Grade 9 Science

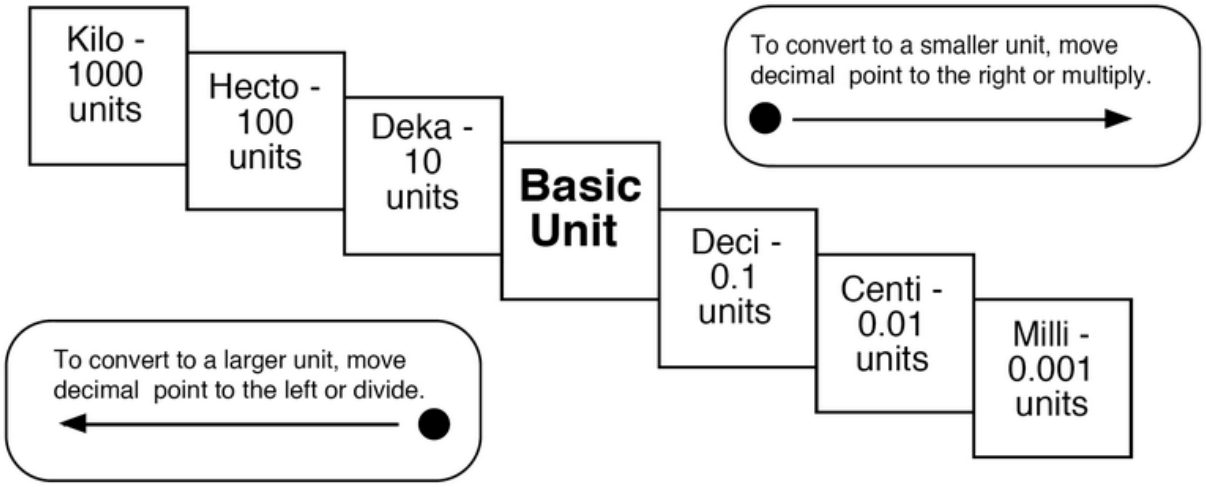
Atoms, Elements and Compounds

Class 1

Overall Expectations

- Assess social, environmental, and economic impacts of the use of common elements and compounds, with reference to their physical and chemical properties
- Investigate, through inquiry, the physical and chemical properties of common elements and compounds
- Demonstrate an understanding of the properties of common elements and compounds, and of the organization of elements in the periodic table

