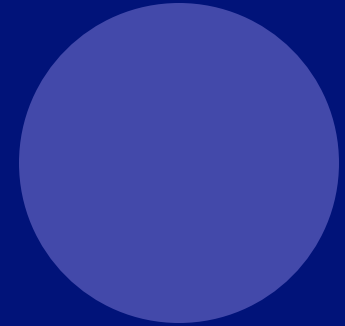
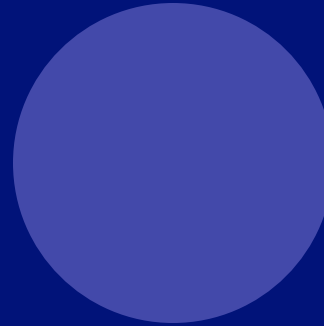
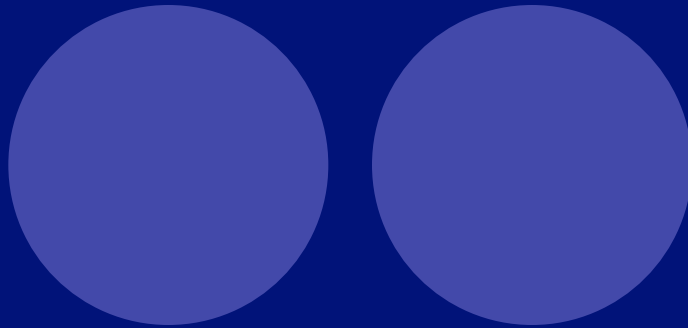


