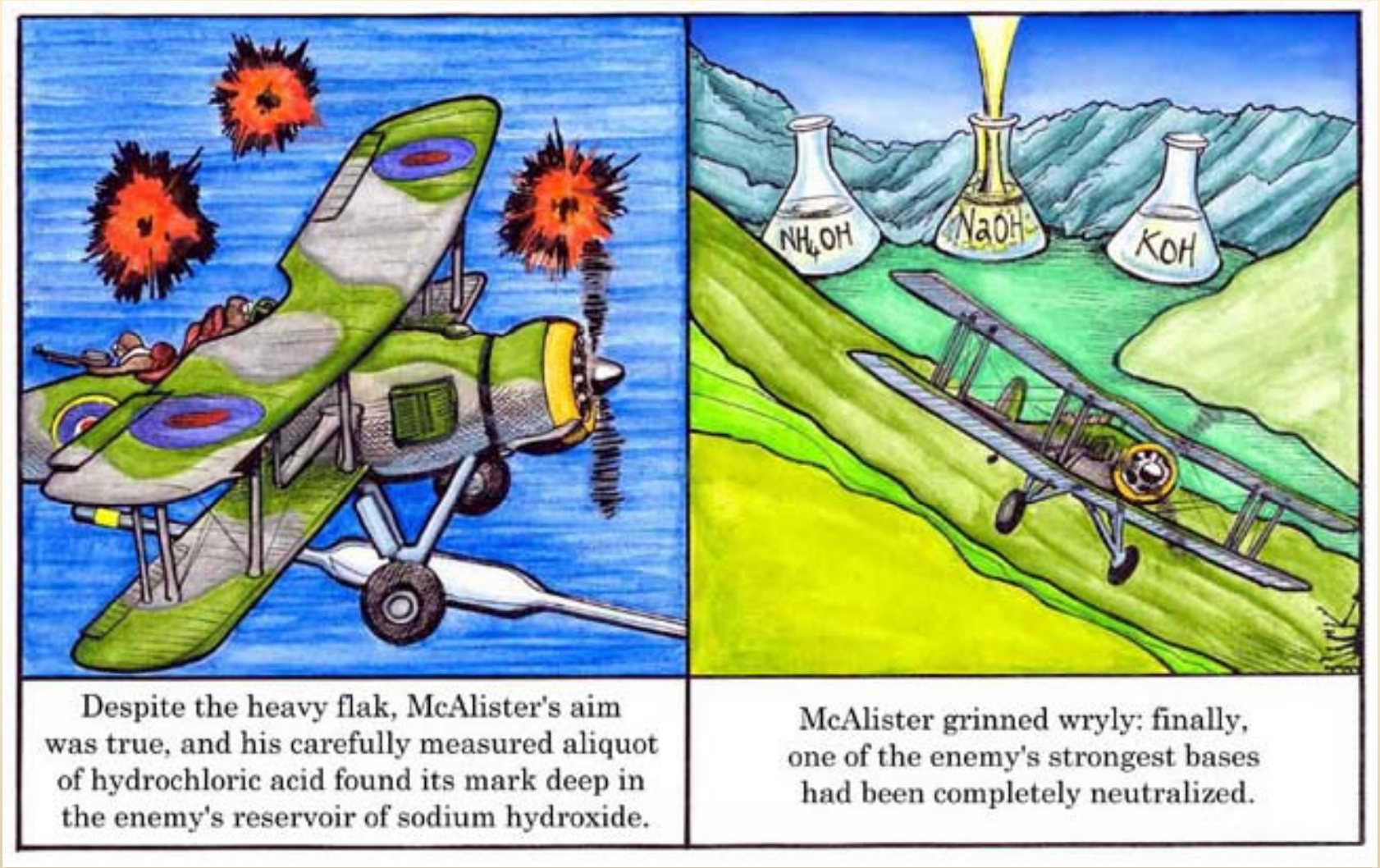
ACIDS AND BASES



CA Standards

Students know the observable properties of acids, bases, and salt solutions.
Students know acids are hydrogen-ion donating and bases are hydrogen-ion accepting substances.
Students know strong acids and bases fully dissociate and weak acids and bases partially dissociate.
Students know how to use the pH scale to characterize acid and base solutions.

