

Chemistry

Chapter 14

Central Science

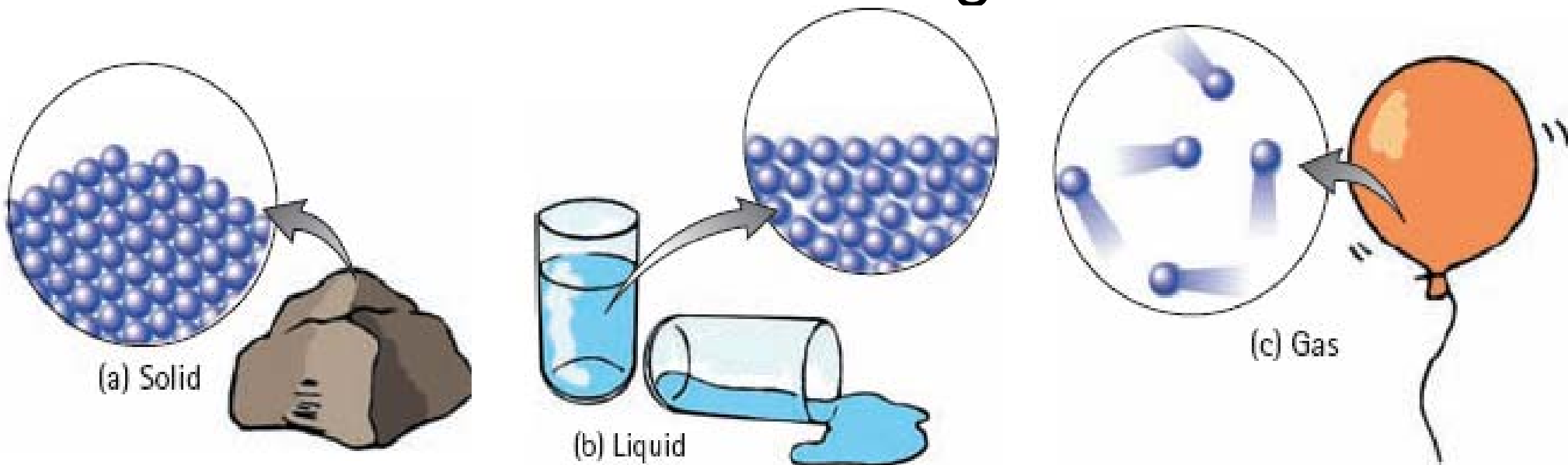
- Study of matter
- Transformations it can make
- Basic research—how things work
- Applied research—making useful things

Submicroscopic world

- Made of atoms
- Link to make molecules

Phases of Matter

- Three normal states at Earth's surface
 - Solid
 - Liquid
 - Gas
- How the molecules hold together



