

An Introduction to Chemistry

Chapter 1

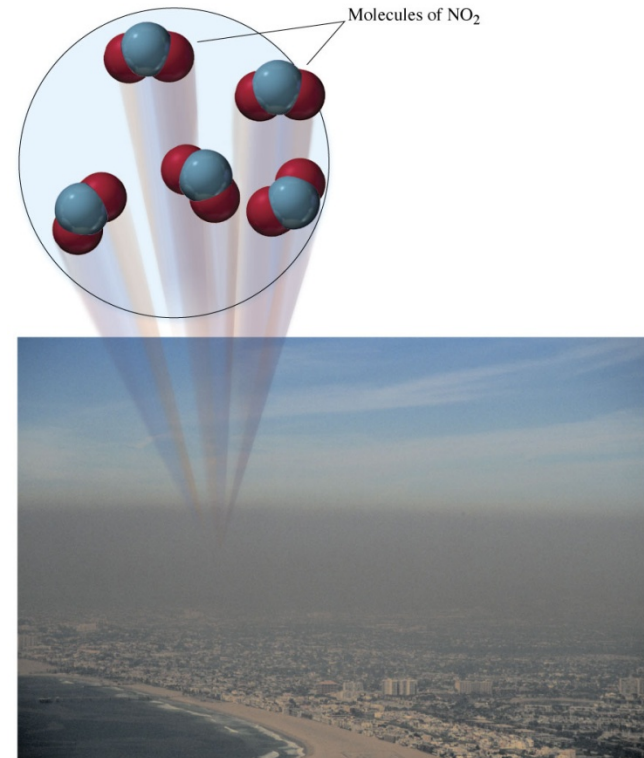
Chemicals

- What are they??
- There is nothing you can touch or hold that is not made of chemicals.



What is Chemistry?

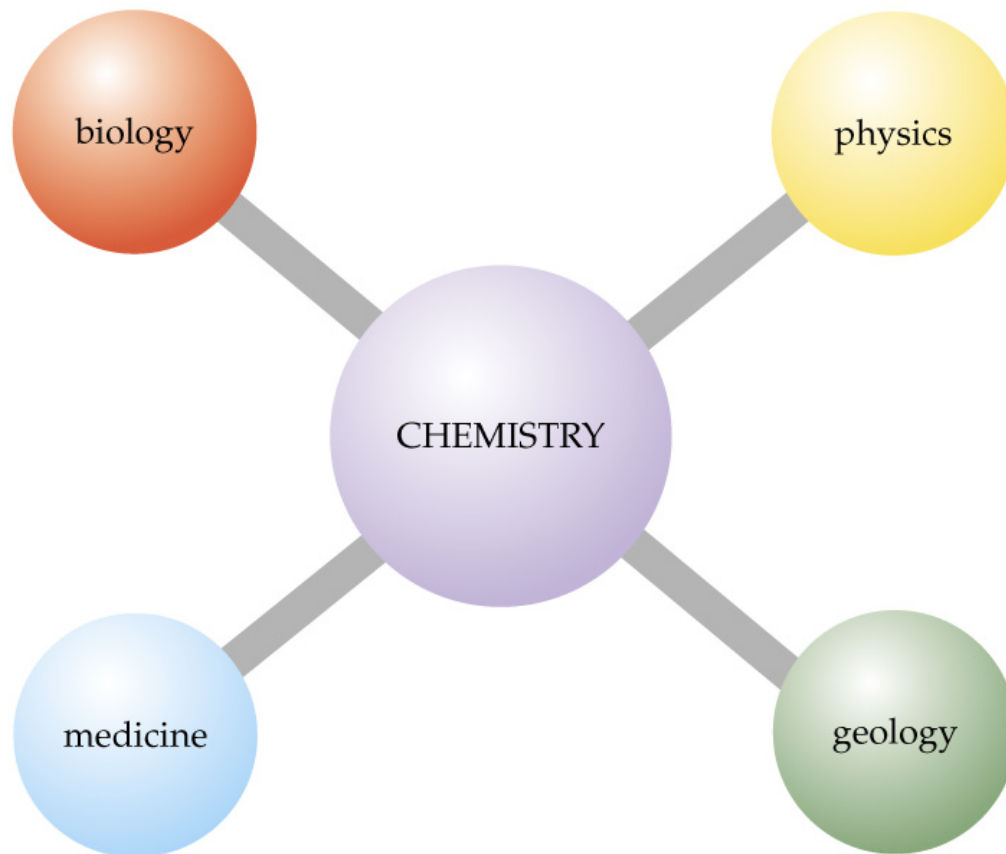
- Chemistry is the science of the properties, composition, and behavior of materials.
- Chemistry is the science concerned with describing and explaining the different forms of matter and the chemical reactions of matter.