The Periodic Table

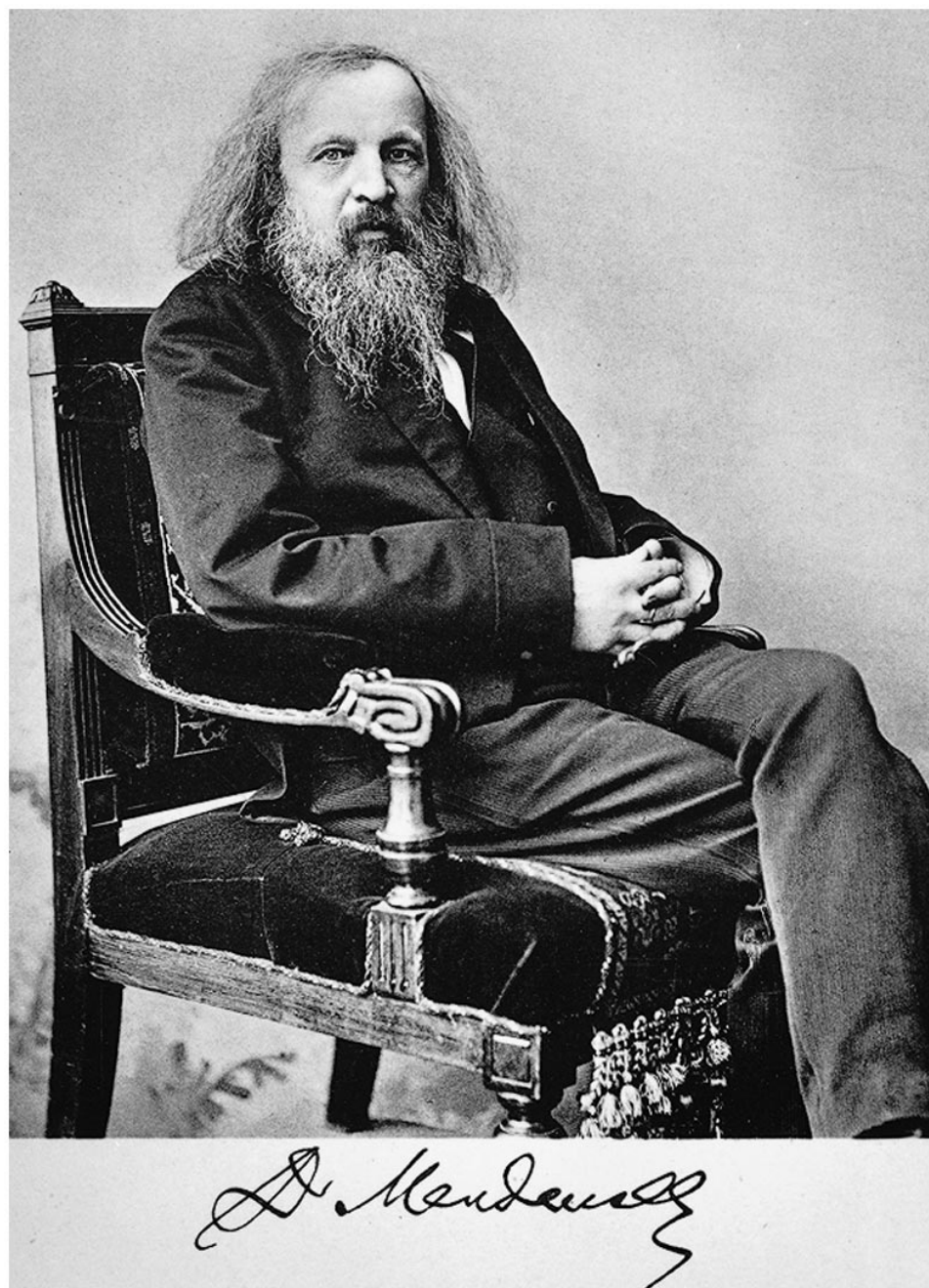


An Introduction

The Modern Periodic Table

- The ancients believed there were just four elements: earth, air, fire, water.
- By the 1800's, chemists knew of many elements and a method of organization was sought.
- Dimitri Mendeleev arranged the elements in order of increasing atomic mass.
 - When arranged in such a way, he found that the properties of elements repeated in a systematic way.
 - Based on his arrangement, scientists could predict the existence and properties of yet undiscovered elements.

**Dmitri
Ivanovich
Mendeleev
(1834-1907)**



Mendeleev's Table

TABELLE II

REIHEN	GRUPPE I. — R ² O	GRUPPE II. — RO	GRUPPE III. — R ² O ³	GRUPPE IV. RH ⁴ RO ²	GRUPPE V. RH ³ R ² O ⁵	GRUPPE VI. RH ² RO ³	GRUPPE VII. RH R ² O ⁷	GRUPPE VIII. — RO ⁴
1	H=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

