Acid Base indicators are weak acids. A weak acid is an acid that does not dissociate well in water. When you put a million molecules of $\mathrm{HC}_{2} \mathrm{H}_{3} \mathrm{O}_{2}$ into water, it forms acetic acid. But only about 50,000 molecules ionize, while the vast majority (nearly $95 \%$ ) just dissolve because they are polar. With so few ions in solution, the strength of the acid is weak. One mole of these molecules does NOT produce $6.02 . \mathrm{x} 10^{23} \mathrm{H}^{+1}$ molecules.

Since acid base indicator molecules are weak acids, they too dissociate poorly. What's so cool about these molecules is that their molecules have color we can see, and the ions that they dissociate into have a different color. We can literally see with our eyes how much the dynamic equilibrium the indicators are in have shifted. Forward for one color, reverse for the other color.

A simple example from our notes is how phenolphthalein works. The molecule is colorless in solution, the more of that molecule that is present, the clearer the solution appears. $\mathrm{HC}_{20} \mathrm{H}_{13} \mathrm{O}_{4}$ is the formula for this weak acid called phenolphthalein. In water it forms a dynamic equilibrium with most of it remaining whole (and colorless). The few ions that do form, which hot pink, are so few that they are invisible to your eye.
Putting phenolphthalein into an acid or base will be the same as adding $\mathrm{H}^{+1}$ ions, or adding $\mathrm{OH}^{-1}$ ions. That will cause a shift forward to more ions (more pink) or shift reverse to more molecules (less pink). At pH between 8-9 there is a near "balance" between the acid and base level, the numbers of pink ions and colorless molecules is almost even, giving the solution a light pink color. Shifts will change the color to HOT pink, or CLEARclear. In symbols:

*Adding base ions $\mathrm{OH}^{-1}$ combine with acid ions $H^{+1}$ to make water, adding base means removing $H^{+1}$ cations.

On the second page are the indicators from Table M. Each changes color at a different pH range. Each of their molecules and anions are different colors, which makes them "indicate" a pH for the solution they are in.
Using COLOR pencils, show where the pH changes occur for each indicator. Use the correct colors for each indicator. Write the pH "zone" where this change occurs as well. All pH lower than the "zone" are ONE COLOR and all pH above the "zone" are the other color. INSIDE the ZONE is where the colors change and sometimes mix (yellow and blue make green) (red and blue make purple) (colorless and pink make light pink)
Indicators can indicate a pH range, but are not necessarily able to tell THE pH of the solution. If a solution is PINK with phenolphthalein YOU know that the pH is above 9. It could be 9 , or $10,12.74$, or even 14 ! Pink indicates something true but it does not always tell exactly what the pH is.