Branches of Chemistry

- Applied Chemistry - the search for and isolation of useful materials.
- Theoretical Chemistry - Provides a chemical view of nature and explanations of natural processes.
 - Organic Chemistry
 - Inorganic Chemistry
 - Biochemistry
 - Physical Chemistry

Chemistry is the Central Science

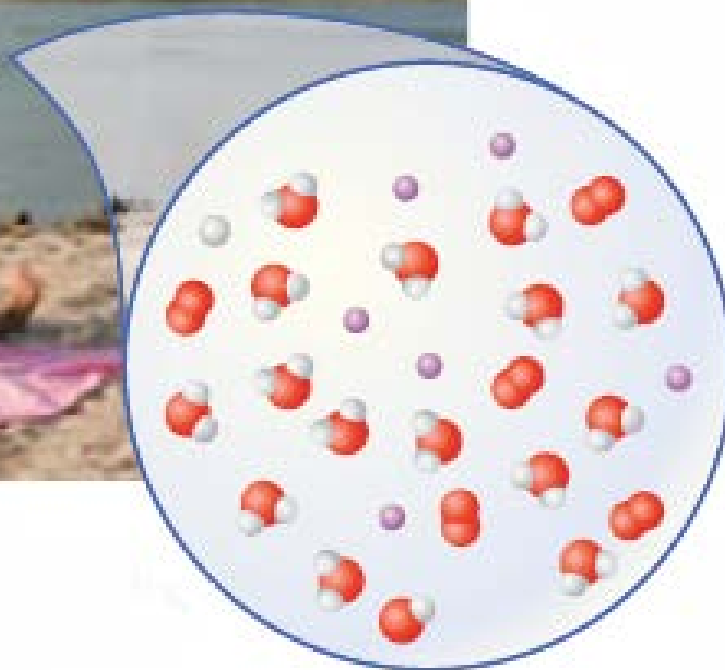


Thinking like a Chemist



What do you see?

Thinking like a Chemist



What does a chemist see?

Studying Chemistry

- Be curious
- Learn vocabulary (and nomenclature)
- Keep current in the class. Don't wait for a test
- Form a study group
- Do problems again and again!!

Scientific Method

- Observation – a statement that accurately describes something we see, hear, taste, feel, or smell.
- Conclusion – a statement that is based on what we think about a series of observations.

