

Eng Ver.

Chemical Traffic Light Reaction Experiment

1 Objective

To demonstrate a redox reaction that changes color in sequence (green → red → yellow) and investigate factors affecting the reaction.

2 Materials

- | | |
|---|------------------------------------|
| 1. Glucose(C ₆ H ₁₂ O ₆) solution : Reductant | 2. Sodium hydroxide (NaOH) : Base※ |
| 3. Indigo carmine | 4. Distilled water |
| 5. Erlenmeyer flask | 6. Rubber stopper |

※Under basic conditions, glucose transforms into the highly reductive enediol form and acts as a reducing agent.

3 Procedure

- ① Pour 100 mL of distilled water into a flask.
- ② Add 4.0 g of sodium hydroxide to make the solution alkaline.
- ③ Add 4.0 g of glucose and stir until it dissolves completely.
- ④ Add 2–3 drops of indigo carmine .
- ⑤ Put a stopper in the flask and shake it until the color turns green.
- ⑥ Let the flask sit and observe the color change: Green → Red → Yellow.
- ⑦ Shake the flask again to restore the green color and repeat the cycle.

4 Observation

The solution changes color from green to red to yellow, and returns to green when shaken.

5 Principle of the Experiment

- Oxidation by Shaking: Shaking the flask dissolves O₂ from the air into the solution. This oxidizes indigo carmine, changing the color from yellow to green.
- Reduction by Standing: When the flask is left to stand, glucose acts as a reducing agent in the alkaline solution. It reduces indigo carmine back to the yellow state.
- Intermediate Color: Red appears as an intermediate color during the transition between the green (oxidized) and yellow (reduced) states.

日本語 Ver.

1 ()

(緑→赤→黄)の連続的な色の変化をする還元反応を行い、その反応に影響を与える要因を探る。

2 ()

- | | |
|-------------------|--------|
| 1. | 2. |
| 3. インジゴカルミン(青い色素) | 4. 蒸留水 |
| 5. | 6. ゴム栓 |

※塩基性条件下において、グルコースは還元性の高い『エンジオール形』へと構造変化し、還元剤として作用する

3 ()

- ①
- ②
- ③
- ④
- ⑤
- ⑥
- ⑦

4 ()

5 ()

-
-
-

Reading and Translating English Lab Books (Chemistry × English)

Class ___ No. ___ Name _____ Group _____

6 Results

(1) Measure the reaction time

	Green to Red	Red to Yellow	Total Time	Average total reaction time
1st time	sec	sec	sec	
2nd time	sec	sec	sec	
3rd time※	sec	sec	sec	

※ If you cannot measure the reaction time correctly for the first two trials, perform a third trial.

(2) Factors affecting the reaction rate (Changing the temperature)

Place the flask in a beaker with a small amount of hot water.

	Green to Red	Red to Yellow	Total Time	Average total reaction time
1st time	sec	sec	sec	
2nd time	sec	sec	sec	
3rd time※	sec	sec	sec	

※ If you cannot measure the reaction time correctly for the first two trials, perform a third trial.

7 English Work: Comparatives in Science

(1) 実験の結果をもとに、()内の単語を並び替えて正しい英文を作りなさい。

① [The / water / is / hotter / the], the faster the reaction proceeds.

② The more strongly you shake the flask, [more / oxygen / dissolves / the] into the liquid.

(2) 次の英文の()内の単語を正しい形に直しなさい。

① Molecules in hot water move much [fast] than those at room temperature.

② In the warm water bath, glucose reduces the indicator [rapidly] than at room temperature.

③ 次の実験データ (仮) を読み取り、英文の空欄を埋めなさい。

Room Temp: 60 seconds to turn yellow Warm Water: 20 seconds to turn yellow

The reaction at room temperature took three [times / as / as / long] the reaction in warm water.

教科書 FACTBOOK より

Fill in the blanks and complete the sentences.

1. () and () women have become politicians since the 20th century.

20世紀以降、ますます多くの女性が政治家になっている。

2. In the 2021 Gender Gap Index, the Scandinavian countries ranked () () than Japan.

2021年のジェンダーギャップ指数において、北欧諸国は日本よりもはるかに高い順位だった。

3. A report says that Norway and Sweden are as () () as Finland to raise children in.

ある報告書によると、ノルウェーやスウェーデンはフィンランドと同じくらい子どもを育てるのによい国だ。

4. () () () 60% of the seats in the Rwandan parliament are occupied by women.

ルワンダの国会では60%もの議席が女性によって占められている。

8 Chemistry Work

化学の課題は日本語や化学式などで解答してかまいません。この信号反応の色素「インジゴカルミン」は、食品着色料(青色2号)や医薬品として利用される青い色素です。なぜ緑になったり、黄色くったりするのでしょうか? なぜ中間色は赤色なのでしょうか? 様々な方法(ネットやAI可)を駆使して考えて教えてください。

9 Self-evaluation(自己評価)

(1) 数値で自己評価してください 4: Can do well 3: Can do 2: Can do with difficulty 1: Not yet

① 実験書の翻訳をグループで協力してできましたか	4 · 3 · 2 · 1
② 翻訳した実験書を元に実験を適切にできましたか	4 · 3 · 2 · 1
③ 比較級を用いて実験結果を適切にまとめることができましたか	4 · 3 · 2 · 1
④ 教科横断授業の意義を感じられましたか	4 · 3 · 2 · 1

(2) 教科横断授業の感想を書いてください