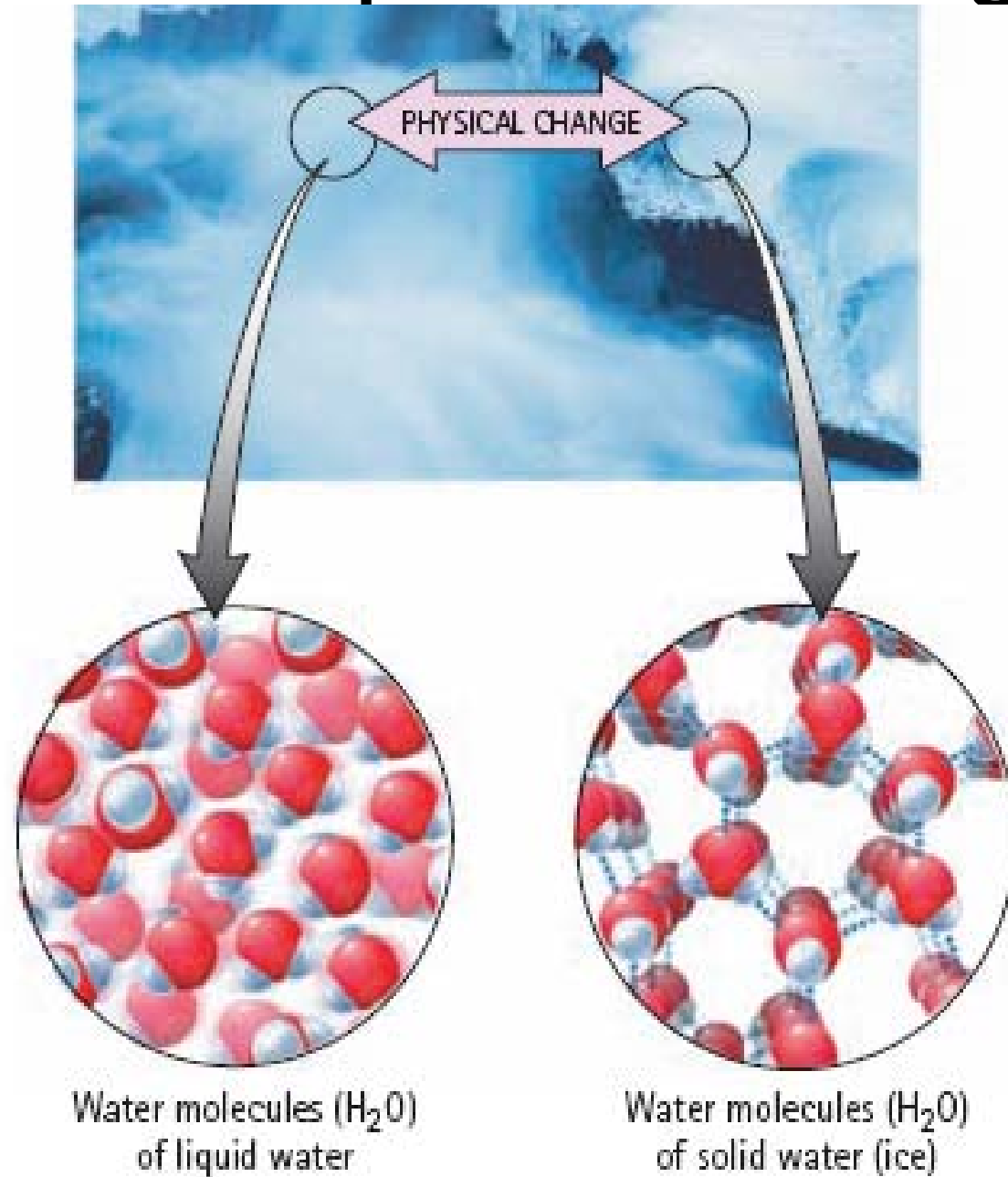
Properties

- What is it like?
- What phase?
- Color
- Reflectance
- Odor
- Density
- Texture ...

