DEMONSTRATION 8.1

REACTIVITY OF SODIUM

The reactivity of sodium is assessed in three different liquids: water, liquid ammonia, and cyclohexane. Its reactivity is seen to be remarkably different in each.

EQUIPMENT

- 2 petri dishes
- scalpel
- glass-walled evacuated Dewar

REAGENTS

- sodium metal, Na
- water (20 mL)
- cyclohexane, C_6H_{12} (20 mL)
- universal indicator

PROCEDURE

- Half fill one petri dish with water and the other with cyclohexane.
- Add some universal indicator to the petri dish filled with water and place both petri dishes onto the overhead projector.
- Cut two small pieces of sodium and add one to the cyclohexane and the other piece to the water.
- Observe the reactions.

RESULTS

There is no reaction between the sodium and the cyclohexane.

The sodium reacts violently with water and produces $H_2(g)$ and hydroxide ions, as evidenced by the green to violet colour change of the universal indicator.

$2Na(s) + 2H_2O(l) \zeta 2Na^+(aq) + 2OH^-(aq) + H_2(g)$

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.2

REACTION OF SODIUM AND CHLORINE

Sodium metal reacts with chlorine gas to produce sodium chloride.

EQUIPMENT

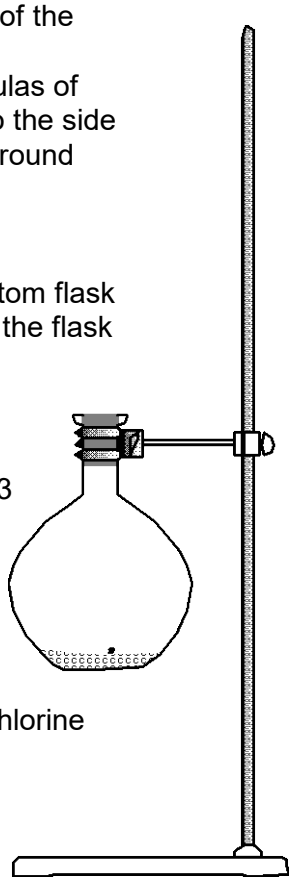
- chlorine gas (reacting Potassium permanganate with conc. Hydrochloric acid in a side arm flask (buchner flask) attached to rubber tubing).
- spatula
- 2 L round bottomed flask
- tongs
- glass stirring rod (to fit flask, with 6 cm protruding)
- cork
- retort stand
- clamp and boss head
- wash bottle

REAGENTS

- sodium metal (fresh), Na (0.5 cm^3)
- ethanol (for washing)
- sand (100 g)

PREPARATION

- Pour dry sand into the round bottom flask, to a depth of approximately 1 cm.
- Smear some vaseline on to the glass stopper and the inside of the neck of the flask. Place the flask in the fume hood.
- Place the side arm flask into the fume hood. Add 3 to 4 spatulas of potassium permanganate. Attach a length of rubber tubing to the side arm of the flask. Place the other end of the tubing inside the round bottom flask.
- Pour 70mL of 10M HCL into the side arm flask and stopper immediately.
- Collect the yellowish chlorine gas generated in the round bottom flask and stopper the flask with the greased glass stopper. Clamp the flask as shown in the diagram.



PROCEDURE

- Just before the lecture begins cut a piece of clean sodium.
- Using the tongs, drop the sodium onto the sand and add 2 - 3 drops of water from the wash bottle, so that it makes contact with the sodium.
- Observe the reaction.
- When the reaction is complete, replace the glass stopper.

RESULTS

The water reacts with the sodium and the reaction generates enough heat to melt the sodium. The hot sodium reacts with the chlorine gas, yielding a bright yellow flame and white fumes of NaCl.

$2Na(s) + Cl_2(g) \zeta 2NaCl(s)$

CAUTION

Sodium metal reacts explosively with moisture and should be stored under nitrogen or kerosene.

Chlorine gas is a strong oxidising agent and an irritant.

DISPOSAL Open the flask in a fume hood to dissipate any unreacted chlorine then wash the flask with ethanol, to remove unreacted sodium; then wash with water.

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.3

THE SOLVAY PROCESS

Aqueous sodium chloride reacts with ammonia gas and carbon dioxide to produce solid sodium hydrogencarbonate which decomposes to produce sodium carbonate.