From Scientific Method

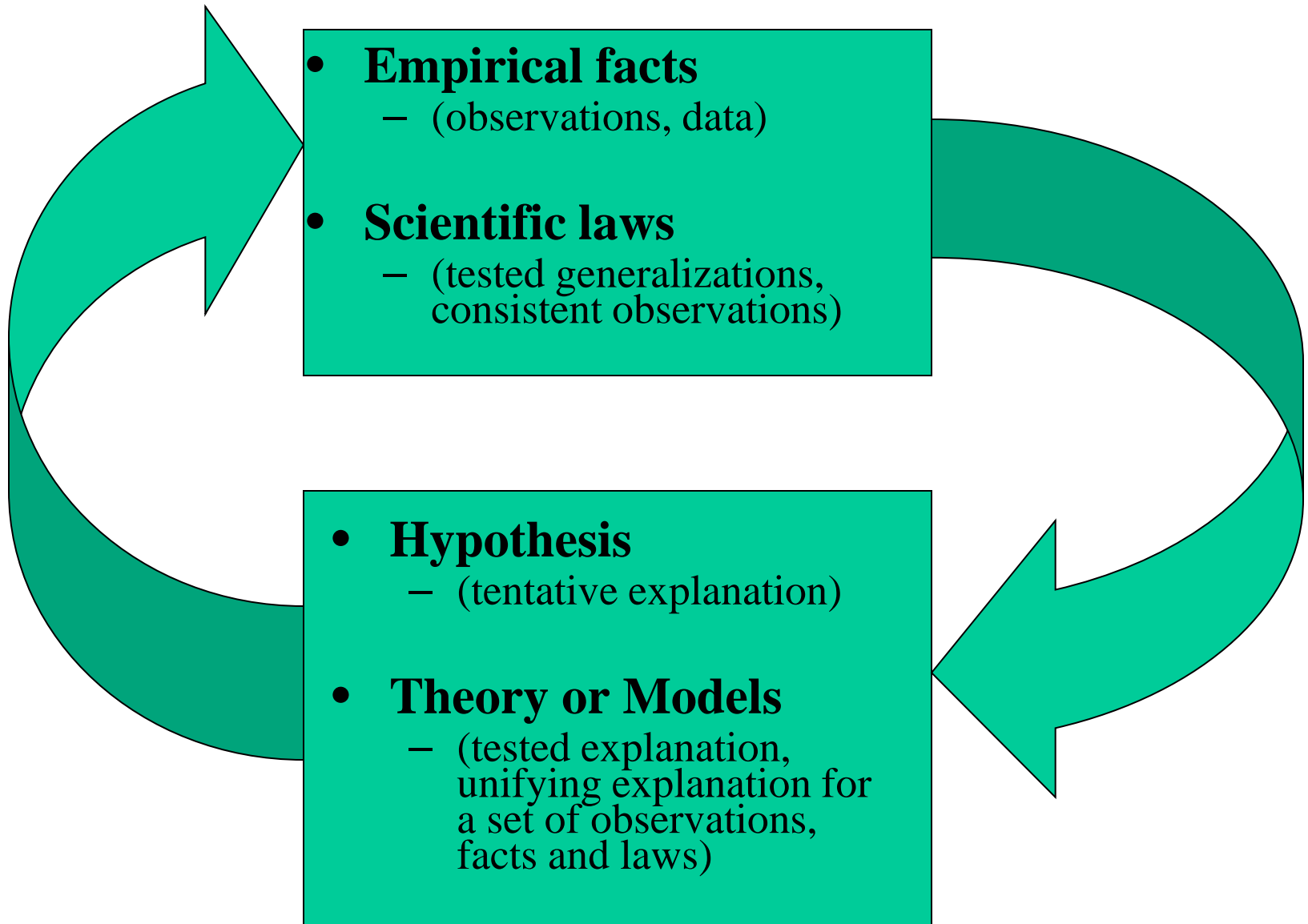


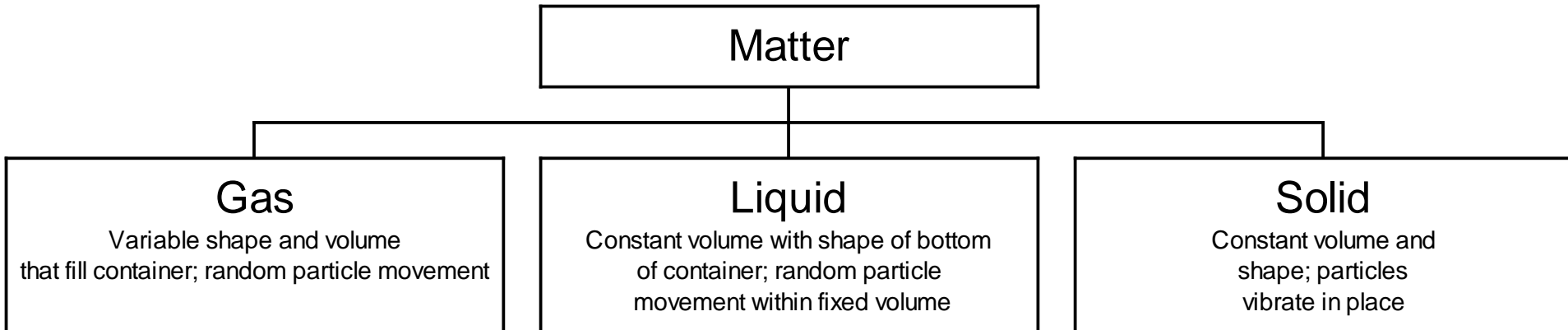
TABLE 1.2 Some Important Scientific Discoveries, Laws, Theories, and Technological Innovations