Conversions Review



Conversions Review

Volume to Capacity Conversions

1 cm^3 = 1 ml

1000 cm^3 = 1 L

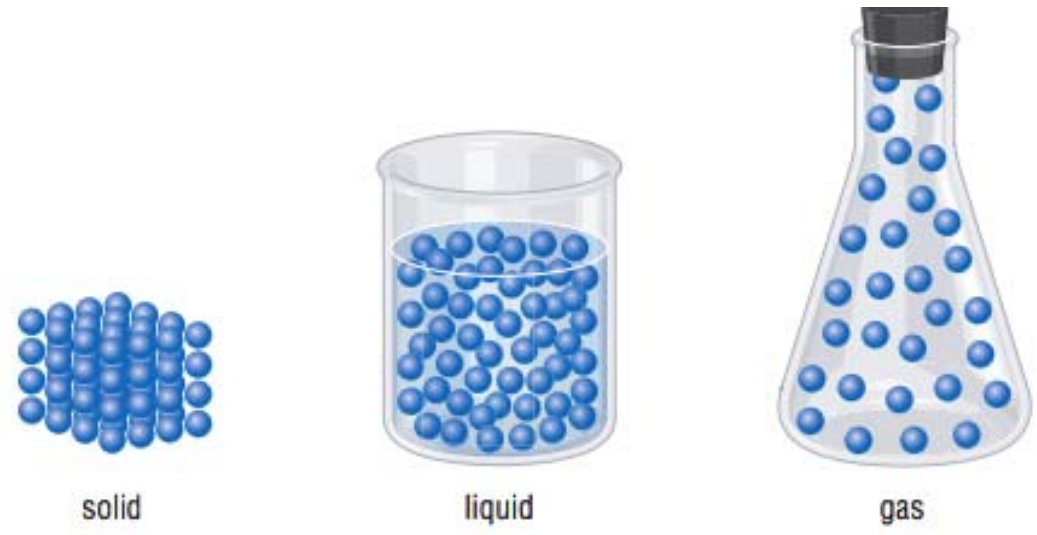
1 dm^3 = 1 L

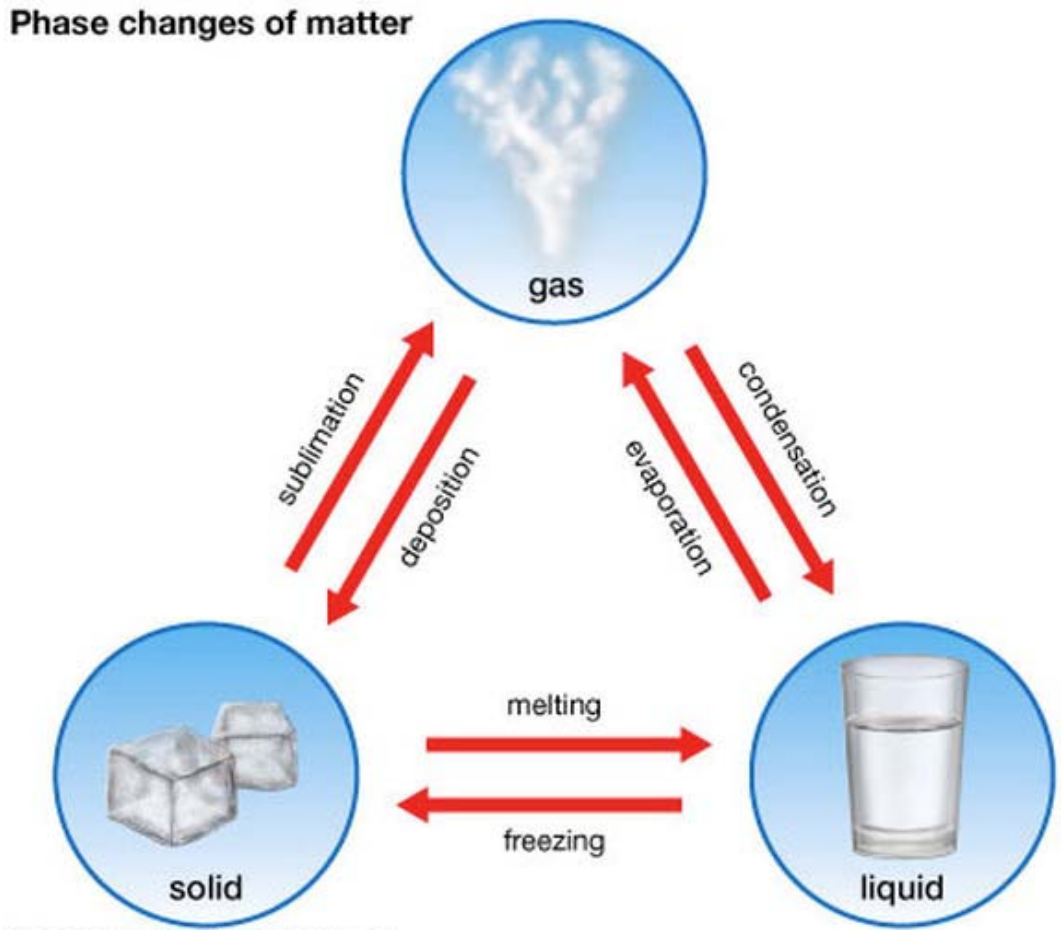
1 m^3 = 1000 L

1 m^3 = 1 000 000 cm^3

The Particle Theory of Matter

- All matter is made of tiny particles with empty space between them
- Different substances are made of different kinds of particles
- Particles are in constant random motion
- Particles move faster when temperature increases
- Particles attract each other