EQUIPMENT

- 250 mL beaker
- tongs
- bunsen burner
- tripod
- filter paper
- filter funnel

REAGENTS

- ammonia, NH_3 (15 M)
- dry ice, solid CO_2
- sodium chloride
- universal indicator

CAUTION

Concentrated ammonia solution can cause burns. It is irritating to eyes, skin and respiratory system.

PROCEDURE

- Saturate the ammonia with sodium chloride.
- Add pieces of dry ice.
- After a period of time sodium hydrogencarbonate precipitates from the cold reaction mixture.
- Filter off the solid $NaHCO_3$ and heat to 175˚C, whereupon the solid decomposes to solid sodium carbonate, Na_2CO_3.

RESULTS

The first stage of the reaction is:

$$NH_3(g) + CO_2(g) + H_2O(l) + Na^+(aq) \zeta NaHCO_3(s) + NH_4^+(aq)$$

The universal indicator changes from purple to green-blue.
This reaction can be thought of as a metathesis reaction of NH_4HCO_3 (from $NH_3 + H_2CO_3$) and NaCl, to yield the products $NaHCO_3$ and NH_4Cl.
When the filtered $NaHCO_3$ is heated to 175˚C, it decomposes to sodium carbonate.

$$2NaHCO_3(s) \xrightarrow{heat} Na_2CO_3(s) + CO_2(g) + H_2O(g)$$

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.4

BURNING MAGNESIUM IN CARBON DIOXIDE

EQUIPMENT

- tongs
- medium beaker
- wooden taper and matches
- bunsen burner

REAGENTS

- dry ice, solid CO_2
- magnesium ribbon (5 cm)
- water

PREPARATION

- Place several small pieces of dry ice into the beaker and add water. Allow the beaker to fill with carbon dioxide gas.
- Light the bunsen burner.

PROCEDURE

- Holding the magnesium ribbon with tongs light one end of the ribbon in the bunsen burner flame and insert it quickly into the beaker (into the gas only).
- Avoid looking directly at the burning magnesium.
- Continue holding the burning strip of magnesium in the beaker until the reaction ceases.
- For comparison light the wooden taper and place it into the gas in the beaker.

RESULTS

The heat from the burning magnesium is sufficient to sever the bonds in carbon dioxide, producing magnesium oxide and carbon.

$$2Mg(s) + CO_2(s) \xrightarrow{heat} 2MgO(s) + C(s)$$

The burning wooden taper is extinguished by the carbon dioxide gas.

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.5

THE REACTION OF CALCIUM HYDROXIDE AND CARBON DIOXIDE

Dry ice is added to a solution of calcium hydroxide and bromothymol blue indicator. Upon adding excess dry ice a colour change is observed.

EQUIPMENT

- tongs
- medium beaker

REAGENTS

- dry ice, solid CO_2
- calcium hydroxide solution, $Ca(OH)_2(aq)$
- bromothymol-blue indicator ($pK_a = 7$)

PROCEDURE

- Add a few drops of bromothymol-blue indicator to the calcium hydroxide solution (200mL)
- Add a few pieces of dry ice to the calcium hydroxide solution.

RESULTS

The carbon dioxide from the dry ice reacts with calcium ions to give a white, milky precipitate of calcium carbonate

$$Ca(OH)_2(aq) + CO_2(g) \zeta CaCO_3(s) + H_2O(l)$$

Upon adding excess dry ice, the calcium carbonate dissolves and the bromothymol-blue changes to a yellow colour indicating the presence of HCO_3^- and an acidic solution.

$$CaCO_3(s) + H_2O(l) + CO_2(g) \zeta Ca^{2+}(aq) + 2HCO_3^-(aq)$$

$$HCO_3^-(aq) \ \Phi \ H^+(aq) + CO_3^{2-}(aq)$$

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.6

COLOURED FLAMES PRODUCED BY THE ALKALI AND ALKALINE EARTH METALS

The salts of Group 1 and Group 2 metals give off unique colours in a flame.

