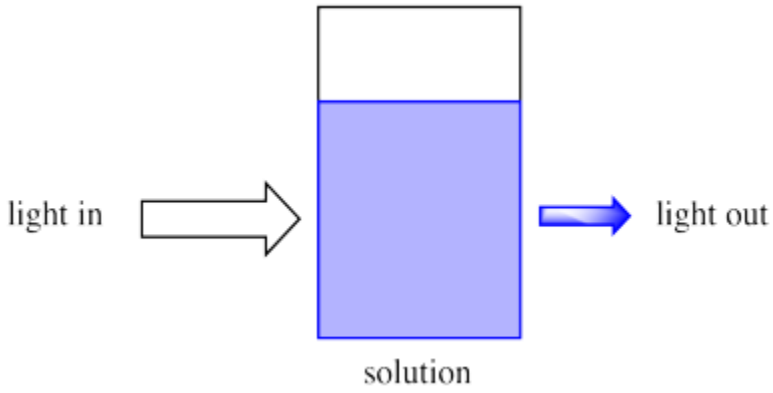
ABSORBANCE

Let's think first about the interaction of light with matter.

We have all seen light shine on different objects. Some objects are shiny and some are matte or dull. Some objects are different colours. Light interacts with these objects in different ways. Sometimes, light goes straight through an object, such as a window or a piece of glass.

Because chemical reactions are frequently conducted in solution, we will think about light entering a solution.

Imagine sunlight shining through a glass of soda. Maybe it is orange or grape soda; it is definitely coloured. We can see that as sunlight shines through the glass, coloured light comes out the other side. Also, less light comes out than goes in.

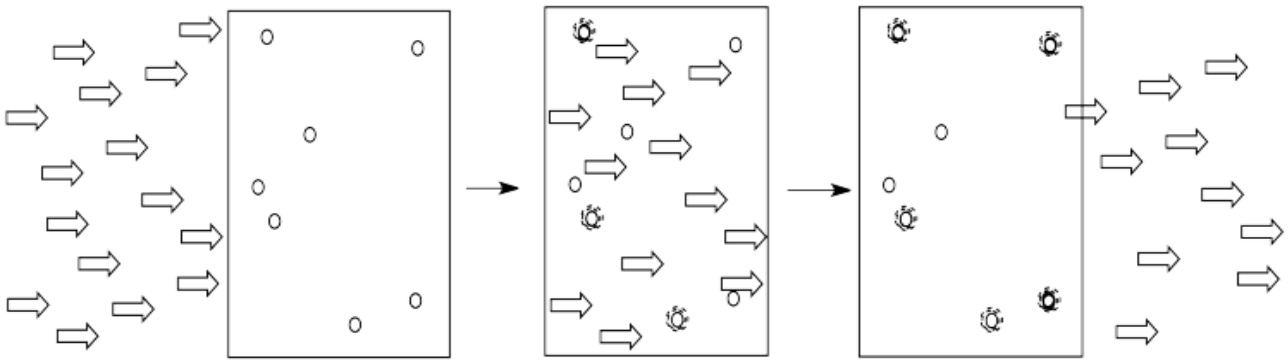


Maybe some of the light just bounces off the glass, but some of it is definitely absorbed by the soda.

