

# Chemical Reactions

# Objectives

- Explore the properties of metals and non-metals
- Learn that different acids react in similar ways with metal carbonates and with metal oxides
- Describe the general salt preparations and how neutralisation reactions produce salts
- Represent elements by symbols and compounds by formulae
- Use word and symbol equations to describe these reactions

# Key Terms

- Malleable
- Semi-metals
- Neutralisation
- Carbonate
- Crystallisation
- Filtration
- Decompose
- Soluble
- Insoluble
- Precipitate
- Solubility
- Reaction
- Product

# Elements

- Elements can be classified into the following groups
  - Metals
  - Metalloids
  - Non-Metals

# White Gold

- Where do our salts come from



# White Gold

- Potassium chloride
- Sodium chloride
- Magnesium chloride



# White Gold

- Preserve food



# White Gold

- Roman Empire built near current Northwich, UK
- The Romans used lead salt pans to extract the salt from the brine.
- Salt pans and 1st century brine kilns have all been found around the Roman fort.



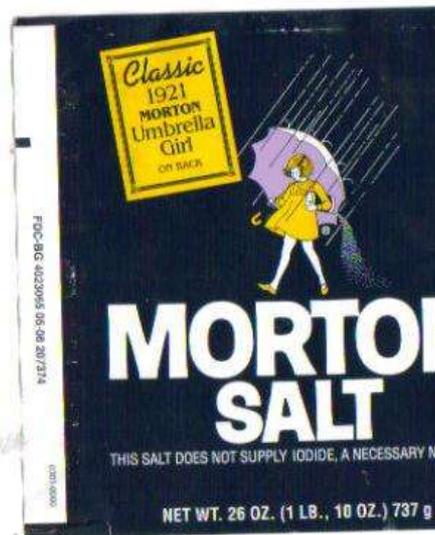
# White Gold



Salt Lake City, Utah (U.S)



Brittany, France



# To Think About

- What is the purpose of salt?
- How might global warming affect the location of sea salt production
- What are the health risks associated with a high intake of sodium chloride

# Metals and Non-Metals

# Metals

- Elements are classified as metals based on physical properties such as;
  - Hardness
  - Shininess
  - Malleability
  - Ductility
  - Conduct electricity
  - Conduct heat
  - Magnetic
  - Dense

# Hardness

- How hard is an element compared to another element
  - Diamonds are the hardest substance
  - Can be rated on Mohs hardness scale

Mohs Hardness Scale	
1. Talc Fingernail	6. Microcline Steel tool
2. Gypsum	7. Quartz
3. Calcite Copper coin	8. Topaz
4. Fluorite	9. Corundum
5. Apatite Knife-Glass	10. Diamond



# Luster (Shiny)

- Can be measured by how much light is reflected
- High quality mirrors often use silver in their makeup

# Malleability

- How easily an element can be pounded into a shape
- Gold is very malleable and can be pound into a foil 1 atom thick



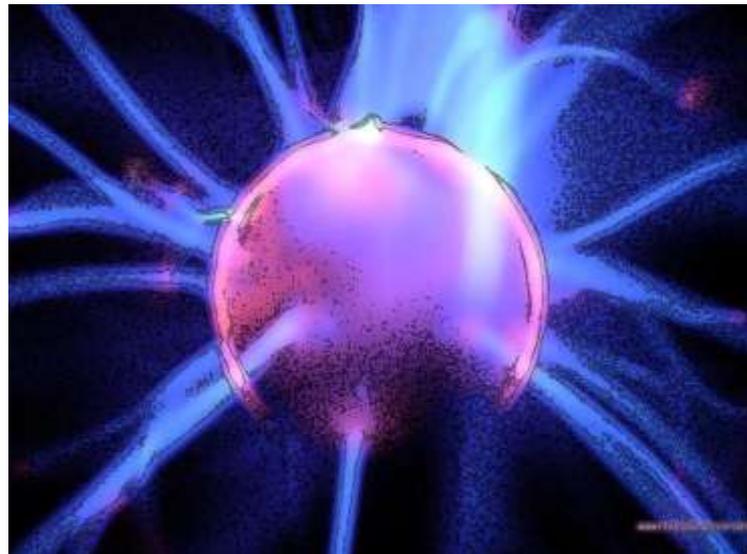
# Ductile

- The ability for an element to be pulled or drawn out into a long wire
- Copper is ductile and can conduct electricity.... So it is found in most wires