EQUIPMENT

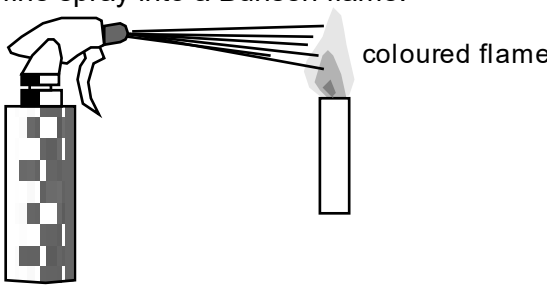
- Wire (platinum or nichrome, clean)
- spray bottle with respective metal ion solutions stored in the mezzanine.
- bunsen burner

REAGENTS

- hydrochloric acid, HCl (10 M)
- salts of alkali metals
- salts of alkaline earth metals

PROCEDURE

- The coloured flames may be observed by dipping a clean platinum or nichrome wire (wet with concentrated HCl) into salts of these metals and holding the wire in a Bunsen flame.
- Persistent colours can be obtained if a concentrated salt solution is blown as a fine spray into a Bunsen flame.



RESULTS The following salts give a substantial colour to the flame:

K:	violet	(1M Potassium chloride)
Na:	intense yellow	(1M Sodium chloride)
Ba:	apple green	(1M Barium chloride)
Sr:	crimson	(1M Strontium nitrate)
Cu:	pale green	(1M Copper chloride)

DEMONSTRATION 8.7

REACTION OF ALUMINIUM AND BROMINE

Aluminium and bromine react spectacularly to produce aluminium bromide.

EQUIPMENT

- 10 mL measuring cylinder
- 600 mL beaker
- 12 cm watch glass

REAGENTS

- liquid bromine, Br_2 (10 mL) (use direct from reagent bottle)
- aluminium foil, (5 cm x 5 cm)

PREPARATION

- Working in a fume hood, add the bromine to the beaker.
- Cover the beaker with a watch glass.
- Tear the aluminium foil into small pieces and place them on the watch glass.

PROCEDURE

- Dim the lecture theatre lights and then invert the watch glass.
- Set the watch glass back on top of the beaker.

RESULTS

After approximately 1 minute, small flashes and flames moving on the surface of the liquid are observed.

$2Al(s) + 3Br_2(l) \zeta 2AlBr_3(s)$

CAUTION

Bromine is a strong oxidising agent which vaporises readily at room temperature to produce toxic fumes. The products of the reaction are also toxic and may cause burns.

DISPOSAL

A mild reducing agent, such as sodium thiosulfate or sodium hydrogen-sulfite, should be reacted with the bromine. The aqueous mixture can then be flushed down the drain with water.

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.8

REACTION OF ALUMINIUM AND IODINE

Three drops of water are added to an evaporating dish containing a mixture of aluminium powder and iodine powder. After a short period, thick purple-brown fumes are seen and the reaction bursts into flames.

EQUIPMENT

- evaporating basin, approximately 8 cm diameter
- pasteur pipette with teat
- insulating mat
- small beaker

REAGENTS

- aluminium powder, Al (dry)
- iodine, I_2
- water

PREPARATION

- Grind 2 heaped nickel spoonfuls of iodine very finely.
- Place the powder into the evaporating basin.
- Add the aluminium powder (10 cm^3).
- Mix the two powders very carefully.

CAUTION

On very humid days the mixture can be ignited by the moisture in the atmosphere.

- Place the basin on an insulating mat in an otherwise empty, darkened fume hood.
- Provide the beaker with a little water and the pipette.

PROCEDURE

- Using the pasteur pipette, place water (3 to 5 drops) on the surface of the mixture. **(Water is the catalyst for the reaction).**
- Step well back from the fume hood.

RESULTS

An initiation period will follow which can range from about ten seconds to five minutes. During the first few seconds thick, purple-brown smoke will grow into a dense cloud. The system will soon burst into bright flames. It is possible that the evaporating basin will crack under the heat. The fuming will abate relatively quickly, whereas the heat persists for a considerable time. A grey-white ash-like product will remain.

$$8Al(s) + 6I_2(s) + 3O_2(g) \zeta 2Al_2I_6(g) + 2Al_2O_3(s)$$

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.9

EXPLOSIVE DECOMPOSITION OF NITROGEN TRIIODIDE

Iodine powder is dissolved in aqueous ammonia and the resultant solution is then allowed to dry on three filter papers. These are touched with a feather on a long pole, giving rise to the violent explosion of nitrogen triiodide and emission of violet smoke.

CAUTION **When dry, nitrogen triiodide (NI_3) is extremely unstable and can detonate unexpectedly. A slight touch or even an air movement can trigger the explosion.**
In contrast, wet nitrogen triiodide is relatively safe to handle.

