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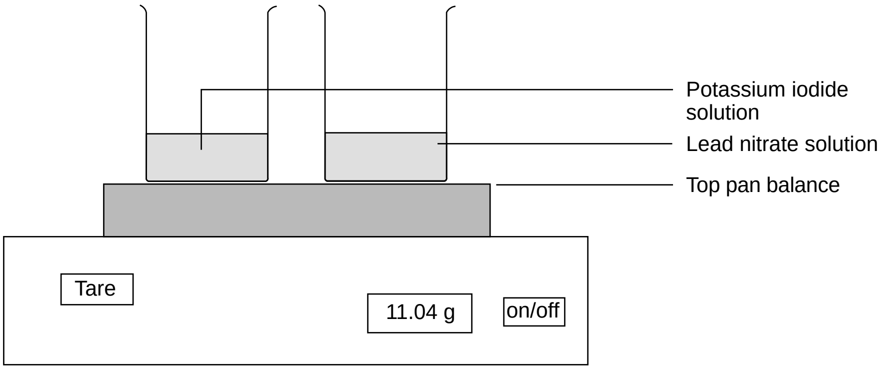
Mass conservation

Introduction

The aim of this experiment is to show that mass is not gained or lost in a chemical reaction.



What to record

Record the total mass of the reactants and the products.

What to do

1. Measure approximately 5 cm^3 of potassium iodide in the measuring cylinder and pour into one beaker.
2. Rinse the measuring cylinder.
3. Measure approximately 5 cm^3 of lead nitrate in the measuring cylinder and pour into another beaker.
4. Zero the balance then place both beakers on the balance at the same time. Accurately measure their total mass.
5. Take them off the balance.
6. Carefully pour the contents of one beaker into the other making sure there is none spilt.
7. Zero the balance again, place both beakers back on the pan and measure the mass.

Safety

Wear eye protection. Solutions of lead compounds may be toxic – wash your hands thoroughly at the end of the lesson.

Questions

1. Has a chemical reaction occurred?
2. Complete the word equation:
   potassium iodide + lead nitrate → __________ + ___________
3. Comment on your result.

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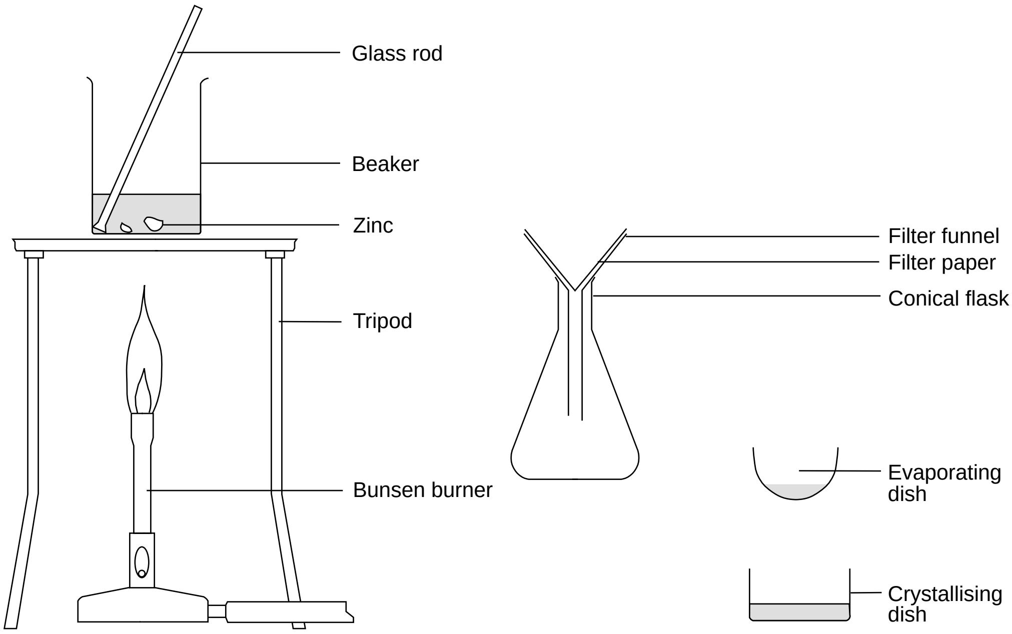
Metals and acids

Introduction

Many, but not all, metals react with acids. Hydrogen gas is formed and the metal reacts with the acid to form a salt.