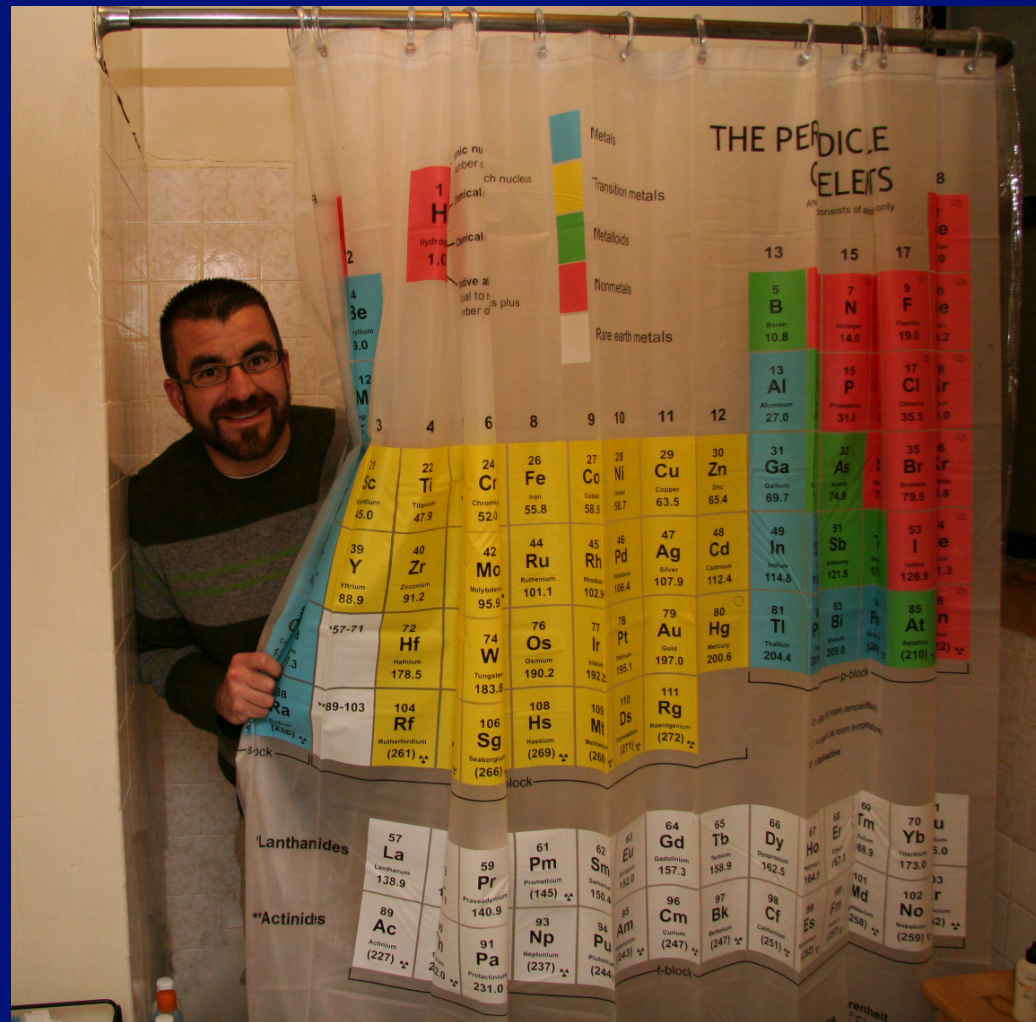
Mendeleev's early periodic table, published in 1872. Note the spaces left for missing elements with atomic masses 44, 68, 72, 100.

Periodic Predictions

TABLE 7.3 Comparison of the Properties of Germanium as Predicted by Mendeleev and as Actually Observed

