1a. multiple proportions
b. conservation of mass
c. definite proportions

2a. water – substance, molecule, compound
b. NaCl – compound, substance
c. sea water – mixture
d. H_2 – molecule, substance

3. 2.51 moles $C_{12}H_{22}O_{11}$

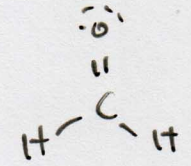
molar mass = $12 \times \overset{C}{12.01} + 22 \times \overset{H}{1.01} + 11 \times \overset{O}{16.00}$

= 342.34 g/mol

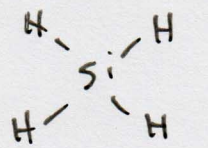
2.51 mol × 342.34 $\frac{g}{mol}$ = 859.27 g

4. $Fe(NO_3)_3$ iron (III) nitrate
CaO calcium oxide
$Mg(OH)_2$ magnesium hydroxide
Li_2CO_3 lithium carbonate
$NaNO_2$ sodium nitrite
KBr potassium bromide

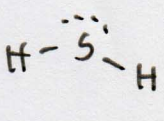
5. aluminum bicarbonate Al^{+3} HCO_3^- $Al(HCO_3)_3$
ammonium phosphate NH_4^+ PO_4^{-3} $(NH_4)_3PO_4$
potassium sulfate K^+ SO_4^{-2} K_2SO_4
hydrogen sulfide H^+ S^{-2} H_2S
beryllium nitride Be^{+2} N^{-3} Be_3N_2
iron(II) cyanide Fe^{+2} CN^- $Fe(CN)_2$



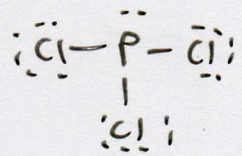
trigonal planar



tetrahedral



bent



trigonal pyramidal

linear

polar non-polar polar polar polar

O : $1s^2 2s^2 2p^4$

S : $1s^2 2s^2 2p^6 3s^2 3p^4$

← Both atoms have 6 valences electrons, so both atoms need two electrons to reach octet.

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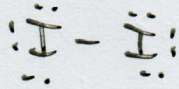
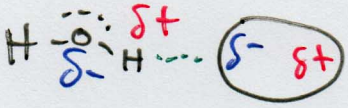
dispersion forces – attractive forces created by temporary dipoles





Temporary dipoles can be created in two different ways!

1) Molecules can experience a sudden uneven distribution of electrons due to the molecule moving around in space.

2) A polar molecule can induce (cause) a dipole to form on a non-polar molecule

If there are enough of these temporary dipoles, they can create enough intermolecular forces to cause solids or liquids to form. These forces due to temporary dipoles are known as dispersion forces.

I_2 is a non-polar molecule because it is linear and it is composed of two of the same atom (no permanent dipole). Because I is a large atom, it is able to form temporary dipoles. The dispersion forces in I_2 are strong enough that iodine can form a solid at room temperature.

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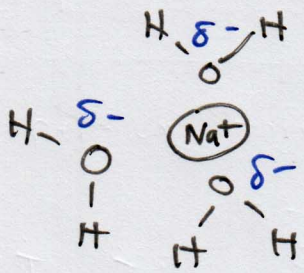
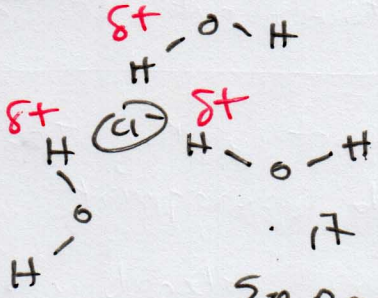
hydrogen bonds – dipoles created whenever H is in a bond with O, N, or F (has a large difference in electronegativity)

aqueous solutions of ions

water-based (water is the solvent)

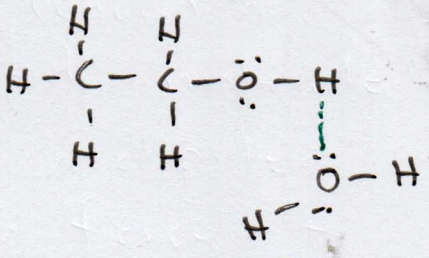




When an ionic substance is able to dissolve in water, it is because the ions separate and are surrounded by water. Some ionic substances are not soluble in water because the attractions between ions is stronger than the attraction between the ions and water.

aqueous solutions of covalent molecules

H_2O (water) + ethanol



Ethanol and other covalent substances form solids and liquids not because of ions attracting but because of intermolecular forces (dipoles). This means that when covalent substances dissolve in water, those substances do not have to have bonds break. The molecules remain intact as the IMFs are overcome.

Temperature is a measure of the average kinetic energy of the atoms/molecules in a sample.

- A solid or liquid will form when the attractive forces between molecules (IMF) are able to overcome the kinetic energy due to temperature.
- A solid or liquid will melt or boil when KE due to temperature increases to the point the IMFs are no longer able to hold molecules together.

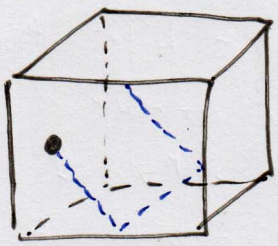
Quiz #2

- Lewis dot structures
- Chapter 5
  - balancing reaction equations
  - molar mass + amu — 1 mol amu = 1 g
  - stoichiometry → calculating how much product can be produced or how much reactant is needed

    grams → moles → moles → grams
  - solutions – solute, solvent, dissolve, soluble
    - concentration
      - molarity
      - % mass (ppm)
- Chapter 6
  - phases of matter – solid, liquid, gas
    - microscopic vs macroscopic
    - phase changes
  - intermolecular forces
    - dipole – dipole
    - dispersion
    - hydrogen bonding
  - forming solutions with covalent vs ionic substances

↓ not on quiz #2

ideal gas – a theoretical gas in which gasses of any substances all have the same behavior



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

$PV = nRT$

- gas molecules effectively have no volume (would affect V)
- gas molecules have no IMF (would affect P)
- if gas molecules collide, they don't lose any energy (would affect T)