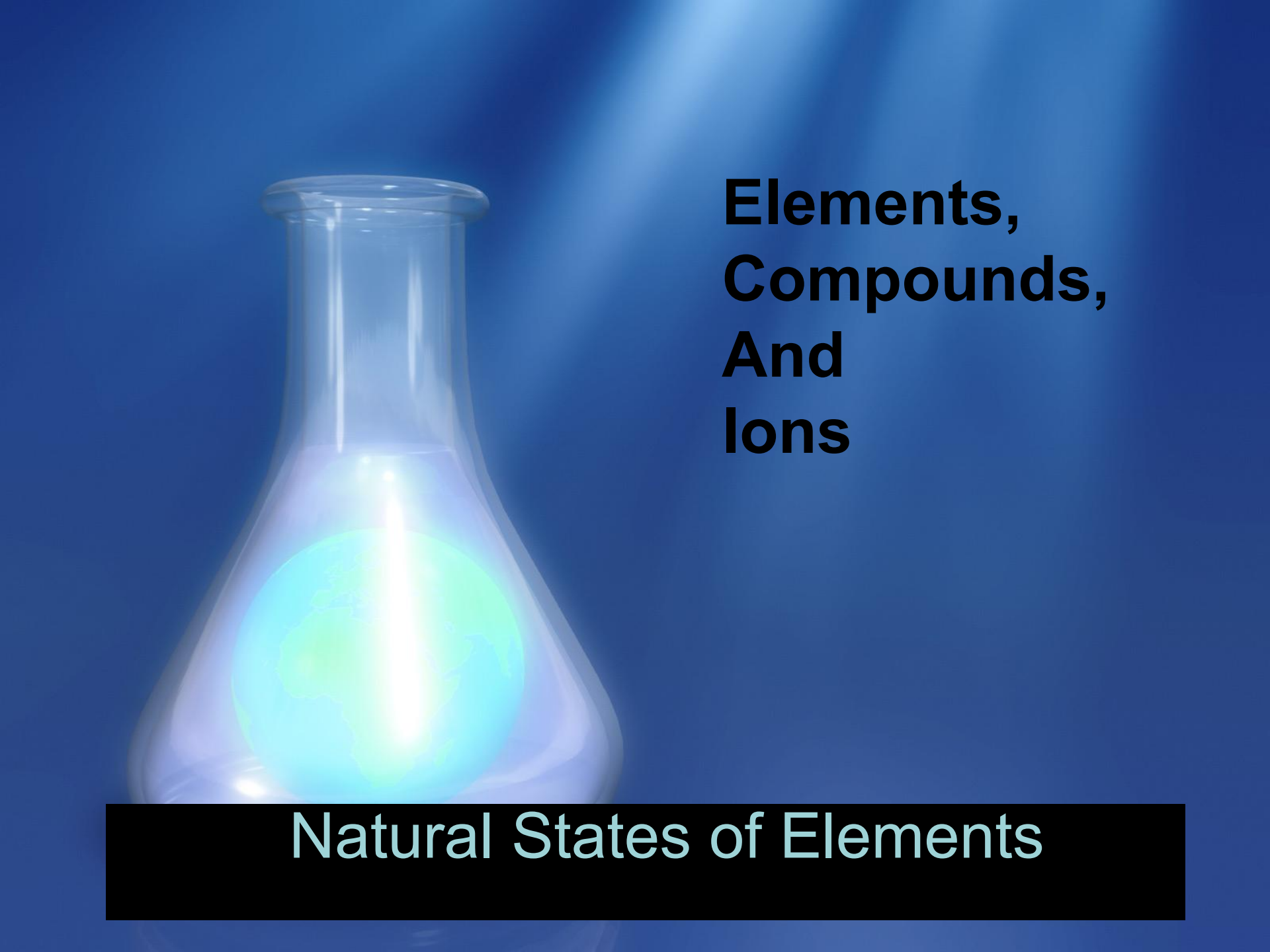


Elements, Compounds, And Ions

Natural States of Elements

Natural States of Elements

- The matter around us consists of many mixtures that contain compounds.
- Most elements are reactive and tend to combine with other elements to form compounds.
- But there are exceptions to this rule…

Natural States of Elements

–In 1849, gold nuggets found in California were virtually pure elemental gold, starting the Gold Rush.

