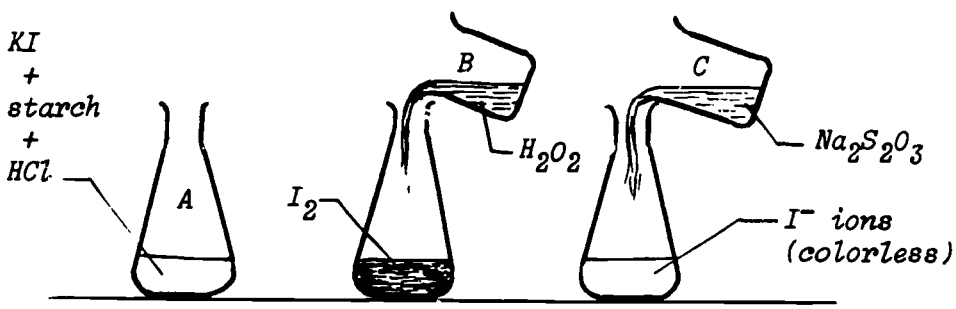
5.11. THE RETURNING COLOR

Materials: 1. One Erlenmeyer flask (medium size), & two beakers.
2. Potassium iodide (KI), hydrogen peroxide (H_2O_2), sodium thiosulfate ($Na_2S_2O_3$), starch solution, and dilute hydrochloric acid (HCl).



Procedure:
1. Dissolve a little KI in water, add some starch solution and a little dilute HCl (Sketch A).
2. Prepare solutions in beaker B and C. Place a 3% H_2O_2 solution in beaker B; dissolve some $Na_2S_2O_3$ in about 100 ml of water in beaker C.
3. Add to flask A some of liquid B (turns blue-black) and immediately afterwards a little of liquid C (turns colorless).
4. Place flask on table and observe: sudden color change!
5. The addition of liquid C can be repeated several times. (To make it more interesting, after addition of liquid C, hold the flask behind your back for a few moments and bring it back on the table as a blue-black solution).

Questions:
1. How is the blue-black color created?
2. What was it that took away the color?
3. Which reaction is slower? The color-producing or the color-removing one?
4. How long can we keep repeating the second reaction?
5. What reactions are usually slower in rate?

Explanation:
The reactions that are taking place are the following:

Flask A + Beaker B : $2\,KI + H_2O_2 \xrightarrow{HCl} 2\,KOH + I_2$

$I_2 \xrightarrow{Starch}$ (blue-black)

Addition of Beaker C : $I_2 + Na_2S_2O_3 \rightarrow NaI + Na_2S_2O_5$

(colorless)

Reaction (1) is an oxidizing reaction, where the iodide ions are oxidized into iodine, which turns starch into a blue-black color. The addition of $Na_2S_2O_3$ reduces the iodine back into iodide ions, which are colorless. The fact that the blue-black color keeps on returning, even after the $Na_2S_2O_3$ is added, shows that the first reaction is still proceeding and thus is a much slower reaction than the second.