What to do

Lesson 1

1. Measure 50 cm^3 of dilute sulfuric acid and pour it into the beaker. Warm this acid but turn off the Bunsen burner before it reaches the boiling point.
2. Carefully remove the beaker of acid from the tripod and stand it on the bench.
3. To this acid, add two lumps of zinc.
4. If all the zinc reacts, add two more lumps. Add more zinc until no more bubbles form. The acid is now used up.
5. Filter into the conical flask to remove the excess zinc and transfer the filtrate into an evaporating basin.
6. Gently heat the filtrate. Dip in a glass rod and hold it up to cool. When small crystals form on the glass rod stop heating.
7. Pour the solution into a crystallising dish. Label the dish and leave it to crystallise for next lesson.

Lesson 2

1. Examine the crystals with a hand lens.

Safety

Wear eye protection. Care with hot acid.

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Questions

1. Write a word equation for the reaction between zinc and sulfuric acid.
2. Write word equations for the reactions of:
   (a) zinc and hydrochloric acid.
   (b) magnesium and sulfuric acid.
3. Write equations for these three reactions using chemical formulas.

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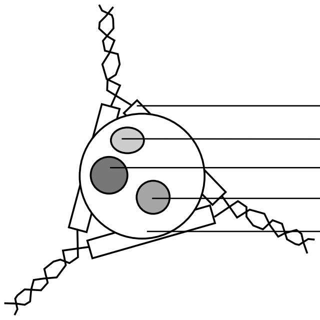
Solid mixtures – a lead and tin solder

Introduction

Electrical solder is an alloy of tin and lead. In this experiment a simple method is used to compare the melting points of lead, tin and solder.



What to record

- What was done.
- The order in which they melt.
- The order in which they solidify.

What to do

1. Place a small piece of lead (Pb), tin (Sn), and solder (a Pb/Sn mixture) on an inverted crucible lid over a Bunsen flame. Remember which is which.
2. Observe the three metals, to see which one melts first.
3. When all three are molten, turn off the Bunsen burner and allow the metals to cool.
4. Observe the order in which they solidify.

Safety

Wear eye protection.

Questions

1. Which of the three metals melts first?
2. Which of the three metals melts last?
3. Which of the three metals solidifies last?
4. Which of the three metals solidifies first?
5. Write down the metals in order of their melting points, lowest melting point first.

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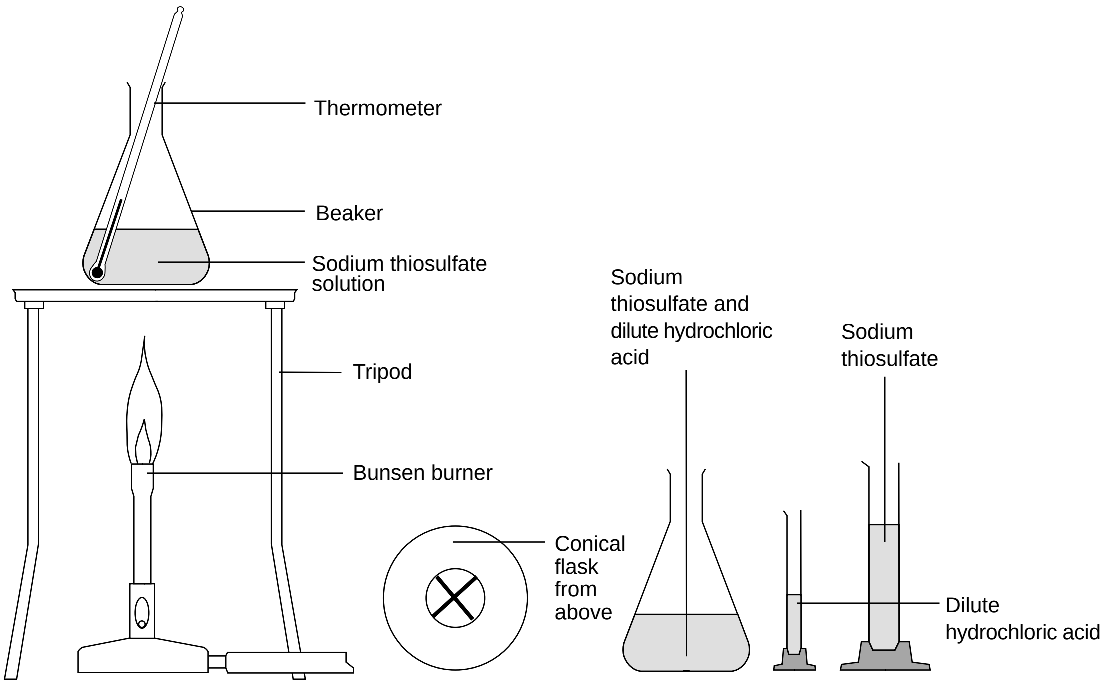
The effect of temperature on reaction rate