Properties of Acids

- Acids are proton (hydrogen ion, H^+) donors
- Acids have a pH lower than 7
- Acids taste sour
- Acids effect indicators
  - Blue litmus turns red
  - Methyl orange turns red
- Acids react with active metals, producing H_2
- Acids react with carbonates
- Acids neutralize bases

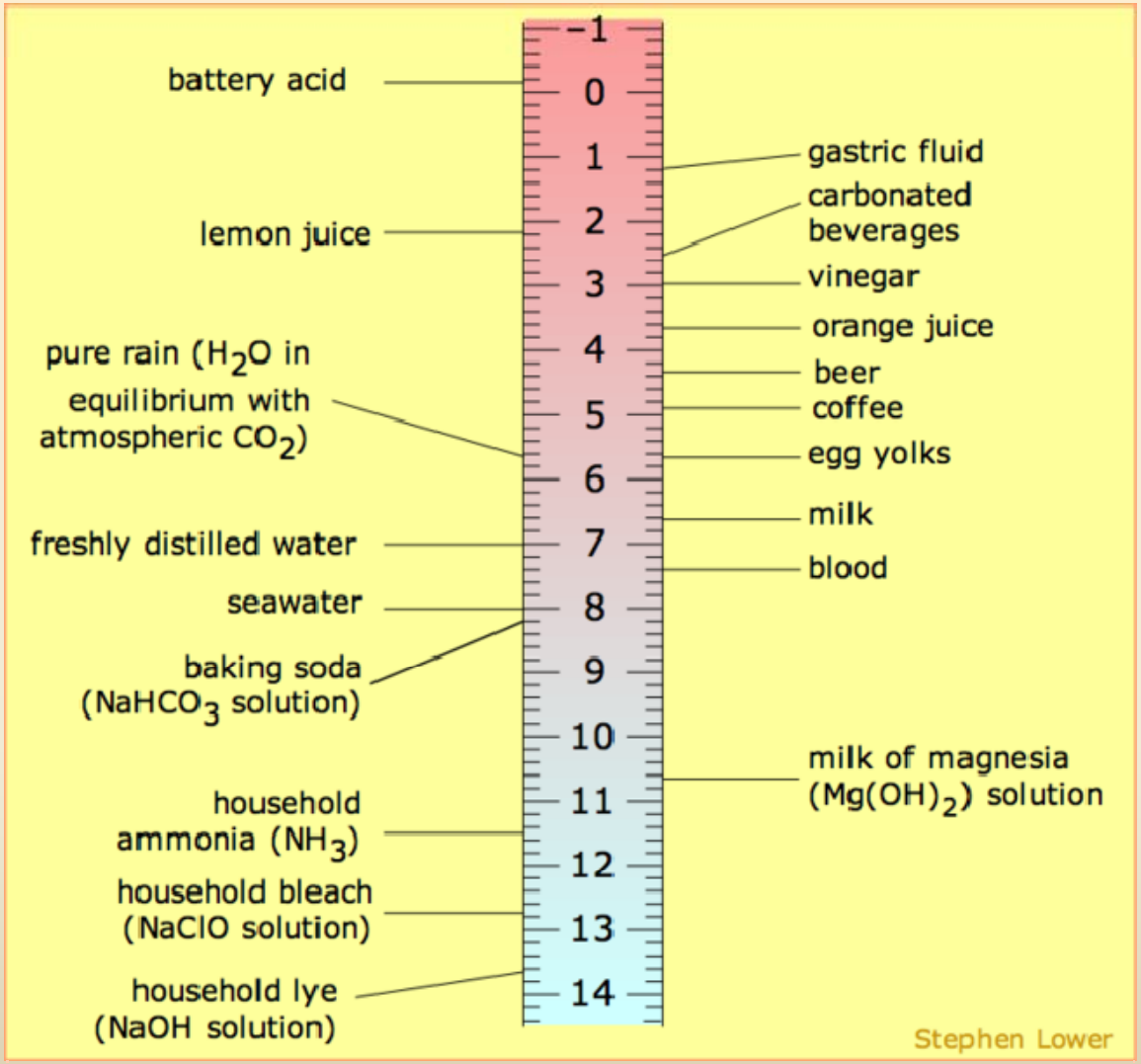
Acids are Proton (H^+ ion) Donors

Strong acids are assumed to be 100% ionized in solution (good H^+ donors).