Discovery, Law, Theory, or Innovation	Date	Discoverer or Inventor	Country
Law of gravity	1687	Isaac Newton	England
Oxygen	1774	Joseph Priestley	England
Electric battery	1800	Alessandro Volta	Italy
Atomic theory	1803	John Dalton	England
Anesthesia, ether	1842	Crawford Long	United States
Nitroglycerin	1847	Ascanio Sobrero	Italy
Germ theory	1865	Louis Pasteur	France
Antiseptic surgery	1865	Joseph Lister	England
Discovery of nucleic acids	1869	Friedrich Miescher	Switzerland
Radioactivity	1896	Henri Becquerel	France
Discovery of radium	1898	Marie and Pierre Curie	Poland, France
Quantum theory	1900	Max Planck	Germany
Theory of relativity	1905	Albert Einstein	Germany
Identification of components of RNA and DNA	1909	Phoebus Theodore Levene	United States
Insulin	1922	Frederick Banting, Charles Best, John Macleod	Canada
Penicillin	1928	Alexander Fleming	England
Nylon	1937	Wallace Carothers	United States
Discovery of DNA as genetic material	1944	Oswald Avery	United States
Synthetic production of transuranium elements	1944	Glenn Seaborg, Arthur Wahl, Joseph Kennedy, Albert Ghiorso	United States
Determination of DNA structure	1953	Francis Crick, Rosalind Franklin, James Watson	England, United States
Polio vaccine	1954	Jonas Salk	United States
Laser	1957	Albert Sabin	United States
	1958	Charles Townes	
Cellular phones	1960	Theodore Maiman	United States
	1973	Martin Cooper	
MRI	1980	Paul Lauterbur	United States
Prozac	1988	Ray Fuller	United States
World Wide Web available to the public	1993	Tim Berners-Lee	Switzerland
HIV protease inhibitor	1995	Joseph Martin, Sally Redshaw	United States
DVD	1996	Many contributors	Japan
Human genome mapped	2007	Craig Venter	United States

Matter

- Matter
 - Anything that occupies space and has mass.
- Mass
 - Measure of the amount of matter that an object contains. (unit – metric grams (g))
 - Related to inertia – a tendency of a body at rest to be at rest
- Weight
 - The effect of gravity on matter

States of Matter

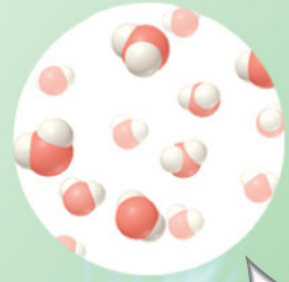
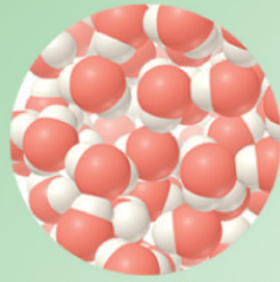
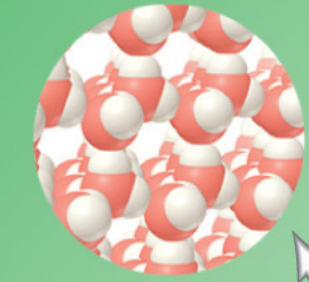


