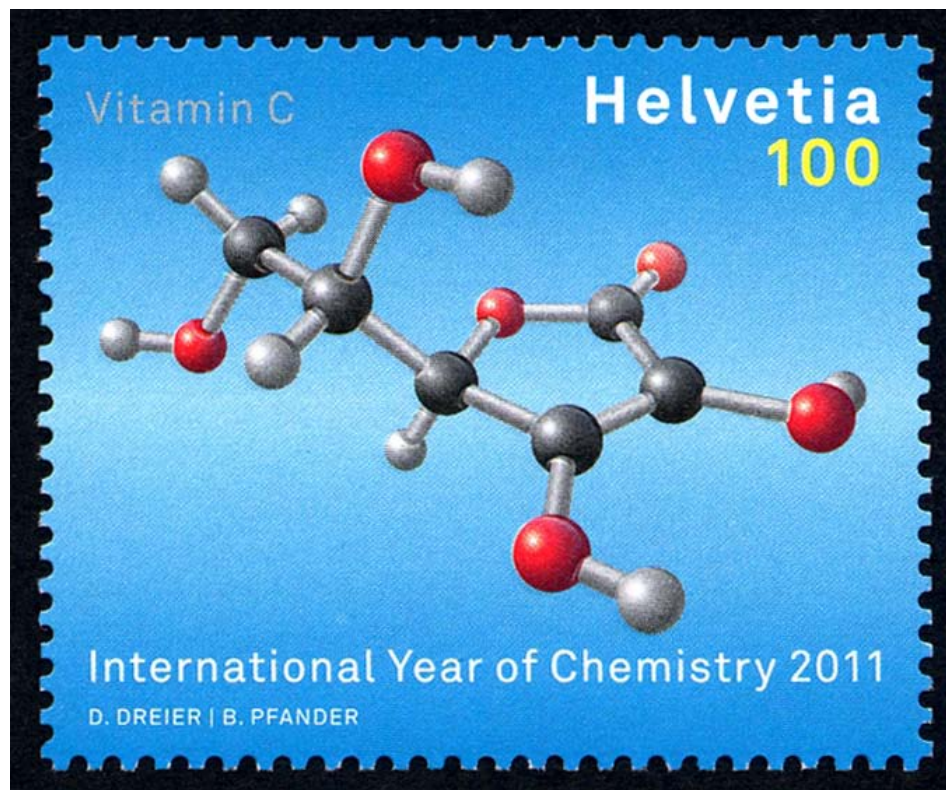
Artoindonesianin C

S.A. Achmad et al.

J. Nat. Prod. **2000**, 63, 243-244.



IYC '11 Stamps: Switzerland



Date of issue: 3 March 2011



Synthesis of vitamin C: Sir Norman Haworth & Tadeusz Reichstein
Chemistry '37 *Phys or Med '50*

IYC '11 Stamps: Jersey & Bosnia and Herzegovina



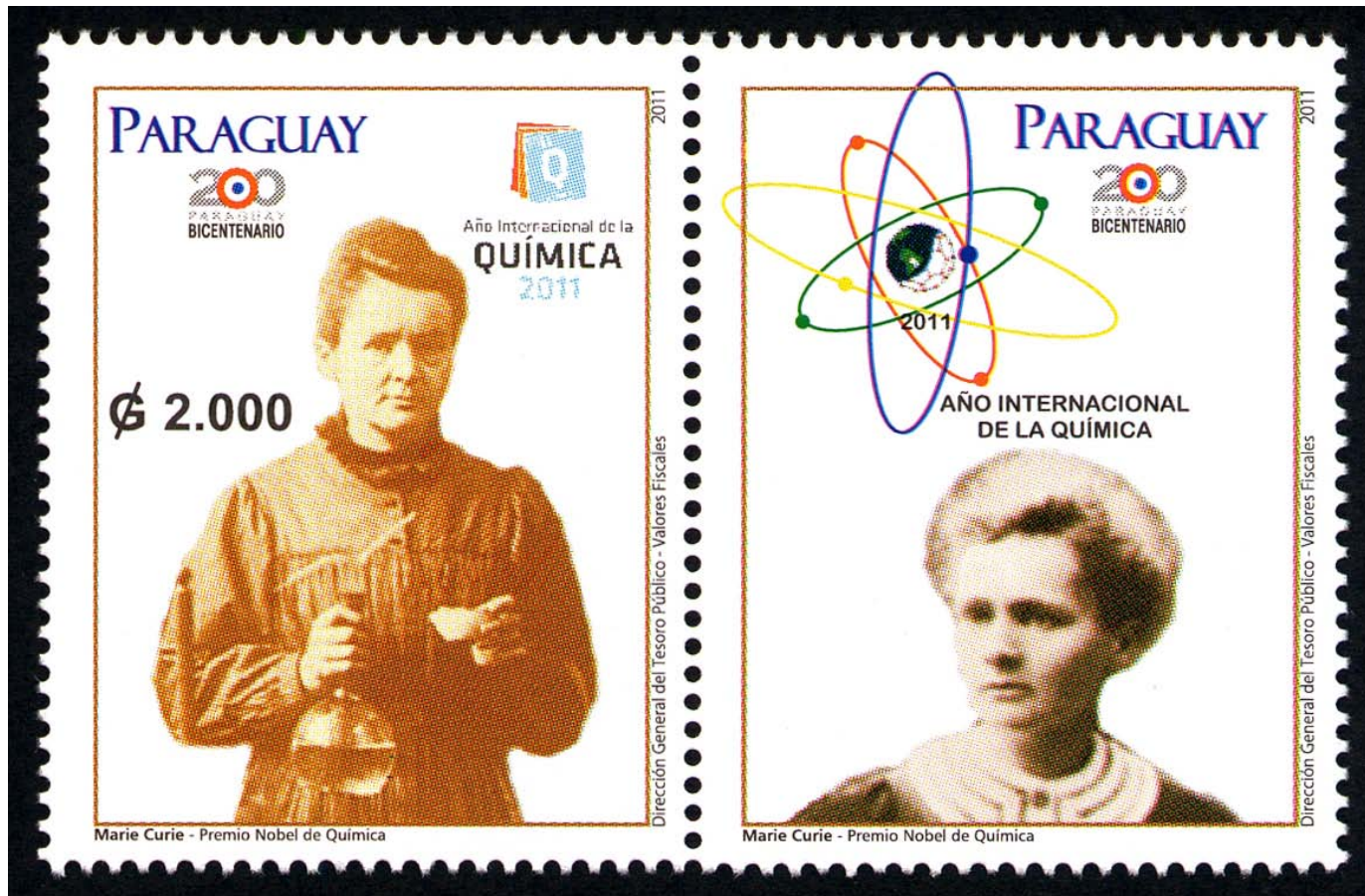
Date of issue: 8 March 2011
(International Women's Day!)