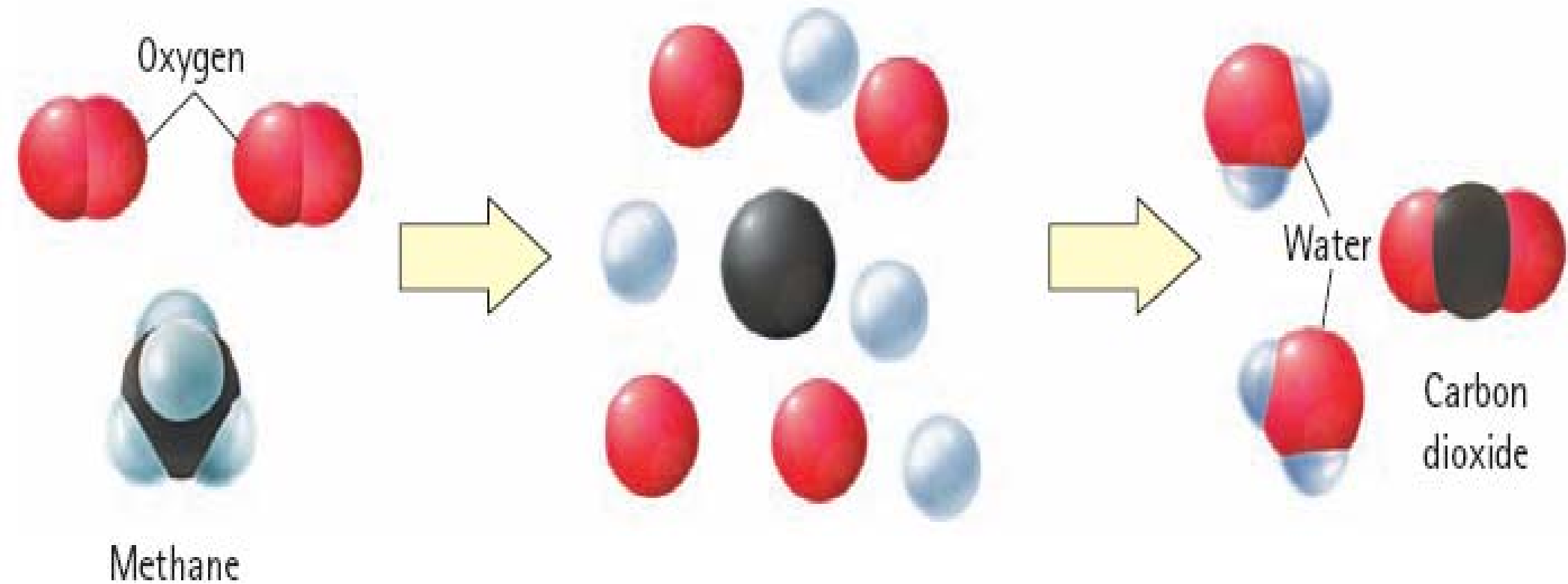
Properties

- Physical changes
 - Usually dependent on conditions
 - New substance NOT created
- Chemical changes
 - A reaction occurs
 - Transforms in to something different that has new properties

Water—phase change



Methane—chemical change



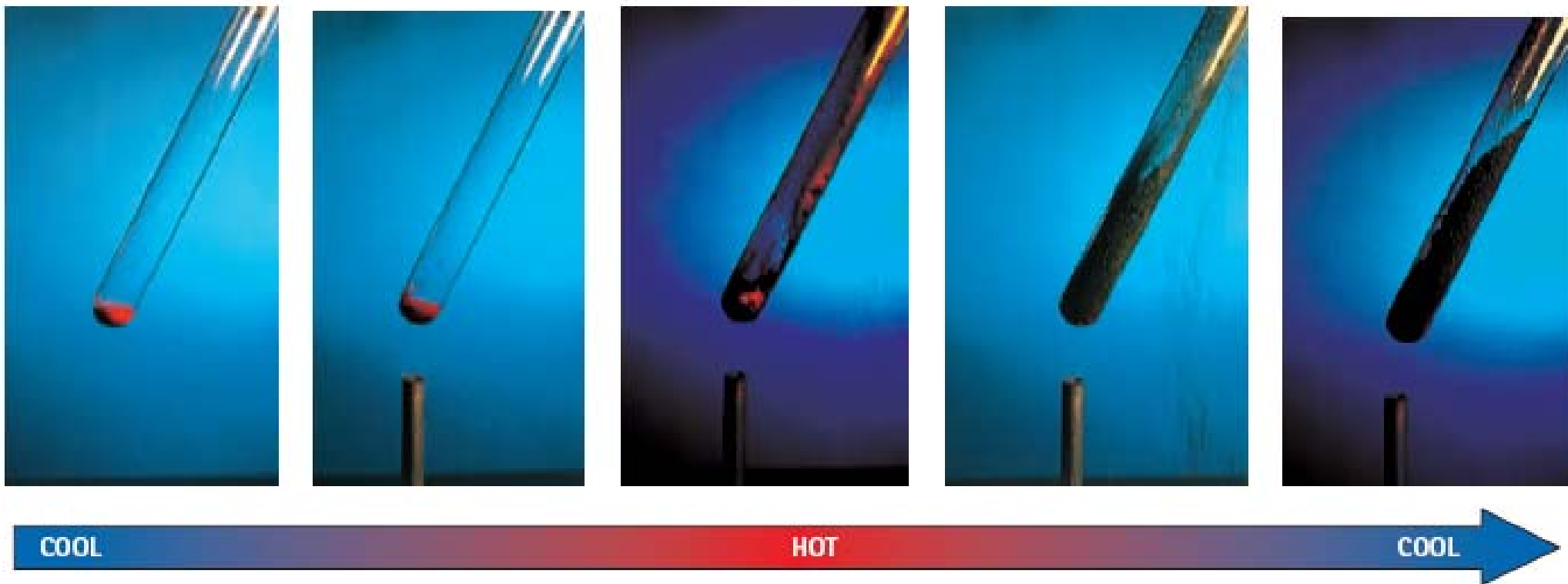
Guidelines to determine which has occurred

- Return to original conditions
 - Do you get the original substance back?
 - Warm it up
 - Cool it down
 - Goes from ice to water
 - Goes from water to ice
- Physical change