–Platinum and silver are also found in nearly pure form.

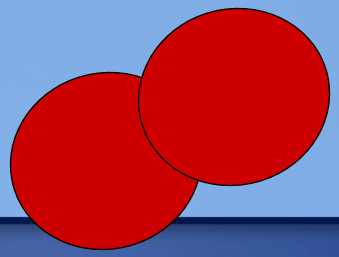
Natural States of Elements

–The atoms in Group 8 are called noble gases because they do not readily combine with the atoms of other elements.

–**Diatomic Molecules**

Diatomic molecules → a molecule composed of two atoms.

- Example: oxygen gas (O_2)



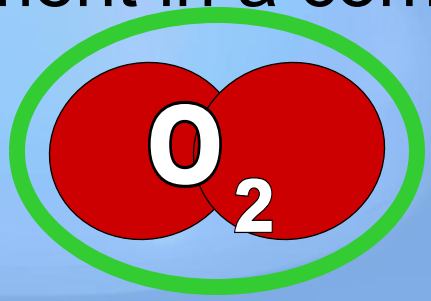
Natural States of Elements

–Elements that form diatomic molecules:

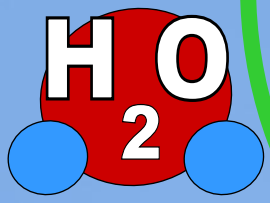
H, I, N, Cl, Br, O, F

–When these atoms are found as a free element, they are never alone.

- They are always a pair (like twins) or bound to another element in a compound.



or



Natural States of Elements

Table 3.5

Elements That Exist as Diatomic Molecules in Their Elemental Forms

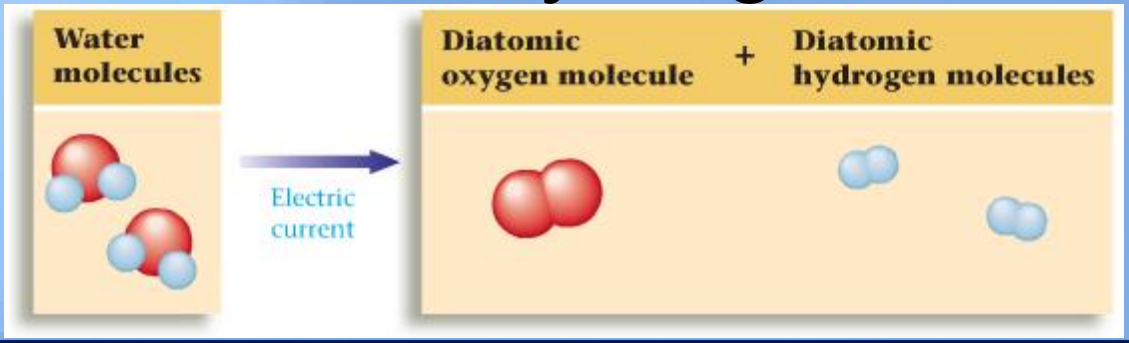
Element Present	Elemental State at 25 °C	Molecule
hydrogen	colorless gas	H_2
nitrogen	colorless gas	N_2
oxygen	pale blue gas	O_2
fluorine	pale yellow gas	F_2
chlorine	pale green gas	Cl_2
bromine	reddish-brown liquid	Br_2
iodine	lustrous, dark-purple solid	I_2

Natural States of Elements

–A molecule is a collection of atoms that behaves as a unit.

–Molecules are always electrically neutral (no charge).