HCl H_2SO_4 HNO_3

Weak acids are usually less than 5% ionized in solution (poor H^+ donors).

H_3PO_4 $HC_2H_3O_2$ Organic acids



Acids Have a pH less than 7

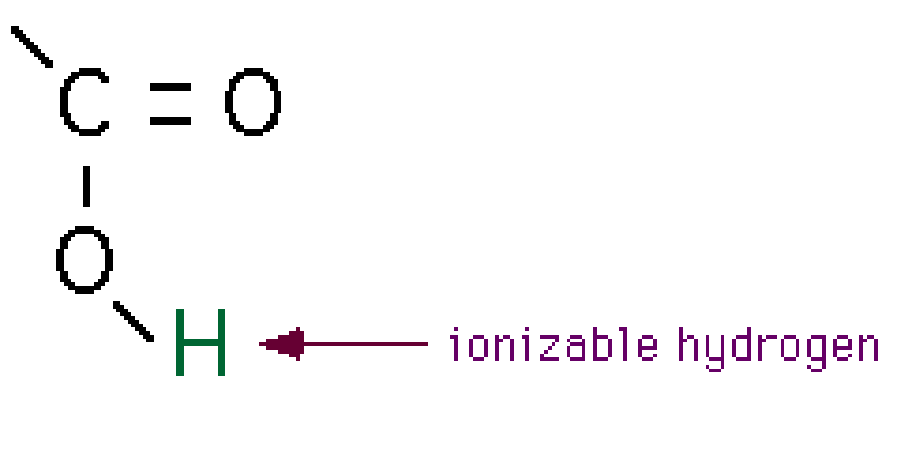
Acids Taste Sour

Organic acids are weak acids. Some are used as flavoring agents in food.

- Citric acid in citrus fruit
- Malic acid in sour apples
- Lactic acid in sour milk and sore muscles
- Butyric acid in rancid butter

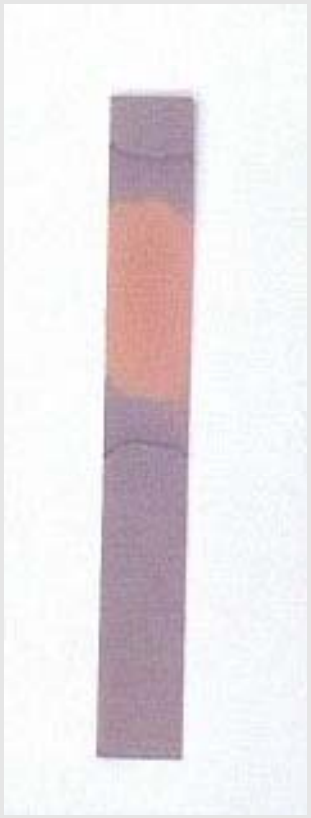
Organic Acids

Organic acids all contain the "carboxyl" group, sometimes several of them.



The carboxyl group is a poor proton donor, so ALL organic acids are weak acids.

Acids Effect Indicators



Blue litmus paper turns **red** in contact with an acid.

Methyl orange turns **red** with addition of an acid

Acids React with Active Metals

Acids react with active metals to form salts and hydrogen gas.

$$Mg + 2HCl \rightarrow MgCl_2 + H_2(g)$$

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2(g)$$

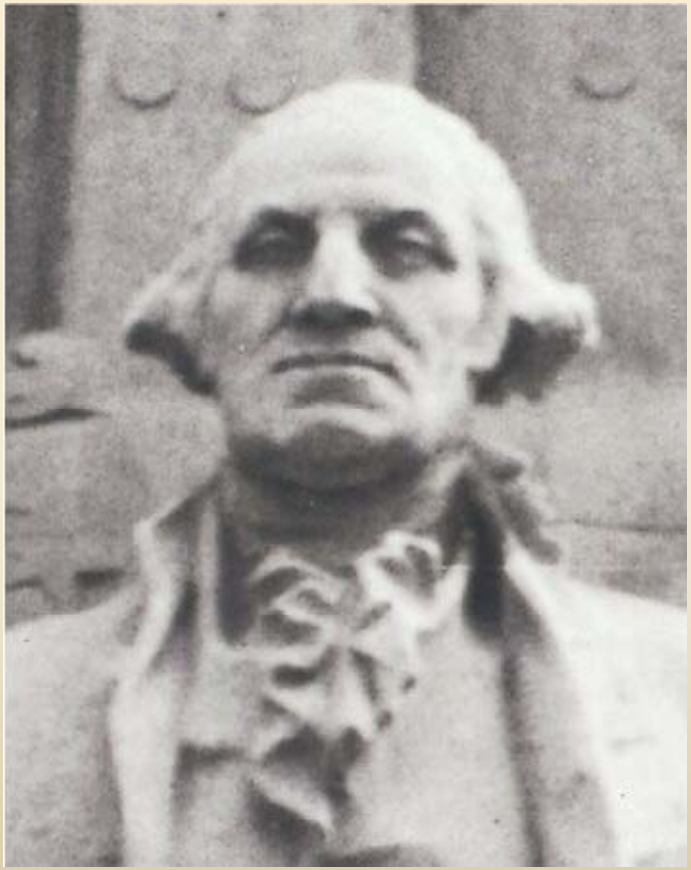
$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2(g)$$