Increasing temperature

Ice

Water

Water vapor



Melting

Vaporizing



Freezing

Condensing



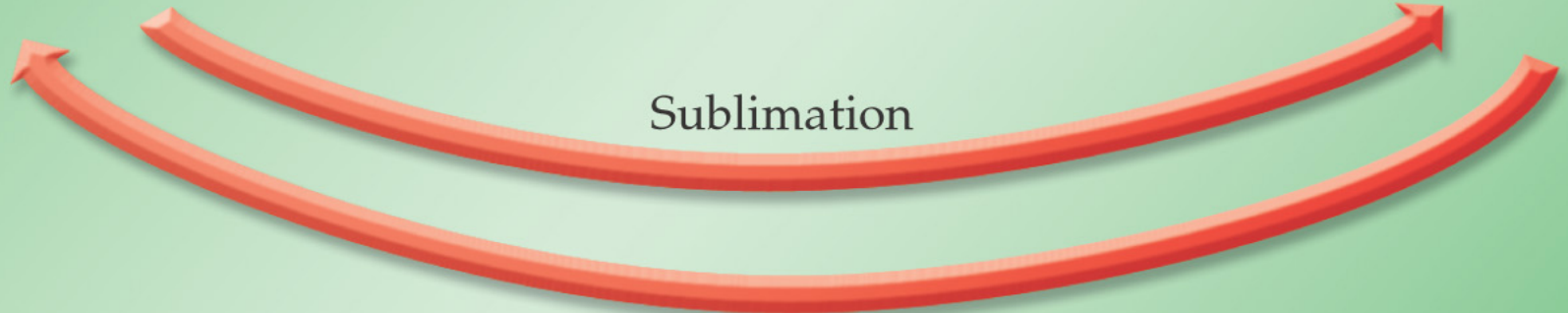
SOLID

LIQUID

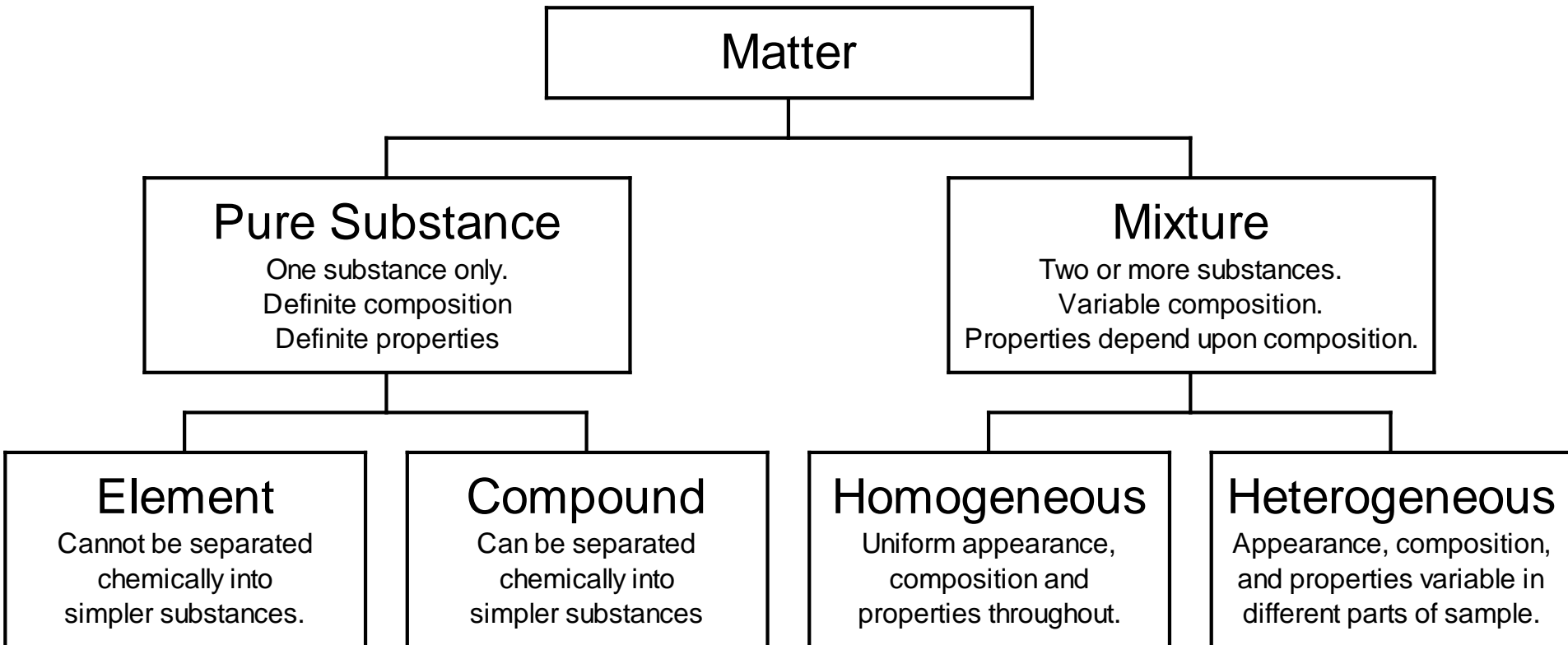
GAS

Sublimation

Deposition

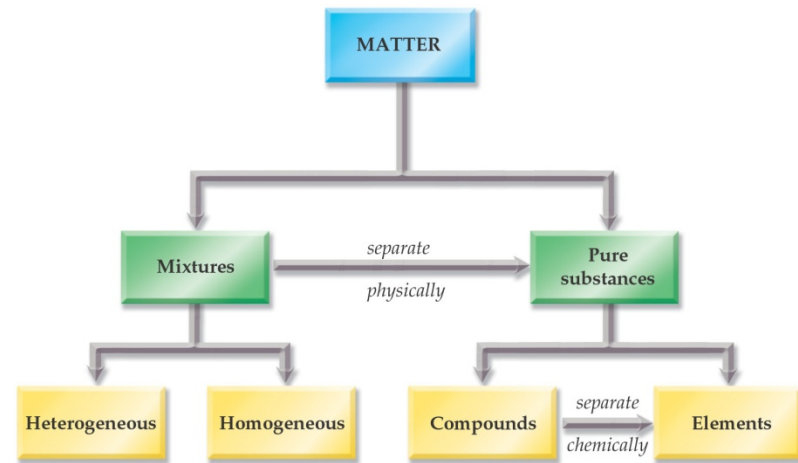


Classification of Matter



Properties of Al

- Aluminum (Al) metal cannot be decomposed into simpler substances by chemical reactions.
- Oxides of Al occur naturally in gem stones such as rubies and sapphires.
- Al is alloyed with copper (Cu), magnesium (Mg), and other elements to form lightweight materials to be used in construction of aircraft and rockets.
- Al ore (or bauxite) is electrolyzed to obtain metallic Al



Elements to know

Periodic Table

IA												VIIA				NOBLE GASES	
1 H 1.008	IIA										5 B 10.81	6 C 12.01	7 N 14.01	8 O 16.00	9 F 19.00	10 He 4.002	
3 Li 6.941	4 Be 9.012											13 Al 27.00	14 Si 28.09	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95