Pure Substances and Mixtures

- Pure substance – contains only one type of particle
  - Ex: Distilled water, Helium in balloons
- Mixtures – contains more than one type of particle
  - Ex: Granola bar, Tap water, Air
  - Types of mixtures:
    - Mechanical Mixture – distinguishable particles
    - Solution – indistinguishable particles
    - Alloy – mixture of metals

Checkpoint

Identify the following as a mechanical mixture or a solution:

a) The plastic lenses on your glasses

b) Chocolate chip ice cream

c) Tea without the tea leaves

d) Pizza

e) Garbage in a garbage can

Physical Properties

- Physical Properties – a characteristic of a substance that can be determined without changing the composition of that substance
  - Qualitative: color, shape, texture, smell
  - Quantitative: mass, length, temperature

Terms to Know

- **Lustre** – how shiny is it?
- **Optical Clarity** – how clear is it?
- **Brittleness** – how fragile is it?
- **Viscosity** – how does it resist being poured?
  - Honey = very viscous; Water = not viscous
- **Malleability** – how easy is it to hammer it into thin sheets?
- **Ductility** – how easy is it to pull into a fine strand?
- **Conductivity** – how easy is it to allow electricity to pass?

Characteristic Physical Properties

- Physical properties are used to identify a substance
  - Density
  - Freezing/Melting Point
  - Boiling Point

Density

- Density – ratio of its mass to volume

$$d = \frac{m}{V}$$

mass

volume

Units: g/cm^3 (solid)
g/ml (liquid)

Table 1 Densities of Common Metals (at Room Temperature and Atmospheric Pressure)

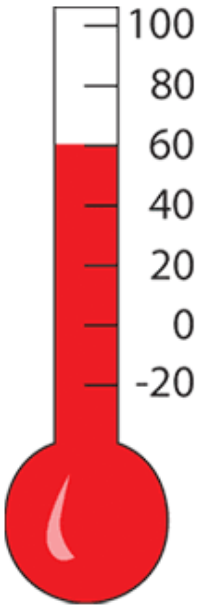
Metal	Density (g/cm^3)
aluminum	2.70
zinc	7.13
iron	7.87
copper	8.96
silver	10.49
lead	11.36
mercury	13.55
gold	19.32

Checkpoint

Calculate the density of a metal sample that is 18cm x 9.21cm x 4.45cm and has a mass of 14.25kg. What is the identity of the metal?

Freezing/Melting/Boiling Point

- Freezing Point – temperature at which substance turns from liquid into solid
- Melting Point – temperature at which substance turns from solid to liquid
- Boiling Point – temperature at which substance turns from liquid to gas
- These are unique to every substance



Physical Change

- Physical Change – when the composition of the substance is unchanged and no new substances are produced
- Ex:
  - Ice melting
  - Folding paper into a paper crane
  - Cutting an apple

Chemical Properties

- Chemical Properties – a characteristic of a substance that is determined when the composition of the substance is changed and one or more new substances are produced

Figure 2 Inside a fireworks tube

Chemical Change

- A change in the starting substance or substances and the production of one or more new substances
- Ex:
  - Fireworks
  - Frying an egg
  - Garbage rotting

Chemical Change

- Evidence of a chemical change:
  - Change of colour
  - Change of odour
  - Formation of bubbles
  - A new solid appears (precipitate)
  - Change in temperature
  - Formation of light
  - Irreversible