Acids React with Carbonates

$2HC_2H_3O_2 + Na_2CO_3$

$2\ NaC_2H_3O_2 + H_2O + CO_2$

Effects of Acid Rain on Marble (calcium carbonate)



George Washington: BEFORE

George Washington: AFTER

Acids Neutralize Bases

Neutralization reactions ALWAYS produce a salt and water.

$$HCl + NaOH \rightarrow NaCl + H_2O$$

$$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$$

$$2HNO_3 + Mg(OH)_2 \rightarrow Mg(NO_3)_2 + 2H_2O$$

Properties of Bases

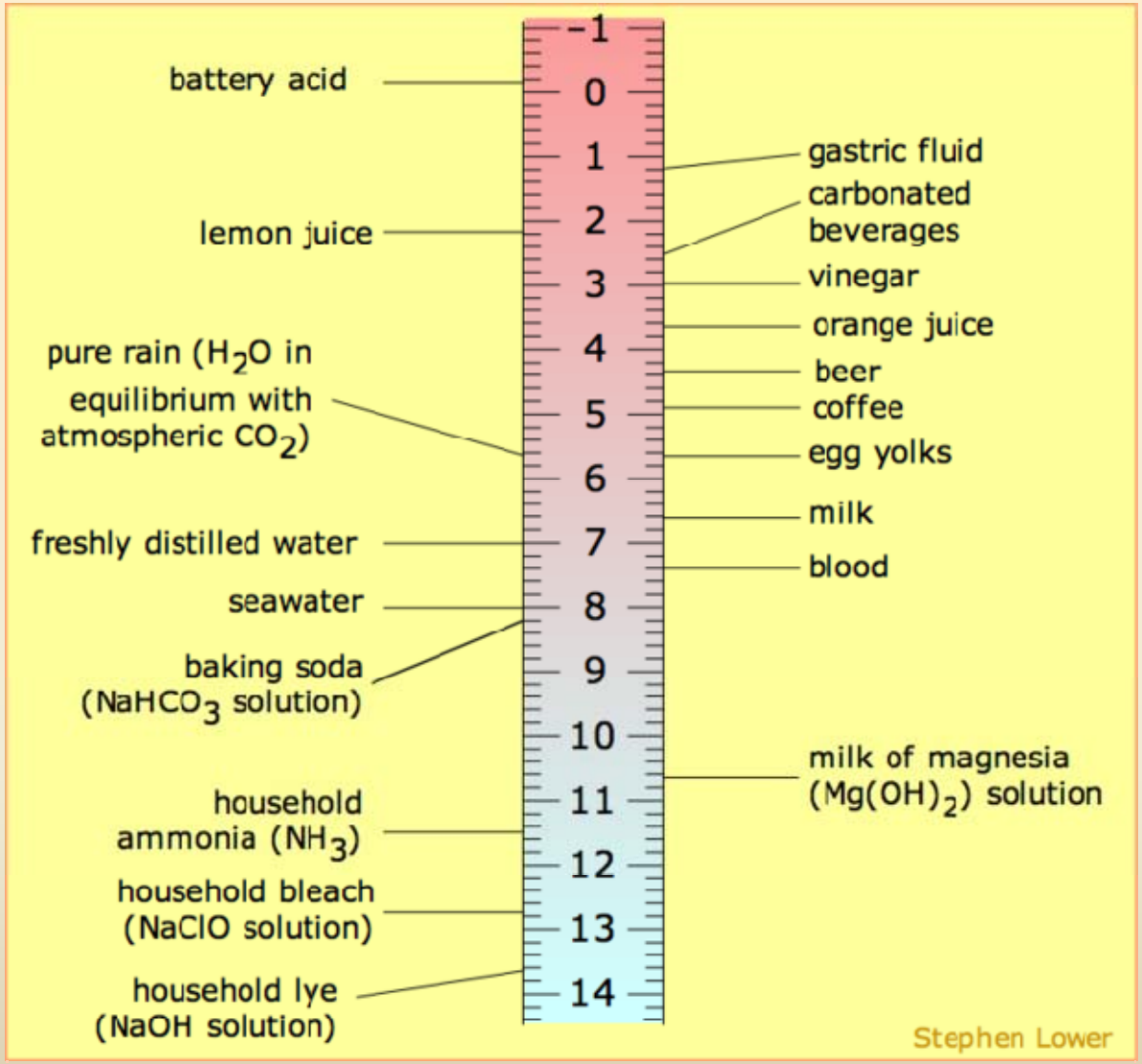
- Bases are proton (hydrogen ion, H^+) acceptors
- Bases have a pH greater than 7
- Bases taste bitter
- Bases effect indicators
  - Red litmus turns blue
  - Phenolphthalein turns purple
- Solutions of bases feel slippery
- Bases neutralize acids

