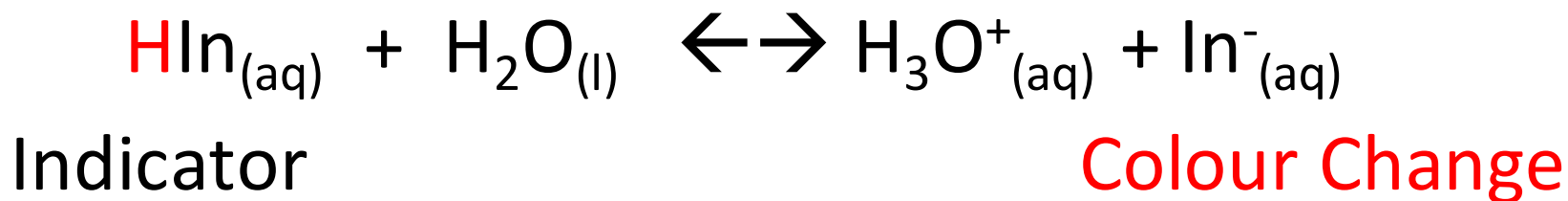


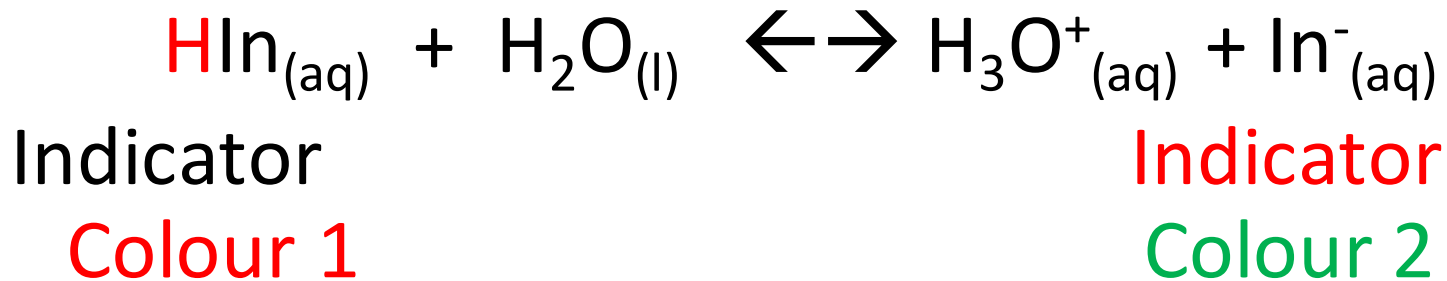
# Indicators and Buffers

# How do pH Indicators work?

- A pH indicator is basically (ha ha) a weak-acid that undergoes a colour change when they gain or lose a hydrogen ion (H<sup>+</sup>)