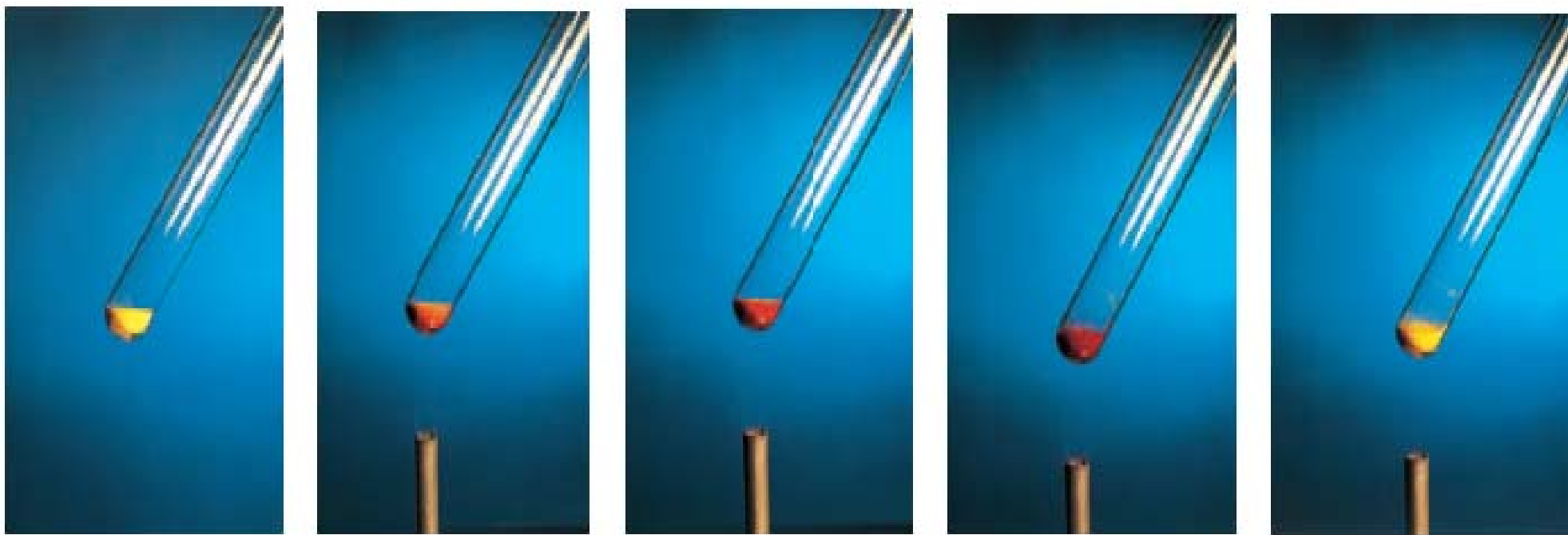
Guidelines to determine which

- Return to original conditions
 - Do you get the original substance back?
 - Warm it up
 - Cool it down
- Ammonium dichromate becomes ammonia, water vapor and chromium oxide



Guidelines to determine which

- Return to original conditions
 - Do you get the original substance back?
 - Warm it up
 - Cool it down
- Potassium Chromate returns to yellow powder



COOL

HOT

COOL

Elements

- Substances not bonded to other types of atoms
- May be single atoms in elemental formula
 - Au Gold
 - Li Lithium
- May have more than one atom to make molecules of that substance
 - O₂ oxygen
 - N₂ nitrogen

Compounds

- More than one type of atom in the molecule
- Has a **Chemical Formula**
- Sodium Chloride NaCl
- Ammonia NH_3
- Subscript tells how many of each
- (Subscript 1 is omitted)

MATTER

Pure

Element

Gold, Au
Sulfur, S₈
Nitrogen, N₂

Compound

Salt, NaCl
Carbon dioxide, CO₂
Ammonia, NH₃

Impure (mixture)

Homogeneous mixture

Solution

Air (N₂, O₂)
Salt water (NaCl, H₂O)
White gold (Au, Pd)

Heterogeneous mixture

Sand in water
Oil and water
Sand and salt

Suspension

Milk (water, solid proteins)
Blood (water, solid proteins)
Fog (air, tiny water droplets)

Properties of elements

- Very different from elements of their composition
- Sodium
 - Shiny soft metal,
 - melts at 97°C
 - Reacts violently with water
- Chlorine
 - Boils at -34°C
 - Toxic gas

Properties of Compound

Sodium Chloride

- Clear, brittle solid at room temperature
- Melts at 800° C
- Not toxic—table salt
- Not reactive with water