Bases are Proton (H^+ ion) Acceptors

- Sodium hydroxide (lye), $NaOH$
- Potassium hydroxide, KOH
- Magnesium hydroxide, $Mg(OH)_2$
- Calcium hydroxide (lime), $Ca(OH)_2$

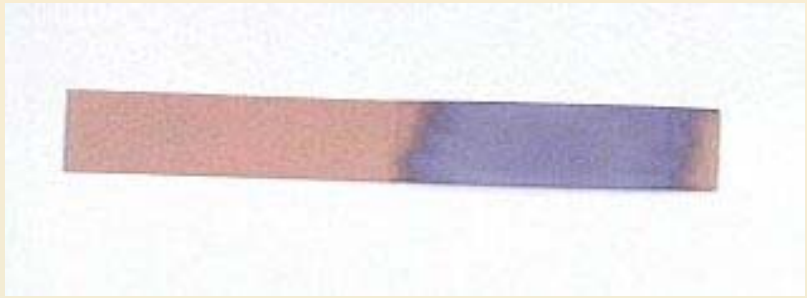
OH^- (hydroxide) in base combines with H^+ in acids to form water

$$H^+ + OH^- \rightarrow H_2O$$



Bases have a pH greater than 7

Bases Effect Indicators

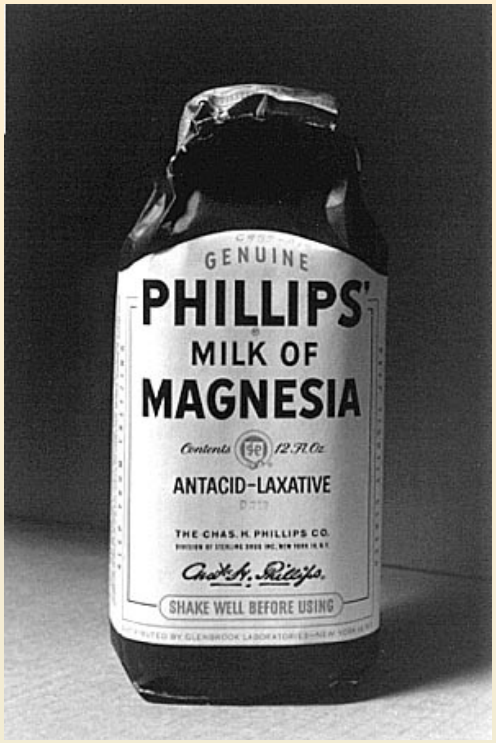


Red litmus paper turns **blue** in contact with a base.

Phenolphthalein turns **bright pink** in a base.

Bases Neutralize Acids

Milk of Magnesia contains magnesium hydroxide, $Mg(OH)_2$, which neutralizes stomach acid, HCl.



$$2\ HCl + Mg(OH)_2 \longrightarrow MgCl_2 + 2\ H_2O$$