This reaction involves Le Chatelier's Principle

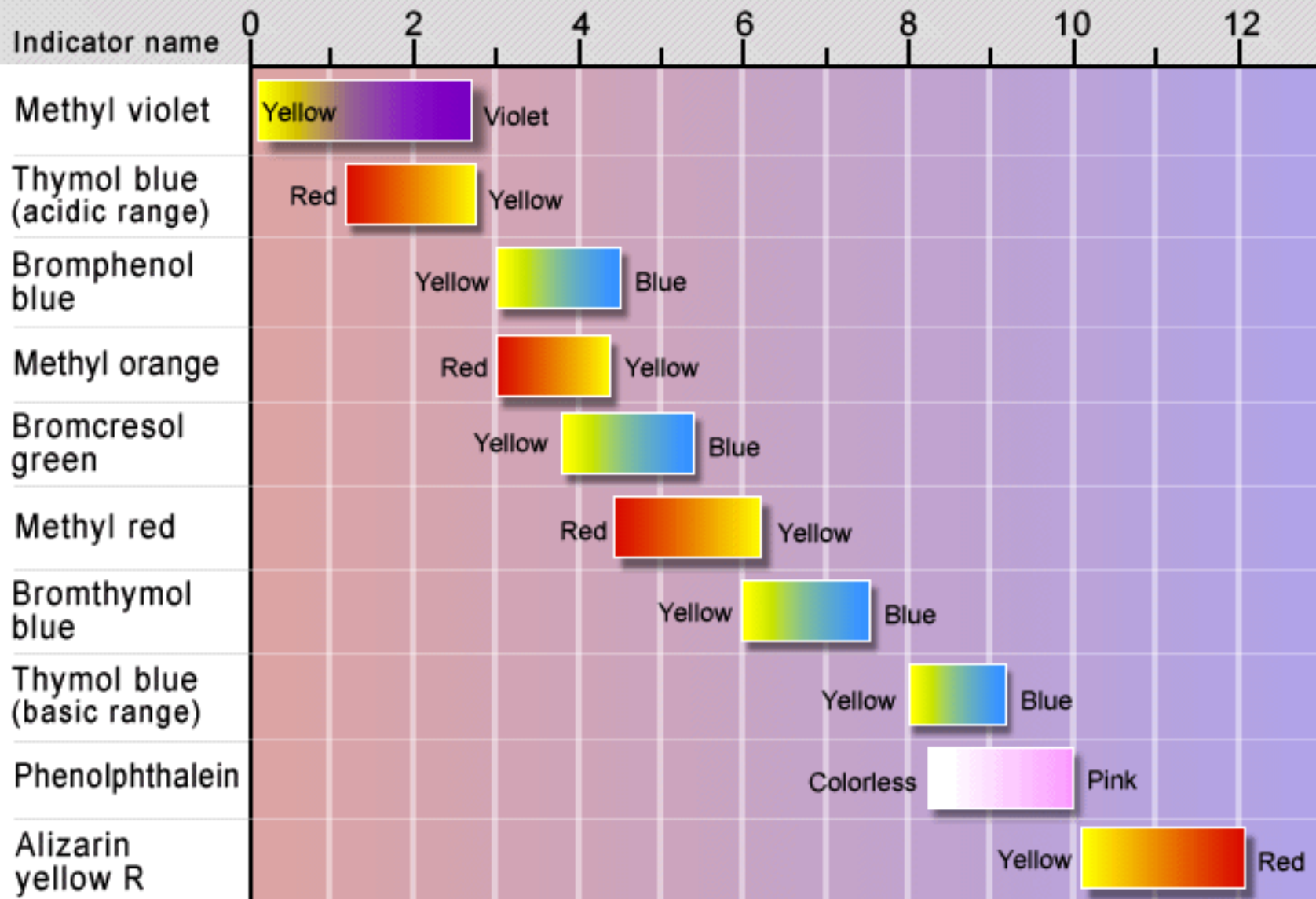


- What happens when you add an acid?
  - Adding acid adds  $\text{H}_3\text{O}^+$  into the reaction, which puts *stress* on the products side, resulting a shift to the reactant side (colour 1)
- Adding a base
  - Adding a base adds  $[\text{OH}^-]$  into the reaction. The  $[\text{OH}^-]$  reacts with  $[\text{H}_3\text{O}^+]$  to form  $\text{H}_2\text{O}$ . Thus, this *decreases* the  $\text{H}_3\text{O}^+$  concentration which shifts the reaction to the right (COLOUR 2)

# pH Indicators

- pH Indicators change colours at specific pH ranges (not really a direct point)
- Ex. Phenolphthalein changes from clear (acid) to pink (base) at the range of 8.2 – 10.0
- Therefore, pH indicators are not entirely accurate

## pH Range for Color Change



# Neutralization reactions

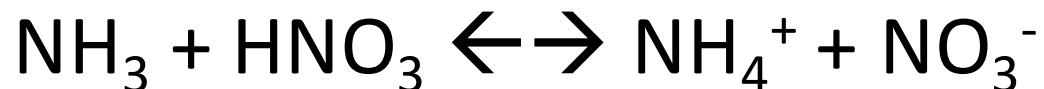
- During a neutralization reaction, salt and water are formed.
- A salt is **not** just NaCl but formed by the reaction between an acid and base.
- The salt can then further react with water to become dissociated into cations (+) and anions (-)
- The salt can make the solution basic or acidic based on the character of the anion/cation.

### 3 Possible Neutralization Reactions and salts produced:

- Strong acid + strong base
  - Forms a neutral salt  $\text{pH} \sim 7$
  - Group 1 or 2 ions generated will not affect  $\text{pH}$
- Weak acid + Strong base
  - Forms a basic salt  $\text{pH} > 7$
  - The anion formed from the salt will accept a proton
- Strong acid + Weak base
  - Forms acidic salt  $\text{pH} < 7$
  - The cation formed from the salt will donate a proton

## Acidic Salt

Reaction between ammonia (weak base) and nitric acid (strong acid) yields an acidic salt



The salt formed is  $\text{NH}_4\text{NO}_3$

From the above reaction, the  $\text{NH}_4^+$  will act as an acid



The  $\text{H}_3\text{O}^+$  produced makes it acidic



## Basic Salt

Reaction between NaOH(strong base) and CH<sub>3</sub>COOH acetic acid (weak acid ) yields a basic salt



The salt formed is NaCH<sub>3</sub>COO sodium acetate

From the above reaction, the CH<sub>3</sub>COO<sup>-</sup> will act as a base:



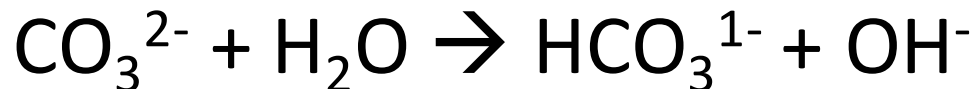
The OH<sup>-</sup> produced makes it basic

Example:

A salt Potassium carbonate  $K_2CO_3$  is produced, is the solution neutral, acidic, or basic?



Since  $K^+$  is a group 1 ion, it will not affect the pH



Negative

so it will take in a  $H^+$

$OH^-$  is produced, so it is a basic solution

# Other notes to know

- Metal salts with 2+ or 3+ charge will be acidic in water.
- Chloride, bromide, iodide, nitrate, and perchlorate ions **will not** affect the pH