11 Na 23.00	12 Mg 24.30	III B	IV B	VB	VIB	VIIB	VIII	VIII	VIII	IB	II B	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 52.00	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (99)	44 Ru 101.1	45 Rh 102.9	46 Pd 106.4	47 Ag 107.9	48 Cd 112.4	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.3	57 La 138.9	72 Hf 178.5	73 Ta 180.9	74 W 183.9	75 Re 186.2	76 Os 190.2	77 Ir 192.2	78 Pt 195.1	79 Au 197.0	80 Hg 200.6	81 Tl 204.4	82 Pb 207.2	83 Bi 209.0	84 Po (209)	85 At (210)	86 Rn (222)
87 Fr (223)	88 Ra 226.0	89 Ac 227.0	104 Rf (261)	105 Db (262)	106 Sg (263)	107 Bh (262)	108 Hs (265)	109 Mt (266)	110 ?? (269)								

Lanthanide series

58 Ce 140.1	59 Pr 140.9	60 Nd 144.2	61 Pm (147)	62 Sm 150.4	63 Eu 152.0	64 Gd 157.3	65 Tb 158.9	66 Dy 162.5	67 Ho 164.9	68 Er 167.3	69 Tm 168.9	70 Yb 173.0	71 Lu 175.0
90 Th 232.0	91 Pa 231.0	92 U 238.0	93 Np (237)	94 Pu (244)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (251)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (260)

Actinide series