Naming compounds first word

- Start with compound to the more left side of periodic table

Legend:

- Metals
- Transition metals
- Nonmetals
- Noble gases
- Lanthanide series
- Actinide series

Callouts for He:

- Atomic number
- Symbol of element
- Atomic weight
- Name of element

1	1 H 1.0080 Hydrogen																VIII A									
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Naming compounds second word

- Add suffix *-ide* to the compound more to the right on the periodic table

The periodic table is color-coded to show different groups of elements. A legend in the center identifies these groups:

- Metals (Red)
- Transition metals (Orange)
- Nonmetals (Yellow)
- Noble gases (Green)
- Lanthanide series (Light Blue)
- Actinide series (Purple)

A callout box for Helium (He) shows its atomic number (2), symbol (He), atomic weight (4.003), and name (Helium).

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Naming compounds NaCl

- Sodium Chloride

Legend:

- Metals
- Transition metals
- Nonmetals
- Noble gases
- Lanthanide series
- Actinide series

Callout for Helium (He):

- Atomic number: 2
- Symbol of element: He
- Atomic weight: 4.003
- Name of element: Helium

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Naming compounds Li_2O

- Lithium Oxide

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Naming compounds CaF_2

- Calcium Fluoride

Legend:

- Metals
- Transition metals
- Nonmetals
- Noble gases
- Lanthanide series
- Actinide series

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Naming different compounds of same elements

- When more than one compound is formed from differing ratios of the same atoms, a prefix is added to distinguish them
 - Carbon Dioxide
 - Carbon Monoxide

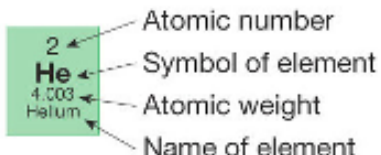
Naming Common Compounds

Some have traditional names

- Water
- Ammonia
- Methane
- Propane
- etc.

Naming compounds

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5	37 Rb 85.47 Rubidium	38 Sr 87.62 Strontium	39 Y 88.91 Yttrium	40 Zr 91.22 Zirconium	41 Nb 92.91 Niobium	42 Mo 95.94 Molybdenum	43 Tc (98) Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.90 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.87 Silver	48 Cd 112.40 Cadmium	49 In 114.82 Indium	50 Sn 118.69 Tin	51 Sb 121.75 Antimony	52 Te 127.60 Tellurium	53 I 126.90 Iodine	54 Xe 131.30 Xenon	
6	55 Cs 132.91 Cesium	56 Ba 137.34 Barium	57 TO 71	72 Hf 178.49 Hafnium	73 Ta 180.95 Tantalum	74 W 183.85 Tungsten	75 Re 186.2 Rhenium	76 Os 190.2 Osmium	77 Ir 192.2 Iridium	78 Pt 195.09 Platinum	79 Au 197.0 Gold	80 Hg 200.59 Mercury	81 Tl 204.37 Thallium	82 Pb 207.19 Lead	83 Bi 208.98 Bismuth	84 Po (210) Polonium	85 At (210) Astatine	86 Rn (222) Radon	
7	87 Fr (223) Francium	88 Ra 226.05 Radium	89 TO 103	57 La 138.91 Lanthanum	58 Ce 140.12 Cerium	59 Pr 140.91 Praseodymium	60 Nd 144.24 Neodymium	61 Pm (147) Promethium	62 Sm 150.35 Samarium	63 Eu 151.96 Europium	64 Gd 157.25 Gadolinium	65 Tb 158.92 Terbium	66 Dy 162.50 Dysprosium	67 Ho 164.93 Holmium	68 Er 167.26 Erbium	69 Tm 168.93 Thulium	70 Yb 173.04 Ytterbium	71 Lu 174.97 Lutetium	
				89 Ac (227) Actinium	90 Th 232.04 Thorium	91 Pa (231) Protactinium	92 U 238.03 Uranium	93 Np (237) Neptunium	94 Pu (242) Plutonium	95 Am (243) Americium	96 Cm (247) Curium	97 Bk (249) Berkelium	98 Cf (251) Californium	99 Es (254) Einsteinium	100 Fm (253) Fermium	101 Md (256) Mendelevium	102 No (254) Nobelium	103 Lw (257) Lawrencium	



- Metals
- Transition metals
- Nonmetals
- Noble gases
- Lanthanide series
- Actinide series