

## Equilibrium/Le Chatelier's Principle

#### Teacher Background Information:

Traditionally, equilibrium experiments and Le Chatelier's Principle are illustrated using chemicals that undergo color changes as the equilibrium position shifts. Examples of several reagents that have typically been used are:

(A)  $CoCl_4^{2-}(aq) + 6H_1O(l) = Co(H_2O)_6^{2+}(aq) + 4Cl^-(aq)$ 

This experiment is used to demonstrate the effects of both temperature changes and concentration changes on an equilibrium mixture.

(B) Cr<sub>2</sub>O<sub>7</sub><sup>2</sup>·(aq) + H<sub>2</sub>O (l) □ 2CrO<sub>4</sub><sup>2</sup>·(aq) + 2H\*(aq) orange yellow

This experiment is used to demonstrate the effects of concentration changes on an equilibrium mixture.

(C) Fe<sup>3+</sup> (aq) + CNS' (aq) | Fe(CNS) <sup>2+</sup> (aq) yellow red

This experiment is also used to demonstrate the effects of concentration changes on an equilibrium mixture.

While all of these effectively demonstrate Le Chatelier's Principle, they each utilize reagents that are toxic. In this lab activity, students will explore Le Chatelier's Principle using non-toxic materials, while still visualizing the equilibrium shifts through color changes.

Activity 1 uses an iodine-starch complex to demonstrate the effect of temperature on equilibrium. The formation of the complex is an exothermic reaction and results in a deep purple color. The Activity 1 section of the teacher guide provides more information regarding this reaction.

In Activity 2, students evaluate the effect of pH on equilibrium using butterfly pea tea, household ammonia solution, and vinegar. When vinegar is added to the tea, the color of the solution lightens and changes from blue to purple. When baking soda is added to the tea, the solution darkens. This can be reversed, and students can change the tea solution in color to observe the shift in equilibrium.

The lab presents this reaction in the basic format of:

Tea (aq) + H' (aq) | TeaH' (aq) blue purple

However, depending on the level of your students, you may prefer to share more information with them. The molecules in butterfly pea tea being considered in this experiment are a group of polyphenols called theaflavins. There are four major theaflavins found in tea, but we will only



# **Pogil Equilibrium And Le Chateliers Principle Answers**

**Lauren Gardner** 

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