IYC '11 Stamps: Macedonia



Date of issue: 13 April 2011

IYC '11 Stamps: Paraguay



Date of issue: 9 May 2011

The Chemistry and Physics on Stamps Study Unit (CPOSSU)

- Non-profit organization that promotes the philatelic study of chemistry, physics, and related fields.
- Started in 1979, currently ca. 160 members worldwide.

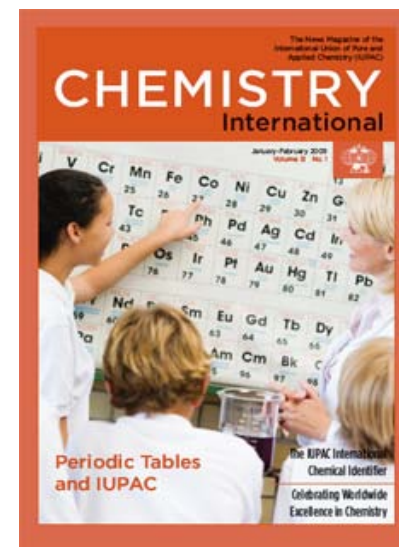
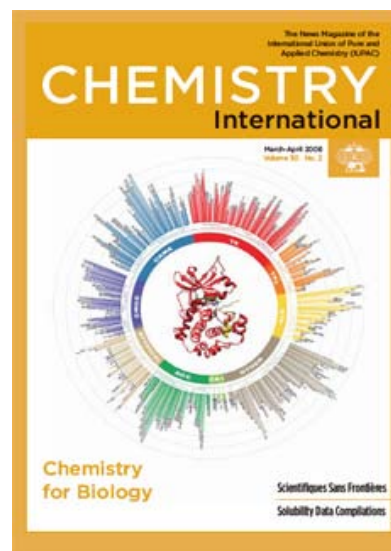
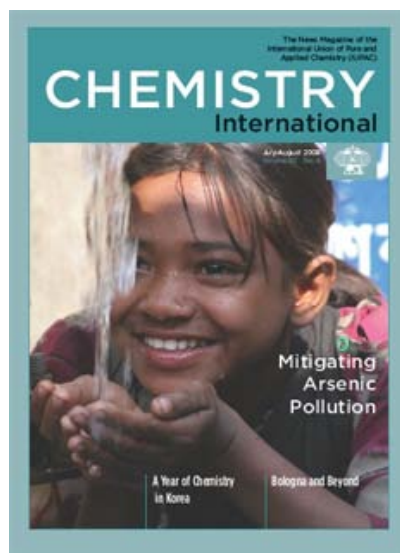
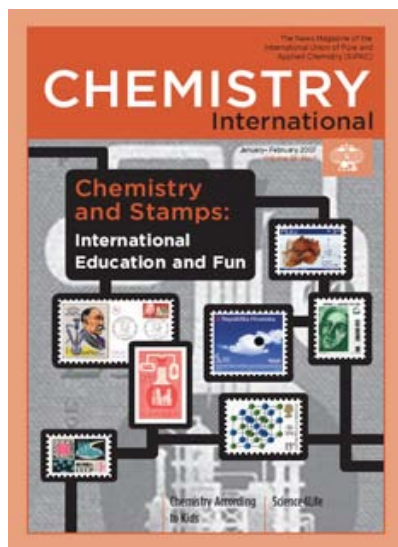
www.cpossu.org

- Publishes *Philatelia Chimica et Physica* (4 issues/year).

Chemistry International

- Bimonthly newsmagazine of IUPAC:

www.iupac.org/publications/ci



Hydrogen to Copernicium: Postage Stamps as Cultural Icons in the IYC

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The University of North Carolina at Charlotte

