

## **Illuminations on Rates of Reactions or Brief bright**

### Introduction:

Students investigate the speed of chemical reactions with light sticks. Reactions can be sped up or slowed down due to temperature changes.



### Materials:

Light sticks - any color

Note: Light sticks can be obtained for a discount just after Halloween.

Goggles

Apron

Lots of paper towels

Clear cups

Source of Ice water and very hot water

Scissors

### To do and notice:

Activate a glow stick by bending it. This breaks the glass ampoule inside, releasing a reagent into the surrounding liquid. Shake the stick to distribute all reagents and increase the glow.

1. Wearing goggles and an apron, cut-off one end of the light stick. \*
2. Before doing step 3, make a prediction about what might happen to the glow stick chemicals.
3. Pour some of the glowing liquid into a cup of very cold water.
4. Pour some of the glowing liquid into a cup of very hot water.
5. Place the tube with the remaining liquid between the two cups. This will be your "standard."
6. Compare the light output of the liquid in the cold and hot cups to the standard. Which is brighter?
7. Which seems to stop glowing first?

\*Light stick ingredients are non-toxic and non-flammable, but can cause skin irritation and may damage clothing.

### What's going on?:

The chemicals in the hot water probably glowed brighter and for a shorter period of time.

Light sticks produce light because of chemical reactions (this is called Chemiluminescence).

Although light sticks undergo a very complicated set of reactions, it all comes down to molecular collisions.

Adding heat to a system increases the motion of molecules. This causes molecules to collide more often and interact with other molecules to form new compounds. When you poured the light stick

chemicals into the hot water, it caused the solution to glow much brighter. However, since these collisions happened more quickly, the reactants or initial molecules form products or final molecules more quickly too. So the heated light stick chemicals glow brighter, but don't last as long.

Conversely, if you cool an activated light stick it will glow, but not as brightly for a longer time.

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Cool optional activity:

To do and notice:

Pour some soap into either cup of light stick chemicals and watch what happens.

What's going on:

I don't know yet. The chemicals glow much more brightly. It seems like it might be related to surface tension...more investigations to come. If you have an idea of what's going on, send comments to [emuller@exploratorium.edu](mailto:emuller@exploratorium.edu).

Image of glow sticks from - <http://www.glowrus.com>