# Conductivity

- Most metals are good conductors
  - Conductors transfer heat and electricity well
- Gold, Copper, and Silver are all good conductors
- Au, Cu, and Ag are all in the same family



# Magnetism

- Some metals are attracted to magnets
  - Fe, Co, and Ni are all magnetic

Magnetic metals are necessary for motors and computers



# Melting Temperature

- Most metals have a very high melting temperature
- Tungsten... used in light bulbs, has a melting temperature of 3,400 degrees C.
- Mercury is an exception and is a liquid at room temperature



# Reactivity

- The ease and speed at which an element combines or reacts with other elements or compounds
- Na and K are very reactive and will react explosively with water, or even air
- Gold and Chromium are very unreactive



# What is Rust?

- Rust is a chemical reaction with iron and oxygen. FeO (Iron Oxide)
- When metals react with oxygen it is called corrosion



# Alloys

- A mixture of metals
  - Copper + Tin = Bronze
  - Copper + Zinc = Brass
  - Iron + Chromium + Vanadium = Stainless Steel



# Alkali Metals

- Group / Family 1
- Very Reactive
- Never found uncombined in nature
- In elemental form, they are very soft like butter
- Sodium and Potassium are important for living things
  
- NOTE:
  - Potassium and Lithium an exception in that they have a low density. They float in water
  - Sodium is an exception in that it is soft

# Alkaline Earth Metals

- Group / Family 2
- Reactive... but not as reactive as Alkalis
- Never found uncombined in nature
- Generally Hard
- Good Conductors
- Magnesium and Calcium are important Alkaline Earth Metals

# Transition Metals

- Groups 3 – 12
- Include most metals
- Groups in transition metals are not distinctly unique... Ie...  
Many transition metals are similar
- Generally hard and shiny
- Good Conductors of Electricity
  
- NOTE: Mercury is an exception. It is a liquid metal

# Mixed Groups

- Groups 13 – 16 include metals, non-metals, and metalloids.
- Not very reactive metals

# Lanthanides and Actinides

- Bottom of Periodic Table
- Known as Rare Earth Elements
- Fit in Periods 6 + 7 but are placed below to fit
- Similar Properties
- Uranium is an important actinide



# Nonmetals and Metalloids

# Nonmetals

- Elements that lack the properties of metals
- There are 17 Nonmetals
- Some Nonmetals are very common
- Living things need nonmetals such as:
  - Carbon
  - Hydrogen
  - Oxygen
  - Phosphorus
  - Sulfur
  - Nitrogen

# Nonmetals

- Many of the nonmetals are gases at room temperature
- Some nonmetals are solids at room temperature
  - Carbon and Iodine
- Bromine is the only nonmetal that is liquid at room temperature

# Nonmetal Properties

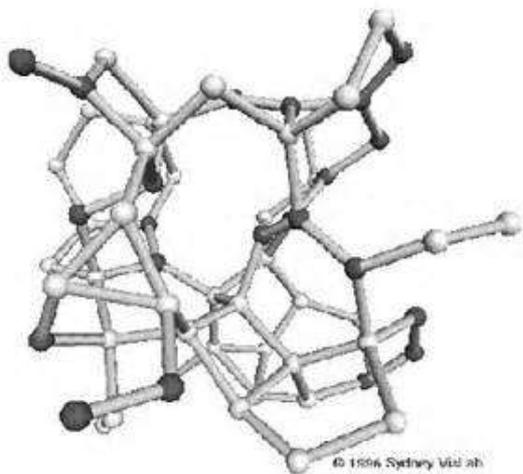
- Generally nonmetals have opposite properties of metals
- Most nonmetals are
  - Dull (Not Shiny)
  - Brittle (Not Ductile or Malleable)
  - Low Densities (lighter in weight per cc)
  - Poor Conductors of Heat and Electricity (Insulators)