Introduction

In this experiment the effect of temperature on the rate of reaction between sodium thiosulfate and hydrochloric acid is investigated.



What to record

Record your results in the table.

Initial temperature of the mixture in the flask/°C	Final temperature of the mixture in the flask/°C	Average temperature of the mixture in the flask/°C	Time taken for the cross to disappear/s	1/time taken /s^{-1}

What to do

1. Put 10 cm^3 of sodium thiosulfate solution and 40 cm^3 of water into a conical flask. Measure 5 cm^3 of dilute hydrochloric acid in a small measuring cylinder.
2. Warm the thiosulfate solution in the flask if necessary to bring it to the required temperature. The object is to repeat the experiment five times with temperatures in the range 15–65 °C.
3. Put the conical flask over a piece of paper with a cross drawn on it.

4. Add the acid and start the clock. Swirl the flask to mix the solutions and place it on a piece of white paper marked with a cross. Take the initial temperature of the mixture.
5. Look down at the cross from above. When the cross disappears, stop the clock and note the time taken. Record the final temperature of the mixture in the flask.
6. As soon as possible, pour the solution down the sink (in the fume cupboard if possible) and wash away.

Safety

Wear eye protection. Take care not to inhale fumes.

Questions

1. For each set of results, calculate the value of 1/time. (This value can be taken as a measure of the rate of reaction for this experiment).
2. Plot a graph of 1/time on the vertical (y) axis and average temperature on the horizontal (x) axis.

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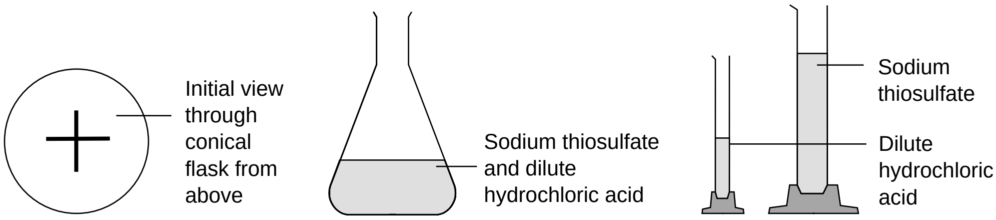
The effect of concentration on a reaction rate

Introduction

In this experiment, the effect of the concentration of sodium thiosulfate on the rate of reaction is investigated.



What to record

1. Complete the table:

Volume of sodium thiosulfate solution/cm^3	Volume of water/cm^3	Time taken for cross to disappear /s	Original concentration of sodium thiosulfate solution/g dm^{-3}	1/time taken /s^{-1}
50	0		50	
40	10			
30	20			
20	30			
10	40			

What to do

1. Put 50 cm^3 of sodium thiosulfate solution in a flask.
2. Measure 5 cm^3 of dilute hydrochloric acid in a small measuring cylinder.
3. Add the acid to the flask and immediately start the clock. Swirl the flask to mix the solutions and place it on a piece of paper marked with a cross.
4. Look down at the cross from above. When the cross disappears stop the clock and note the time. Record this in the table.
5. Repeat this using different concentrations of sodium thiosulfate solution. Make up 50 cm^3 of each solution. Mix different volumes of the sodium thiosulfate solution with water as shown in the table.
6. As soon as possible, pour the solution down the sink (in the fume cupboard if possible) and wash away.

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Safety

Wear eye protection. Take care not to inhale fumes.