Checkpoint

Identify the following as a physical or chemical change:

a) Water boils and turns into steam

b) Wood is sawed and made into a toy box

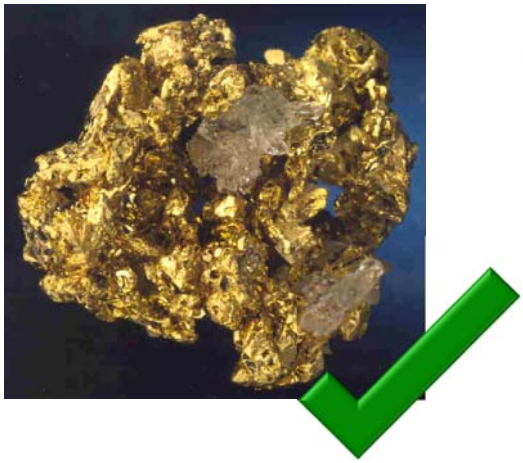
c) Firewood burns and ashes remain

d) Orange Kool-Aid crystals are stirred into a pitcher of water

e) Sugar, eggs, and flour are mixed and baked into cookies

What is an Element?

- Element: A pure substance that cannot be broken down into a simpler chemical substance by physical or chemical means



Element Symbol

Carbon

6

C

12.011

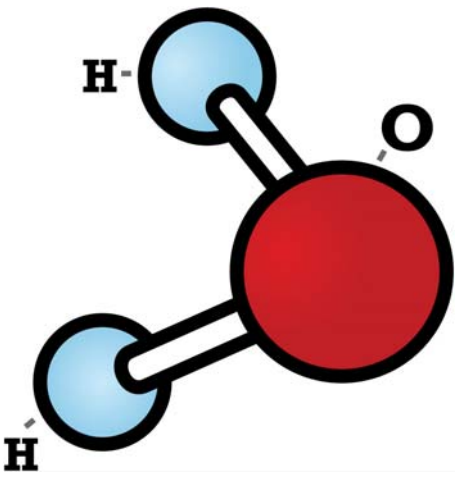
- An abbreviation for the element
- Some are based on Latin names
  - Silver is Ag (Latin: *Argentum*)
  - Gold is Au (Latin: *Aurum*)
  - Copper is Cu (Latin: *Cuprum*)