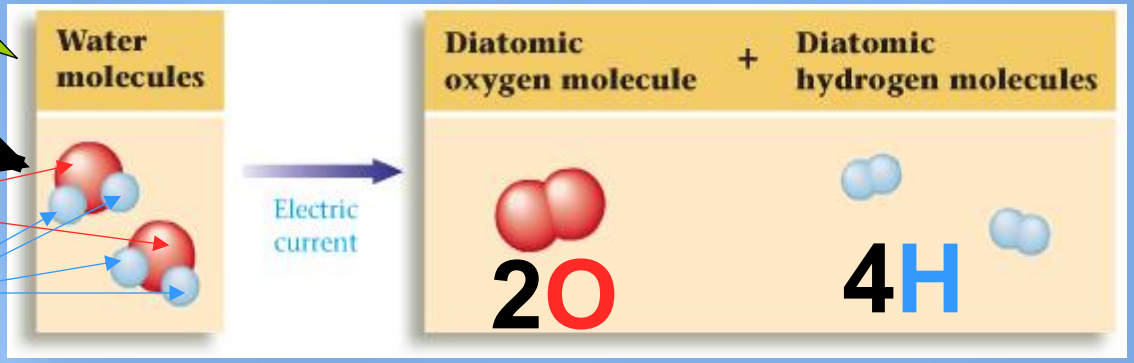
- An electrical current decomposes water into elemental hydrogen and oxygen.



This is a chemical reaction!

Natural States of Elements

2O
4H



–Only the grouping of the atoms changes.

–No atoms are created or destroyed.

- The same number of H atoms and O atoms are present both before and after.

Natural States of Elements

approximately

- Gases at room temperature (~25 °C):
  - –Noble gases (He, Ne, Ar, Kr, Xe, and Rn)
  - –Some diatomic molecules (H_2, N_2, O_2, F_2, Cl_2)
  - –Liquids at room temperatu
- Bromine (Br_2)
  - –Mercury

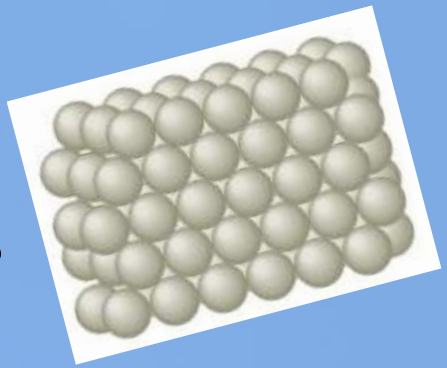
Natural States of Elements

Elemental Solids

–All of the other elements are solids in their elemental form.

- Gallium and cesium are solids at room temperature, but both melt at ~30 °C.

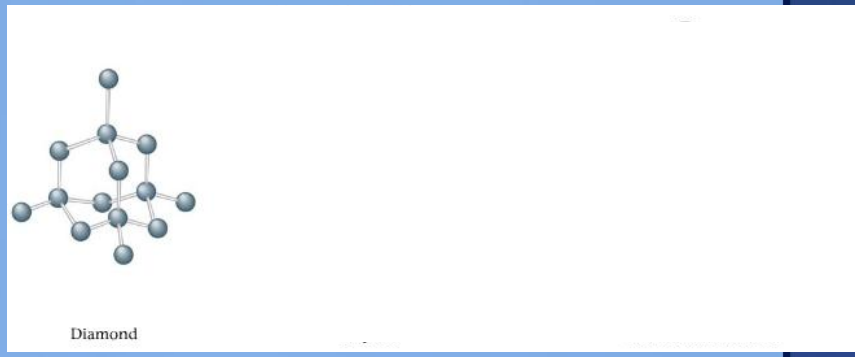
–Solid metals contain many atoms packed together.



–Solid nonmetallic elements are more varied.

Natural States of Elements

- Different forms of the same element can occur.
  - –Different forms of a given element are called *allotropes*.
  - –Example: Carbon has 3 allotropes.
    - Diamond
    - Graphite
    - Buckminsterfullerene



The End