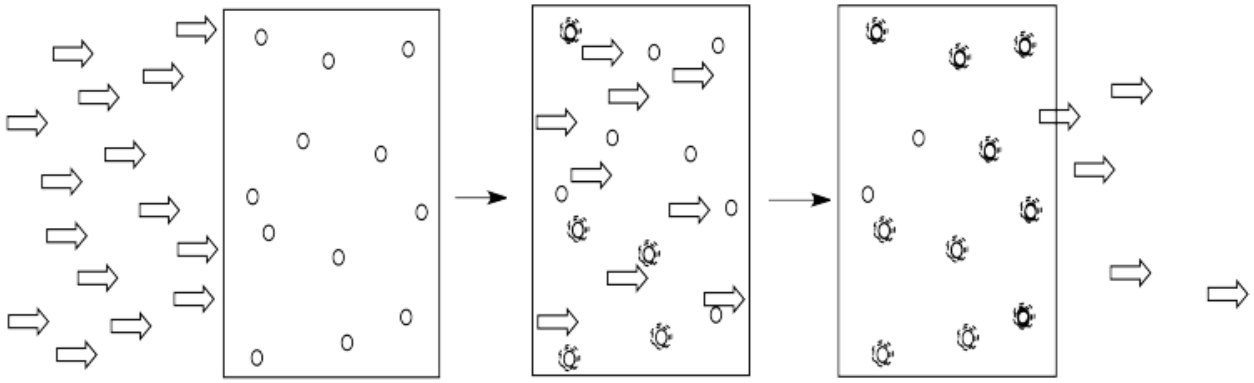
So, what is the soda made of? Molecules. Some of these molecules are principally responsible for the colour of the soda. There are others, such as the ones responsible for the flavour or the fizziness of the drink, as well as plain old water molecules. The

soda is a solution; it has lots of molecules (the solute) dissolved in a solvent (the water).

Light is composed of photons. As photons shine through the solution, some of the molecules catch the photons. They absorb the light. Generally, something in the molecule changes as a result. The molecule absorbs energy from the photon and is left in an excited state.

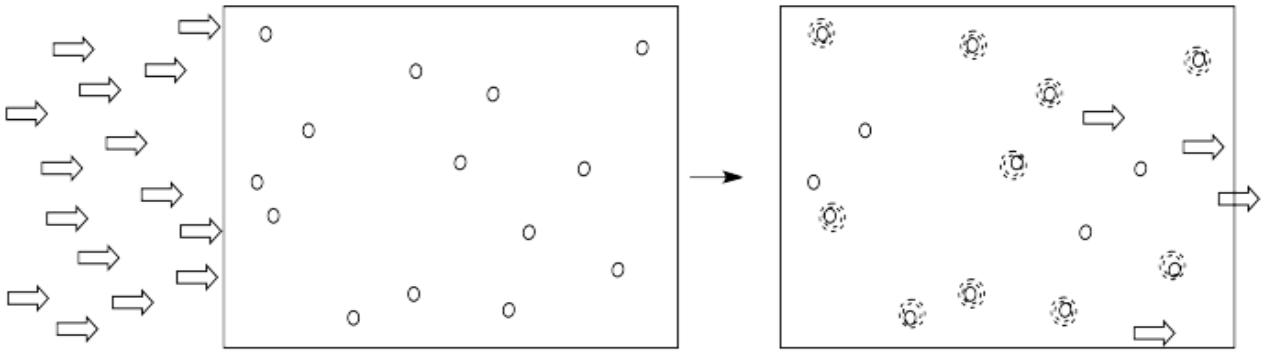


The more of these molecules there are in the solution, the more photons will be absorbed. If there are twice as many molecules in the path of the light, twice as many photons will be absorbed. If we double the concentration, we double the absorbance.



- The amount of light absorbed depends on the concentration of the solution.

Alternatively, if we kept the concentration of molecules the same, but doubled the length of the vessel through which the light traveled, it would have the same effect as doubling the concentration. Twice as much light would be absorbed.



- The absorbance depends on the length of cell holding the solution.

These two factors together make up part of a mathematical relationship, called Beer's Law, describing the absorption of light by a material:

$$A = \varepsilon c l$$

in which A = Absorbance, the percent of light absorbed; c = the concentration; l = the length of the light's path through the solution; ε = the "absorptivity" or "extinction coeficient" of the material, which is a measure of how easily it absorbs a photon that it encounters.

That last factor, ε, suggests that not all photons are absorbed easily, or that not all materials are able to absorb photons equally well. There are a couple of reasons for these differences.

Source: http://employees.csbsju.edu/cschaller/Reactivity/photochem/PCabsorbance.htm