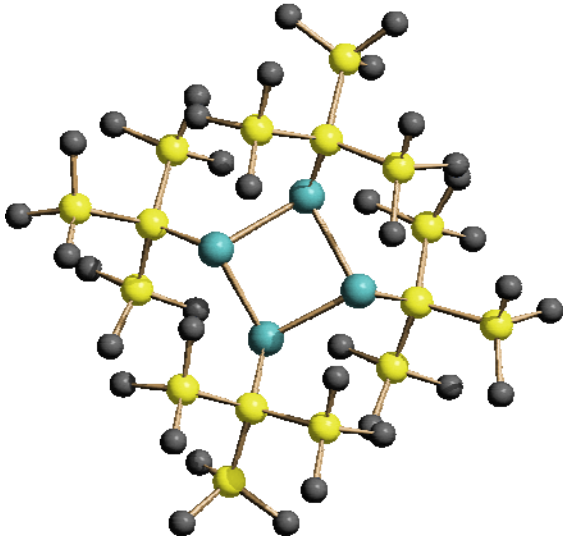
Checkpoint

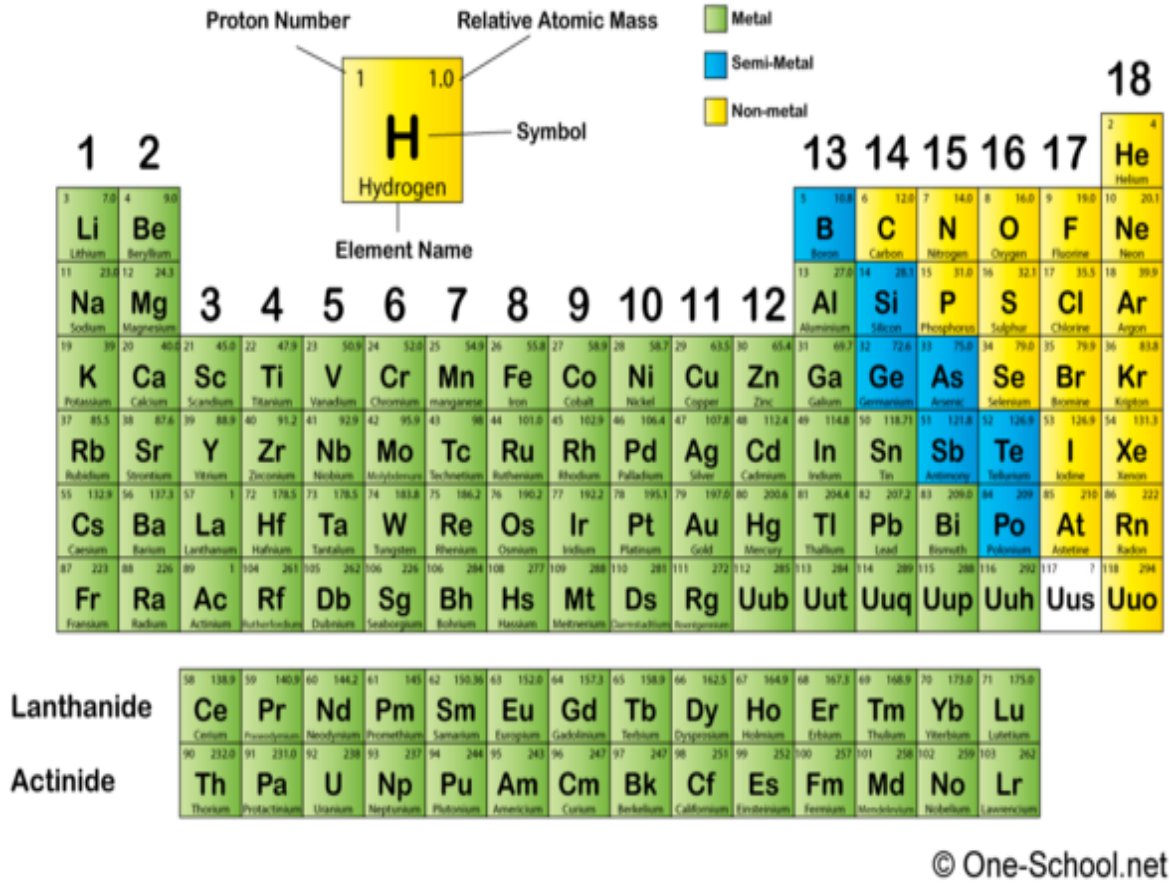
- Which of the following substances are elements?
  - Bronze
  - Tin
  - Chromium
  - Propane
  - Nickel
  - 14-K Gold

What is a Compound?

- A pure substance composed of two or more different elements that are chemically joined







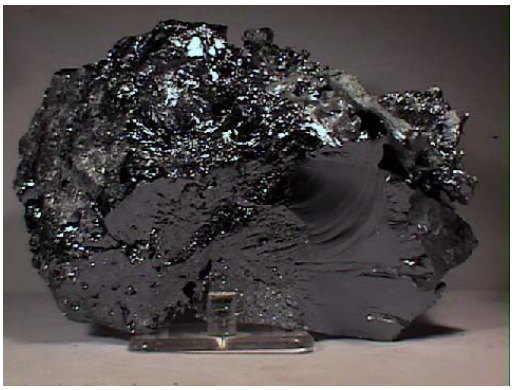
Metals vs. Non-metals

- **Metals**
  - Lustrous
  - Malleable
  - Ductile
  - Conducts heat and electricity

- **Non-metals**
  - Gases
  - Powdery solids
  - Does not conduct heat or electricity

Metalloids

- Elements located on the staircase
- Has properties of metals and non-metals



Checkpoint

Name two physical characteristics of a

a) Metal

b) Non-metal