**Water chemistry** (chapters 2 and 6)  **Page 1**

Water (H2O)

H

O

H

• The most abundant molecule in living things

√ Our bodies are about half water by weight

Fig 2.4

Water has many properties that are essential to sustaining life

• Water dissolves many substances

√ This allows substances to be easily transported in body fluids

• Water cools when it evaporates

√ We can lower body temperature through sweating

**Water chemistry Page 2**

Hydrophilic molecules (also called polar or lipophobic molecules)

Molecules that dissolve in water

√ Ex: Ions (salts), carbohydrates, proteins

Fig 2.6

Hydrophobic molecules (also called non-polar or lipophilic molecules)

Molecules that do not dissolve in water

√ Ex: Fats, oils, waxes

• Molecules that are hydrophobic usually have large regions made of

only carbon and hydrogen atoms

The "like mixes with like" principle:

Hydrophilic molecules mix with other hydrophilic molecules, not with

hydrophobic molecules

Hydrophobic molecules mix with other hydrophobic molecules, not with hydrophilic molecules

**Water chemistry Page 3**

Dissolve

When molecules become evenly spread out with a liquid

• Solute = The substance that is dissolved in the liquid

• Solvent = The liquid that does the dissolving

√ Water is the solvent in all body fluids

• Solution = The liquid with the solute dissolved in it

Diffusion

The movement of a solute from an area of its high concentration to an area of its low concentration

• Cell membranes are barriers that prevent most solutes from diffusing

through them

√ Water can pass through cell membranes

Fig 6.3

**Water chemistry Page 4**

Osmosis

The movement of water across a cell membrane towards whichever side has the highest solute concentration

• “Water moves towards solutes”

• Hypertonic = A solution with a higher solute concentration than a

cell

√ Cells lose water by osmosis in hypertonic solutions

√  The cell will shrink and crenate (shrivel)

• Hypotonic = A solution with a lower solute concentration than a

cell

√ Cells gain water by osmosis in hypotonic solutions

√  The cell will enlarge and may lyse (burst)

• Isotonic = A solution with an equal solute concentration to a cell

√ Cells stay the same size in isotonic solutions because they

don’t gain or lose water through osmosis

√ Blood and other body fluids are isotonic solutions

√ Most hospital IV solutions are also isotonic solutions

Figs 6.7, 6.8, and 6.13

**Water chemistry Page 5**

Acid

Any molecule that adds H+ ions to a solution

• Examples:

HCl -> H+ + Cl–

Hydrochloric acid

H2CO3 -> H+ + HCO3–

Carbonic acid

Table 2.2

Base

Any molecule that removes H+ ions from a solution

• Examples:

OH– + H+ -> H2O

Hydroxide ion

HCO3– + H+ ->H2CO3

Bicarbonate ion

Table 2.2

**Water chemistry Page 6**

pH scale

A number (from 0 to 14) that indicates the H+ concentration of a

solution

• The pH is how acidic or how basic the solution is

• Pure water has a pH of 7 and is called “neutral” (not acidic or basic)

• Solutions that are acidic have a higher [H+] than pure water

√ Acidic solutions have pHs **lower** than 7

√ The higher the [H+], the lower the pH

• Solutions that are basic have a lower [H+] than pure water

√ Basic solutions have pHs **higher** than 7

√ The lower the [H+], the higher the pH

Table 2.3

**Water chemistry Page 7**

Buffer

Substances that (when added to a solution) minimize changes in the solution’s pH

• Buffers make a solution resistant to acids and bases

• Blood is buffered by the carbonic acid and bicarbonate ions in the

blood

• The carbonic acid replaces any lost H+

H2CO3  HCO3– + H+

• The bicarbonate ion absorbs any excess H+

HCO3– + H+  H2CO3

See "Buffer" section of chapter 2