Got heartburn? Get "Rolaids, Tums, Alka-seltzer ...antacids.
Why? Heartburn is due to acid reflux (backup) into the esophagus, causing a burning sensation near the heart. Antacids are bases that solve the problem by neutralizing the acid.


## Aim: How do bases neutralize acids?

1) neutralization - is a double replacement reaction in which an acid combines with a base to form a salt plus water.

$$
\text { ACID }+ \text { BASE }=====>\text { SALT }+ \text { WATER }
$$

For examples, let's turn to Table K and L:

$$
\mathrm{H}^{+} \mathrm{Cl}^{-}(\mathrm{aq})+\mathrm{Na}^{+} \mathrm{OH}^{-}(\mathrm{aq})=====\mathrm{Na}^{+} \mathrm{Cl}^{-}(\mathrm{aq}+\mathrm{HOH}(\mathrm{l})
$$

Remember these compounds consist of ions when dissolved in water. So, what happens is they just "switch partners". (It's better to write the formula for water as HOH so you can see what contributes to its formation.)

Let's do some more examples:


OK, Let's do some multiple choice questions on what we just covered. Refer to today's handout; questions 1 to 5.

1) Which type of reaction will occur when volumes of $0.1 \frac{A}{\mathrm{MCl}} \stackrel{B}{\mathrm{HCl}} \frac{B}{\mathrm{M}} \mathrm{NaOH}$ are mixed?
©) neutralization
B) hydrolosis
C) electrolysis
D) ionization
2) Given the reaction:

$$
\begin{gathered}
A \\
\mathrm{HCl}(\mathrm{aq})+\mathrm{LOH}(\mathrm{aq}) \\
\text { REACTANTS }
\end{gathered} \underset{\mathrm{HOH}(\mathrm{l})+\mathrm{LICI}(\mathrm{aq})}{\mathrm{S}} \mathrm{PRODUCTS}
$$

The reaction is best described as
A) synthesis
(2) neutralization
B) oxidation-reduction
D) decomposition
3) What are the (products) of a reaction between $\mathrm{KOH}(\mathrm{aq})$ and $\mathrm{HCl}(\mathrm{aq})$ ? double Replace meat
A) $\mathrm{H}_{2}$ and KClO
(大) $\mathrm{H}_{2} \mathrm{O}$ and KCl
C) KH and HClO
D) KOH and HCl
4) Which equation represents a neutralization reaction?
A) $\mathrm{NaCl}+\mathrm{AgNO}_{3} \rightarrow \mathrm{AgCl}+\mathrm{NaNO}_{3}$
(c) $\underset{\mathrm{H}_{2} \mathrm{SO}_{4}}{\mathrm{~A}}+\stackrel{\mathrm{Bg}(\mathrm{OH})_{2}}{\mathrm{~B}} \rightarrow \stackrel{\mathrm{MgSO}}{4}+\underset{2}{\mathrm{~S}} \mathrm{H}_{2} \mathrm{O}$
B) $\mathrm{Na}_{2} \mathrm{CO}_{3}+\mathrm{CaCl}_{2} \rightarrow 2 \mathrm{NaCl}+\mathrm{CaCO}_{3}$
D) $\mathrm{Ni}\left(\mathrm{NO}_{3}\right)_{2}+\mathrm{H}_{2} \mathrm{~S} \rightarrow \mathrm{NiS}+2 \mathrm{HNO}_{3}$
2) When adding acid to base or vice versa, how do we determine how much to add of each? We need a formula that incorporates their concentrations and volumes. It's called the titration formula.

## $M_{A c i d} V_{\text {Acid }}=M_{b a s e} V_{b a s e}$

Refer to today's handout. Let's do some titration problems.

1. How many ml or 2.5 M NaOH will be neutralized b) $50 . \mathrm{ml}$ of 2.0 M HCl ?

$$
\begin{aligned}
& M_{A} \cdot V_{A}=M_{B} \cdot V_{B} \\
& 2,0(50 .)=2.5\left(V_{B}\right)
\end{aligned}
$$

$1 M_{A} \quad V_{B}=40 . \mathrm{mL}$
3) What's the basis of the titration formula?

If we cross out the ions that don't change ("spectator" ions), we'll get the net ionic equation,

$$
\mathrm{H}^{+}(\mathrm{aq})+\mathrm{OH}^{-}(\mathrm{aq}) \quad=====>\mathrm{HOH}(l)
$$

Therefore, to be neutral, the moles $\mathrm{H}^{+}=$moles $\mathrm{OH}^{-}$.
And, since we are dealing with volumes of solutions with specific molarities,

$$
M_{A C I D}=\frac{\text { moles acid }^{V_{A C I D}} \rightarrow M_{A C I D} V_{A C I D}=M_{B A S E} V_{B A S E}}{}
$$

