WORKSHEET 12

EXPERIMENT: THE EFFECT OF LIGHT ON SILVER HALIDES

Syllabus reference 8.2.4

INTRODUCTION

In the presence of light, silver halides are decomposed into metallic silver and the halogen. The chemistry involves the absorption of light energy by the halide ion to form the halogen. In turn silver ions accept donated electrons and silver forms.

$$2Ag^+ + 2Br^- \rightarrow 2Ag(s) + Br_2$$

If finely spread this silver will show up as a dark patch. If no light falls onto the silver bromide it will not decompose. In photography, the undecomposed silver halide is removed by reacting it with a sodium thiosulfate solution to dissolve the unreacted silver halide and so stop further blackening of the paper.

AIM

To investigate the effect of light on silver halides.

EQUIPMENT

- 50 mL 0.2 mol/L silver nitrate solution, $AgNO_3(aq)$
- 50 mL 0.2 mol/L sodium bromide solution, NaBr(aq)
- 50 mL 0.2 mol/L sodium chloride solution, NaCl(aq)
- 50 mL 0.2 mol/L sodium iodide solution, NaI(aq)
- 50 mL 0.2 mol/L sodium thiosulfate solution, $Na_2S_2O_3(aq)$
- 4 petri dishes
- four pieces of filter paper (approx 10 cm width)
- measuring cylinder
- tongs
- sponge or piece of cotton wool
- scissors
- piece of stiff paper
- gloves and safety glasses

SAFETY: Safety glasses must be worn. Beware: silver nitrate stains clothes and skin so avoid contact. If contact occurs wash thoroughly with soap and water.

PROCEDURE

1 Using the stiff paper provided cut out four shapes to fit on the filter paper.

2 Pour each of the silver nitrate and sodium halide solutions into separate petri dishes.

3 Label each of the four pieces of filter paper.

4 Immerse a piece of filter paper in the silver nitrate solution. Place on a flat surface and place one shape on top.

5 Take another piece of filter paper, immerse it in the silver nitrate solution and then in the sodium bromide solution. Record any changes. Put it on a flat surface and place one of the shapes on top.

6 Repeat step 5 with each of the other two sodium halide solutions.

7 Expose all the pieces of filter paper to sunlight or a bright light.

8 Record any changes over the next 15–20 minutes. (You may leave it overnight.)

9 Remove the shape and sponge all pieces of filter paper with sodium thiosulfate solution.

RESULTS

QUESTIONS

1 Which of the filter papers were affected by exposure?

2 Why was the design left on the filter paper?

3 Write a list of compounds in order from least affected to most affected.

4 Write equations for the reactions which occurred.

5 Why was the filter paper washed with the sodium thiosulfate solution? Write an equation for this reaction. (The product is $Ag(S_2O_3)_2^{3-}$.)

6 Why are silver compounds stored in dark bottles?

7 Suggest one use that could be made of these reactions.