Questions

1. Calculate the concentration of sodium thiosulfate in the flask at the start of each experiment. Record the results in the table.
2. For each set of results, calculate the value of 1/time. (This value can be taken as a measure of the rate of reaction).
3. Plot a graph of 1/time taken on the vertical (y) axis and concentration on the horizontal (x) axis.

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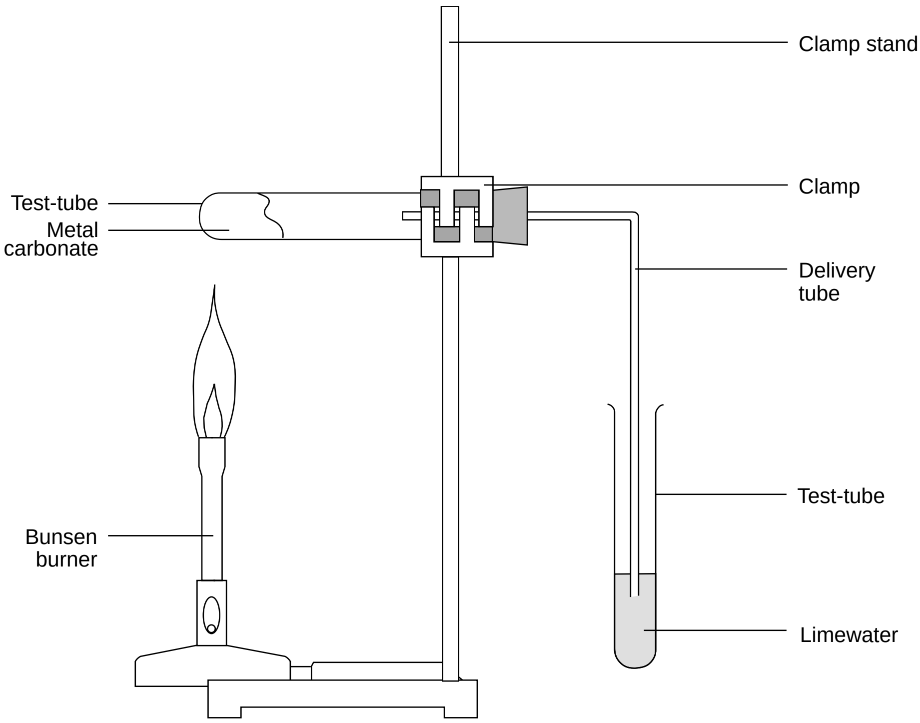
The effect of heat on metal carbonates

Introduction

Metal carbonates decompose when heated. Some carbonates are more reactive than others. The aim of this experiment is to compare the reactivity of some different metal carbonates.



What to record

Complete the table

Carbonate tested	Colour of metal carbonate before heating	Gas evolved, if any	Decomposition easy or difficult	Colour of solid after heating
Sodium carbonate				
Lead carbonate				
Potassium carbonate				
Copper carbonate				

What to do

1. Put a large spatula of the carbonate to be tested in a test-tube.
2. Fit a delivery tube and then clamp the tube so that the delivery tube dips into a second test-tube containing limewater.
3. Heat the solid gently at first then more strongly.

Safety

Wear eye protection.

Remove the delivery tube by lifting the clamp stand as soon as heating is stopped. Some metal compounds are toxic. Avoid raising dust. Wash hands thoroughly at the end of the experiment.

Questions

1. Why do some gas bubbles pass through limewater when heating is first started?
2. Why must the delivery tube be removed as soon as heating is stopped?

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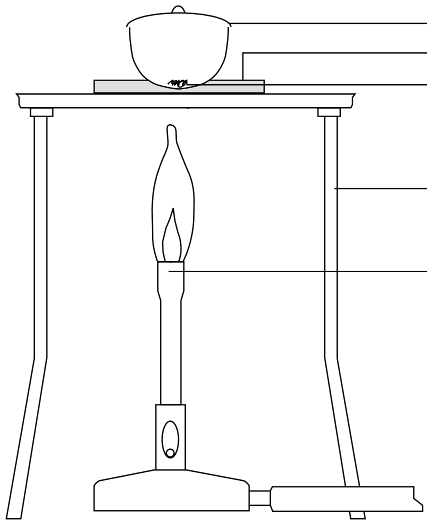
The change in mass when magnesium burns

Introduction

Many areas of chemistry involve careful measurement. One example is measuring the change in mass before and after a chemical reaction. This experiment shows how the mass of magnesium changes when it combines with oxygen.