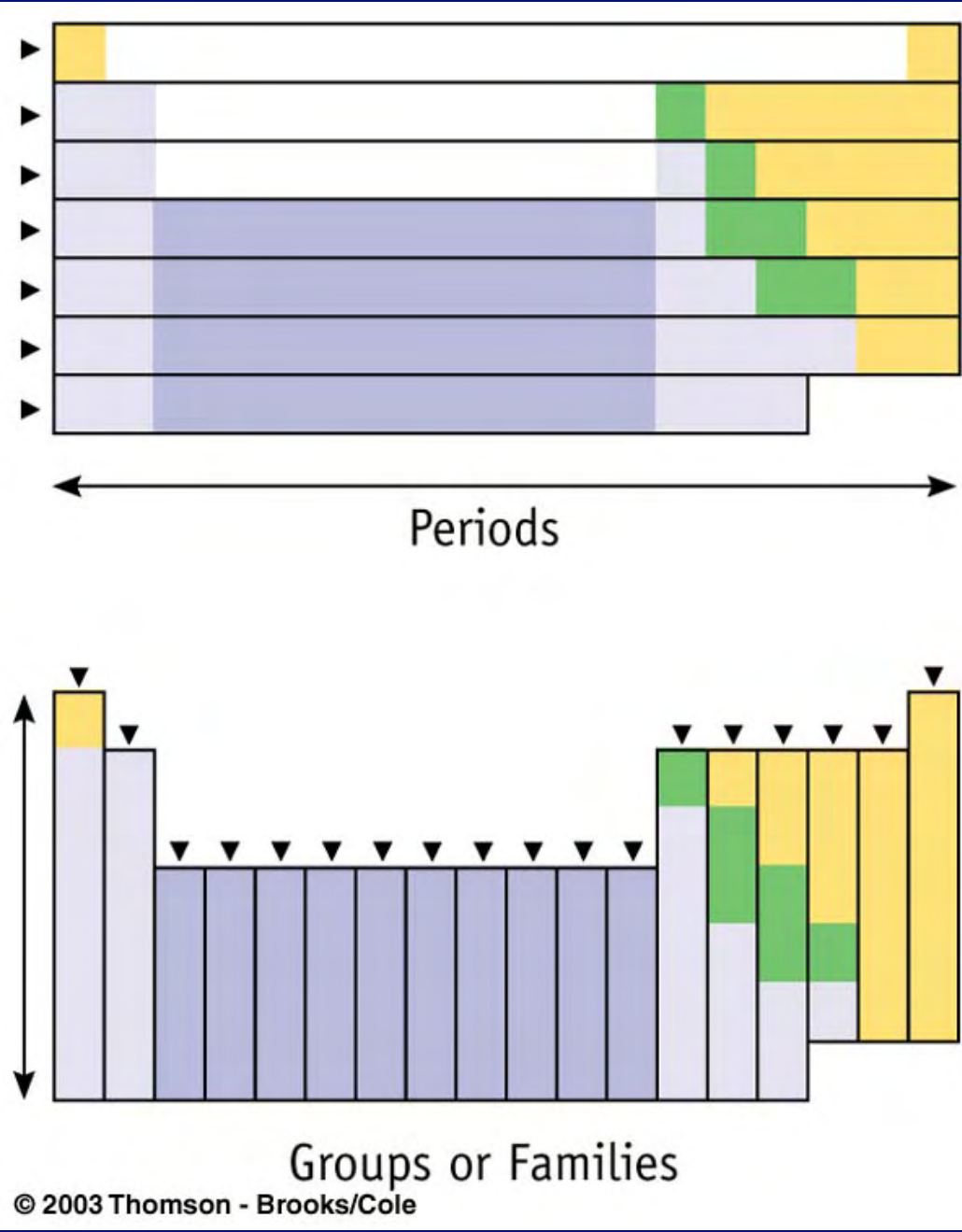
Properties of Germanium	Predicted in 1871	Observed in 1886
Atomic weight	72	72.3
Density	5.5 g/cm ³	5.47 g/cm ³
Specific heat	0.31 J/(°C · g)	0.32 J/(°C · g)
Melting point	Very high	960°C
Oxide formula	RO ₂	GeO ₂
Oxide density	4.7 g/cm ³	4.70 g/cm ³
Chloride formula	RCl ₄	GeCl ₄
bp of chloride	100°C	86°C

Periodic Popular Culture

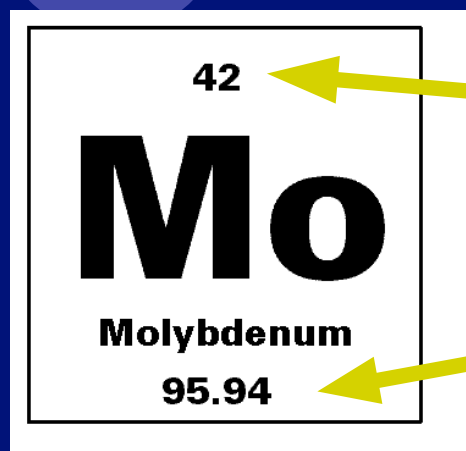


Periodic Table Basics:

- *The principal method of arrangement of elements in the modern periodic table is **atomic number**.*
- The **rows** of the periodic table are called **periods**.
- The **columns** of the table are called **groups** or **families**.
- The **periodic law** states that when elements are arranged in order of increasing atomic number, then they fall into groups of repeating properties.



