Unit 2

2/3/20

Matter

anything that takes up space (volume) & has mass (amount)

4 States of Matter (phases)

	solid	liquid	gas	plasma
particles	tightly packed together	close together	far apart	very far apart
shape	definite	indefinite	indefinite	
volume	definite	definite	indefinite	
movement	vibrate in position	slide past each other	fast & random	very fast & random
kinetic energy (energy of motion)	least			most

→ a gas whose valence electrons have been removed due to extreme heat

Physical Properties/Changes

'verbs 'nouns

- can be observed w/o changing the matter's composition

Examples

- mass
- volume
- state of matter
- melting/freezing pt.
- boiling/condensing pt.
- odor
- color
- texture
- density
- malleability
- cutting
- ductile
- solubility - ability to dissolve

Chemical Properties/Changes

'actions 'ideas

- can ONLY be observed when changing matter's composition (something new forms)

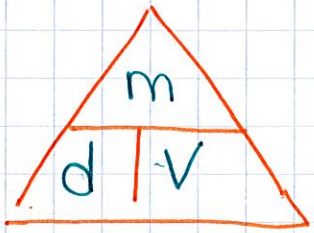
Examples

- reactivity
- corrosion
- tarnishing
- rusting
- digesting
- combusting
- cooking
- decomposition

Density

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

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

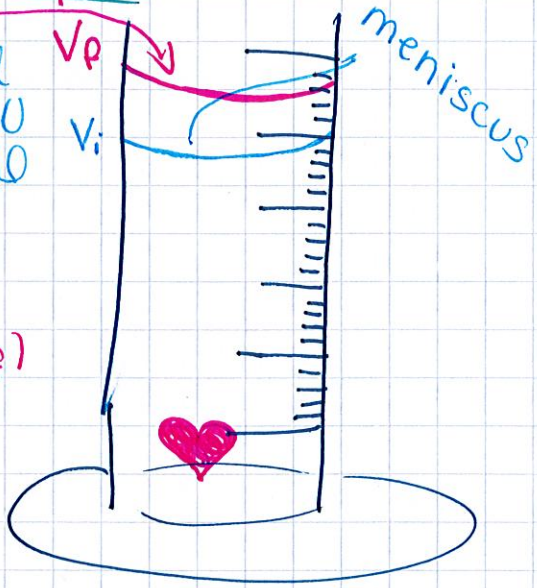


Volume of a square

$$V = l \times w \times h$$

Volume of a weirdly shaped object - water displacement

1) Fill graduated cylinder w/ H_2O read the initial volume (V_i)
2) Place object in H_2O. Read the final volume (V_f)
3) $V_{object} = V_f - V_i$

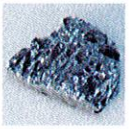


Density Examples d = m/V

1.  A piece of copper has a mass of 11.5 g and its volume was determined to be 1.283 mL. Calculate its density.

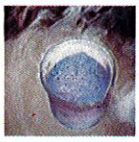
m V

$$d = \frac{m}{V} = \frac{11.5\,g}{1.283\,mL} = 8.96\ g/mL$$

2.  A chunk of silver has a density of 10.49 g/cm^3 and its volume was calculated to be 5.88 cm^3. What is the mass of the silver?

d V

$$m = d \cdot V = 10.49\ \frac{g}{cm^3} \cdot 5.88\,cm^3 = 61.7\,g$$

3.  What is the volume of a sample of liquid oxygen with a mass of 7.89 g and a density of 1.141 g/cm^3, what is the volume?

m d

$$V = \frac{m}{d} = \frac{7.89\,g}{1.141\ \frac{g}{cm^3}} = 6.91\,cm^3$$

4.  A cube of aluminum has a mass of 34.02 g. The length is 3.6 cm, the height is 1.4 cm, and its width is 2.5 cm. Calculate the volume of the cube and then the density of the aluminum.

m l h w

$V = l \times w \times h = 3.6\text{cm} \times 2.5\text{cm} \times 1.4\text{cm}$

$= 13\ \text{cm}^3$

$d = \frac{m}{V} = \frac{34.02\text{g}}{13\text{cm}^3} = 2.6\ \text{g/cm}^3$

5.  A piece of glass was found at a crime scene and the forensic scientist needs to determine what it is made from. He finds the mass of the glass to be 18.85 g and he uses water displacement to determine its volume. He fills a graduated cylinder with water and determines the initial volume to be 34.3 mL. After that, he carefully lowers the glass into the cylinder and reads the final volume to be 49.9 mL. Calculate the volume of the glass sample and the density. Use the chart below to determine the type of glass.

m V_i V_f

Type of Glass	Density (g/cm^3)
Sapphire glass	3.98
Flint glass	3.0
Common glass	2.6
Gorilla glass	2.54
Pyrex glass	2.21
Lexan glass	1.21

$V_{glass} = V_f - V_i = 49.9\text{mL} - 34.3\text{mL} = 15.6\text{mL}$

$d = \frac{m}{V} = \frac{18.85\text{g}}{15.6\text{mL}} = 1.21\ \text{g/mL}$

2/4/20

Matter

Pure Substances
- only have 1 type of matter in it

Elements
1 type of atom

- 118 elements
  - 92 occur naturally
  - 26 man-made

cannot be broken down by chemical or physical changes (on nuclear)

Ex)
K - potassium (kalium)
Au - gold (aurum)
W - tungsten (wolfram)
Ag - silver (argentium)

Compounds
2 or more elements chemically bonded together

- can be broken down by chemical changes but not physical changes

Ex) H_2O - water
NaCl - salt
CO_2 - carbon dioxide
$C_6H_{12}O_6$ - glucose
$C_{12}H_{22}O_{11}$ - table sugar
NaOCl - bleach

Mixtures
- a physical blend of 2 or more pure substances

Heterogeneous mixtures
not uniform

Ex) cap'n crunch cereal
mixed salad
trail mix
dirt
granite

Homogeneous Mixtures (Solutions)
uniform

Ex) coffee
coca-cola
paint
make up
Cheerios
alcohol
bronze (Cu & Sn)

can be separated by phyical changes
1) by hand
2) by magnet
3) by filtration
4) by evaporation
5) by chromatography
6) By distillation