What to record

What was done.

The mass of the magnesium and the magnesium oxide product.

What to do

1. Clean a 10–20 cm length of magnesium ribbon with emery cloth to remove the oxide layer. Loosely coil it.
2. Weigh a clean crucible and lid. Place the magnesium inside and reweigh.
3. Heat the crucible for 5–10 minutes, lifting the lid a little from time to time with tongs. Ensure that as little product as possible escapes.
4. Continue heating until glowing ceases.
5. Cool the crucible and reweigh.

Safety

Wear eye protection.

Questions

1. Why is the magnesium ribbon cleaned before the experiment?
2. Why is the lid needed?
3. Why is the lid lifted from time to time?
4. How could weighing be used to show when the reaction is complete?

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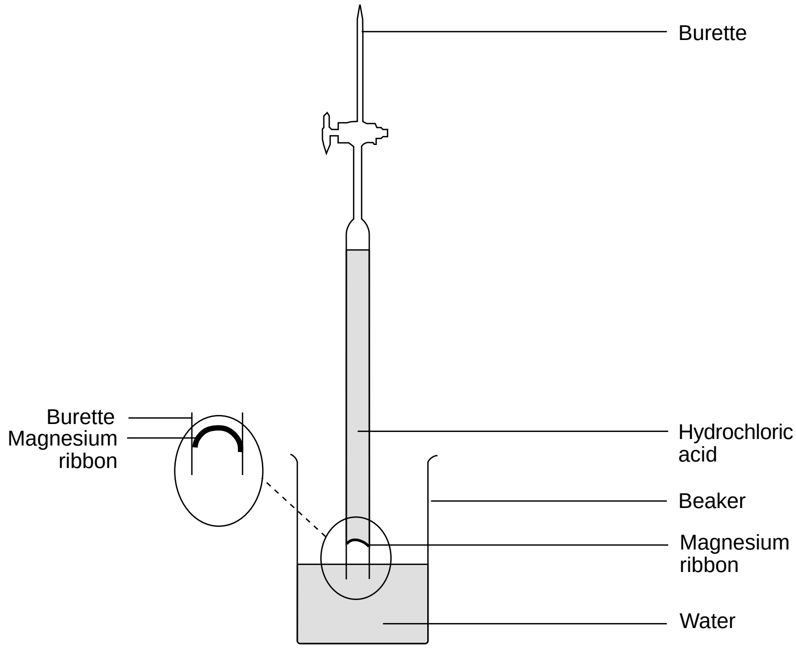
The volume of 1 mole of hydrogen gas

Introduction

One mole of any gas occupies the same volume when measured under the same conditions of temperature and pressure. In this experiment, the volume of one mole of hydrogen is calculated at room temperature and pressure.



What to record

What was done.

The mass of magnesium used and the volume of hydrogen produced.

What to do

1. Clean a piece of magnesium ribbon about 3.5 cm long and weigh accurately. (This should weigh between 0.02 and 0.04 g; if not adjust the amount used.)
2. Measure 25 cm^3 of dilute hydrochloric acid (**Irritant**) into the burette. Carefully add 25 cm^3 of water on top of this.
3. Push the magnesium into the end of the burette so it will stay in position with its own tension.
4. Add 50 cm^3 of water to a 250 cm^3 beaker.
5. Quickly invert the burette into the water. If this is done quickly and carefully very little is lost. It is important that the liquid level in the burette starts on the graduated scale. If it is not on the scale; momentarily open the tap, this allows the level to drop). Clamp the burette vertically.
6. Take the burette reading (care: it is upside down!)
7. Observe the magnesium react as the acid diffuses downwards, wait until all the magnesium has reacted.

8. Note the new volume on the burette (care: it is upside down).
9. Record your results.

Safety

Wear eye protection.

Questions

The equation for the reaction is

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

The relative atomic mass of magnesium is 24.