Interpreting an element symbol:

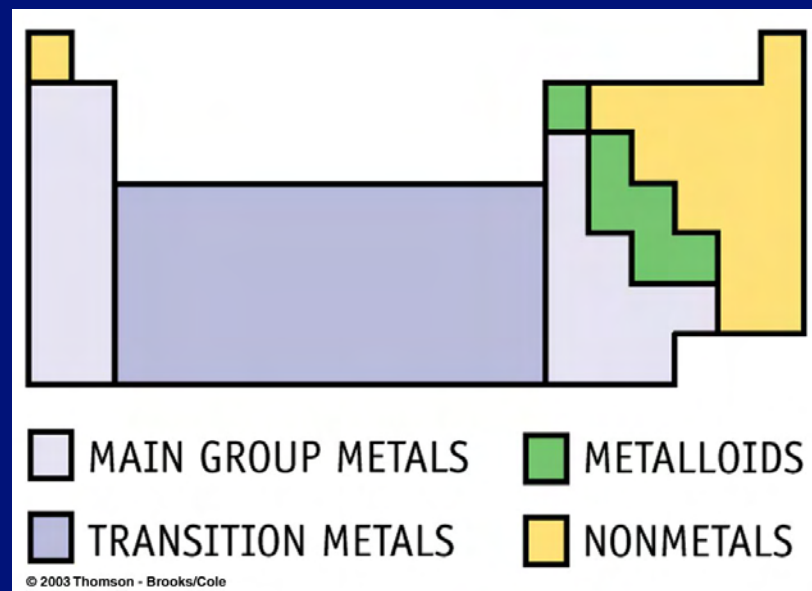


Atomic Number (# protons)

Average Atomic Mass (amu)

There are three types of elements:

- Metals
- Metalloids (semi-metals)
- Non-metals



Specific Families and Blocks

- Main Group – Representative elements
 - Group 1A – Alkali metals.
 - Group 2A – Alkaline earth metals.
 - Group 7A – Halogens.
 - Group 8A – Noble Gases.
- Transition Metals
- Inner Transition Metals

Group 1A
Lithium — Li (top)
Potassium — K (bottom)



Group 2A
Magnesium — Mg

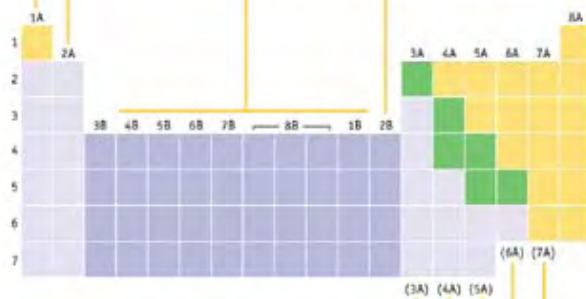


Transition Metals

Titanium — Ti, Vanadium — V, Chromium — Cr,
Manganese — Mn, Iron — Fe, Cobalt — Co, Nickel — Ni,
Copper — Cu



Group 2B
Zinc — Zn (top)
Mercury — Hg (bottom)



Group 8A, Noble Gases
Neon — Ne



Group 3A
Boron — B (top)
Aluminum — Al (bottom)



Group 4A
Carbon — C (top)
Lead — Pb (left)
Silicon — Si (right)
Tin — Sn (bottom)



Group 5A
Nitrogen — N₂ (top)
Phosphorus — P (bottom)