# Nonmetal Compounds

- When two identical atoms share their electrons, they are called DIATOMIC MOLECULES
  - All gases and Halogens
  - $O_2$ ,  $N_2$ ,  $H_2$  are all diatomic molecules

# Carbon Family – Group 14

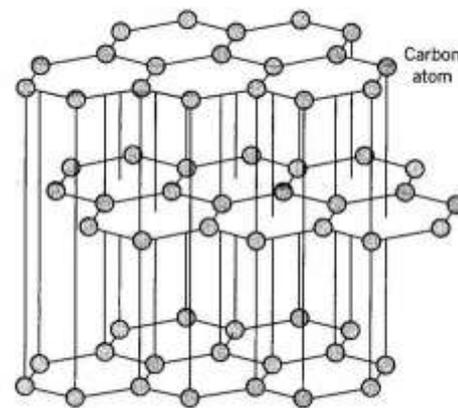
- One form of carbon, graphite, is a good conductor of electricity



Carbon



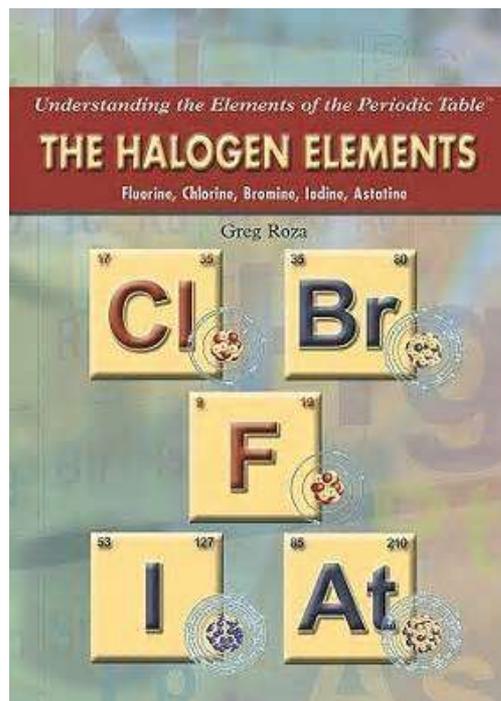
Diamond



Graphite

# Halogen Family – Group 17

- All atoms in the Halogen Family have 7 electrons
- Most halogens are nonmetals
- Halogens are very reactive, especially with Group 1



# Nobel Gases – Group 18

- All of group 18 are gases
- All Nobel Gases except helium have 8 electrons
- Nobel Gases do not react with other elements
- Nobel Gases are rare



# Hydrogen – A unique element

- Hydrogen makes up 90% of the atoms of the universe
- Hydrogen only makes up 1% of the earth's crust, water, and atmosphere
- Most hydrogen is found combined with oxygen....  $H_2O$
- When electricity is passed through water, the bond between the oxygen and hydrogen are broken and  $H_2$  molecules form

# Metalloids

- On the border between metals and nonmetals are 7 elements that have both metal and nonmetal properties
- Boron, Silicon, Germanium, Arsenic, Antimony, Tellurium, Polonium

5 <b>B</b>	6 <b>C</b>		
13 <b>Al</b>	14 <b>Si</b>	15 <b>P</b>	
31 <b>Ga</b>	32 <b>Ge</b>	33 <b>As</b>	34 <b>Se</b>
49 <b>In</b>	50 <b>Sn</b>	51 <b>Sb</b>	52 <b>Te</b>
81 <b>Tl</b>	82 <b>Pb</b>	83 <b>Bi</b>	84 <b>Po</b>

# Semiconductor

- Some metalloids, such as silicon, are very useful because they have a varying ability to conduct electricity
- They are able to release outer electrons that are mobile