1. Copy out and fill in the gaps:
   ____ g Magnesium has produced ____cm^3 hydrogen
   ____ /24 moles magnesium produces _____ cm^3 hydrogen.
   1 mole magnesium produces ________cm^3 hydrogen which is the volume of one mole of hydrogen gas.

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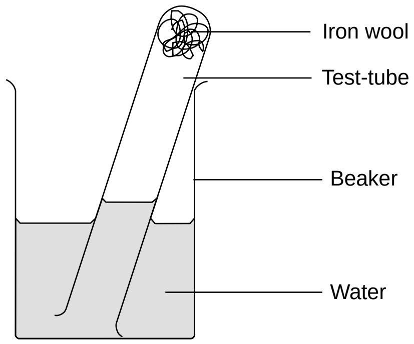
How much air is used during rusting

Introduction

This experiment illustrates how much of the air is used in the rusting process. It is the oxygen component of air which reacts in the rusting process. This experiment allows calculation of the percentage of oxygen in the air.



What to record

Initial length of column of air	
Final length of column of air in the tube	

What to do

1. Place approximately 3 cm depth of iron wool in the bottom of a test-tube. Wet the iron wool with water.
2. Invert the test-tube in a beaker of water (approximately 20 cm^3).
3. Measure the length of the column of air.
4. Leave the test-tube for at least one week, and then measure the new length of the column of air. Take care not to lift the test-tube out of the water.

Questions

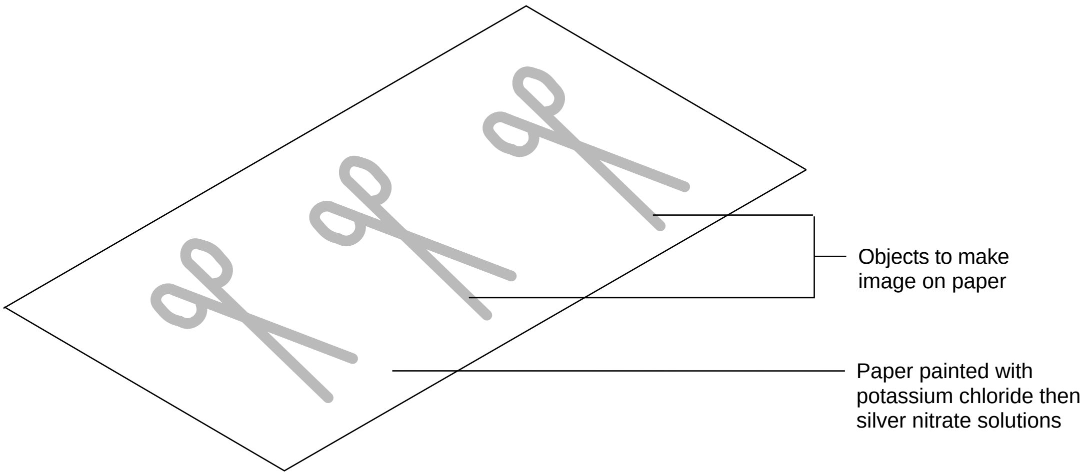
1. Write a word equation for this reaction.
2. Calculate the percentage of oxygen in air.
3. How could it be shown that the reaction is complete?

RS•C

Making a photographic print

Introduction

Only a very small amount of energy is needed to break down silver halide compounds (silver chloride, silver bromide or silver iodide) to the silver metal. This small amount of energy is available from many sources including light, X-rays and radiation from a radioactive substance. The above three silver halides can be used to make photographic film and photographic paper. In this experiment, a photographic print is produced.



What to do

1. In a darkened room, take a piece of paper and paint one side of it with the potassium chloride solution. Dry the paper with a hairdryer.
2. Paint the dried paper, on the same side, with the silver nitrate solution. Dry the paper with a hairdryer.
3. Place your chosen objects(s) on top of the paper and place under an ultraviolet light for 30 min or in sunlight for 2 h.
4. Switch off the ultraviolet light (if used) and remove the objects from the top of the paper. Observe what has happened.

Safety

Wear eye protection and protective gloves. Care with ultraviolet light; do not look directly at the light, it can damage your eyes.

Questions

1. What happens to the paper when the silver nitrate is painted onto it?
2. Write a word equation for the above reaction.
3. Explain what happens when the paper is exposed to light.