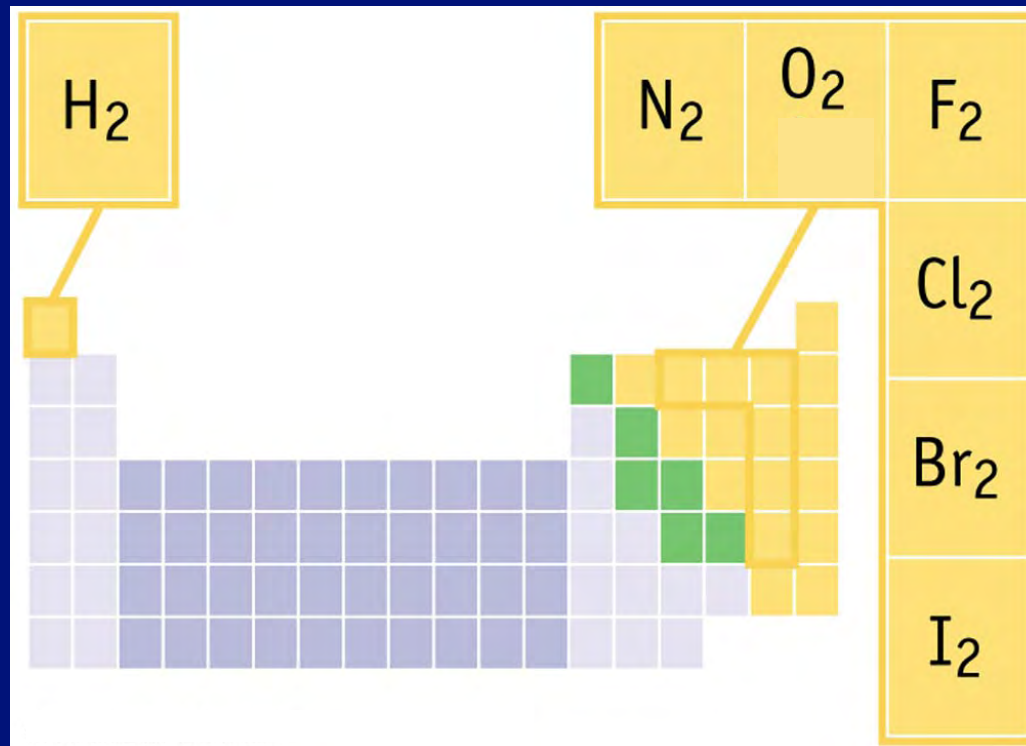
Group 6A
Sulfur — S (top)
Selenium — Se (bottom)



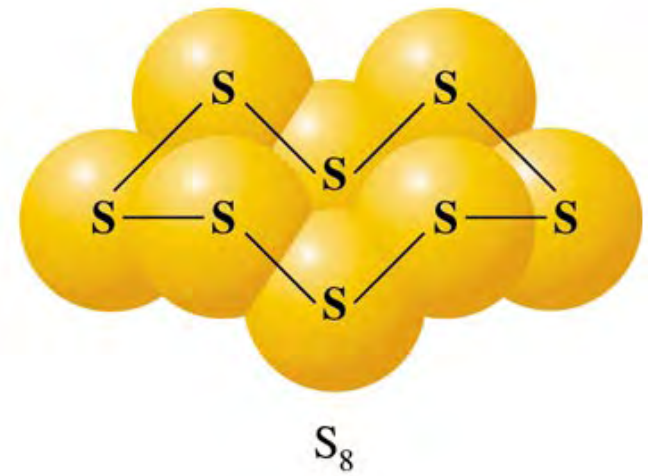
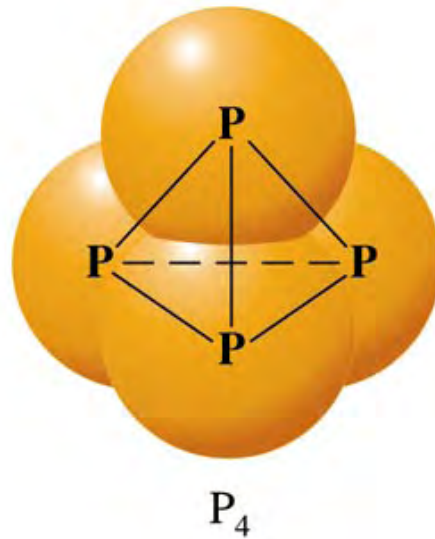
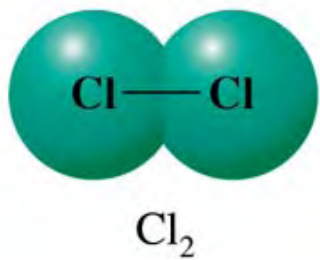
Group 7A
Bromine — Br

Diatomic Elements

- The following elements are diatomic molecules in their standard elemental form:



Molecular Models of Some Elementary Substances



Allotropes of Carbon

- Some elements may have more than one elemental form. Consider carbon:
 - Diamond
 - Graphite
 - Buckminsterfullerene (C_{60} and related)