EQUIPMENT

- 50 mL beaker
- stirring rod and spatula
- filter paper, at least 9 cm diameter
- feather or a shred of tissue paper
- pole, about 2 metres long
- headphones
- adhesive tape
- optional: retort stand with 3 retort rings, perspex safety screen

REAGENTS

- iodine, I_2 (3 g)
- ammonia, NH_3 (15 M, 15 mL)

PREPARATION

- Use the beaker to make up nitrogen triiodide.
- Add iodine to the ammonia.
- Stir and let stand for 15 minutes.

CAUTION **Concentrated ammonia solution can cause burns.**
It is irritating to the eyes, skin and respiratory system.

- Place three pieces of filter paper on the bench, at least half a metre apart or place them on the retort rings which are mounted on the retort stand, one above the other, with as much vertical distance between them as possible.
- Secure filter paper with adhesive tape to the desk or retort rings.
- Place the safety screen in position.
- Fasten the feather or the tissue securely to the top of the pole with adhesive tape.

CAUTION **The following preparation must be completed within 5 minutes!**

- Retaining the solid matter in the beaker, decant the supernatant liquor into a sink and flush with water.
- With a spatula, scrape the brown residue of nitrogen triiodide onto a stack of four pieces of filter paper. These will absorb most of the remaining liquid.
- Divide the solid into 3 equal parts while still damp.
- Transfer each part to one of the pieces of filter paper secured to bench or retort stand and pat down gently.
- Allow the solid to dry undisturbed for 60 minutes. In humid conditions allow a longer drying time.

CAUTION **Nitrogen triiodide is extremely sensitive to the touch.**
It is a powerful explosive!
Larger amounts than specified here should not be prepared!
Great care must be taken even when handling these modest amounts.

The noise from the explosion can cause ringing in the ears. The demonstrator must wear earplugs. Students should be warned to cover their ears with their hands and be no closer than 5 metres.

Standing well back and using the pole, lightly touch the triiodide with the feather. If the retort ring assembly is used, only the sample on the bottom need be touched. The other two will be set of by the explosion below.

RESULTS Detonation with emission of violet smoke should occur immediately. A successful detonation will completely destroy all traces of the dry nitrogen triiodide.

$$8NH_3 \cdot NI_3(s) \zeta 5N_2(g) + 6NH_4I + 9I_2$$

DISPOSAL If a sample should not have exploded, rub it gently with the pole to encourage detonation or allow it more time to dry. Otherwise, carefully pour water on the lecture table so that it slowly flows into the sample. When totally wet, the sample should be flushed down the drain with water. Any nitrogen triiodide that remains in the preparation beaker or on the spatula should be decomposed by rinsing with ethanol. Let stand overnight and then flush the solution down the drain with water.

DEMONSTRATION 8.10

PRODUCTION OF SULFUR DIOXIDE AND SULFUROUS ACID

Sulfur dioxide gas, produced by burning sulfur, is dissolved in water containing universal indicator. The indicator changes colour in the acid.

EQUIPMENT

- 3 x 1 L flasks
- deflagrating spoon

REAGENTS

- universal indicator
- sulfuric acid, H_2SO_4 (1 M)
- solid sulfur (a pea-sized chunk is sufficient)

PROCEDURE

- Prepare three large flasks by adding about 100 mL of water to each.
- Add enough universal indicator solution to each to give the water a distinct colour (usually green is the neutral range).
- Set the first container aside as a standard.
- To the second container add a few drops of acid to produce a red colour which can be used as a standard.
- Carefully lower a deflagrating spoon containing a pea-sized piece of burning sulfur into the third container.
- Swirl the container and notice the colour change as the gas dissolves in the water.

RESULTS

Note the production of a gas as the sulfur burns.

1) Burning sulfur produces sulfur dioxide gas

$S_8(s) + 8O_2(g) \rightarrow 8SO_2(g)$

2) Sulfur dioxide dissolves in water to form sulfurous acid,

$H_2SO_3(aq)$, which oxidises to form sulfuric acid.

$SO_2(g) + H_2O(l) \rightarrow H_2SO_3(aq)$

$2H_2SO_3(aq) + O_2(g) \rightarrow 2H_2SO_4(aq)$

The acid solution causes the universal indicator to change from green to red.

DEMONSTRATION 8.11

IRON AND SULFUR

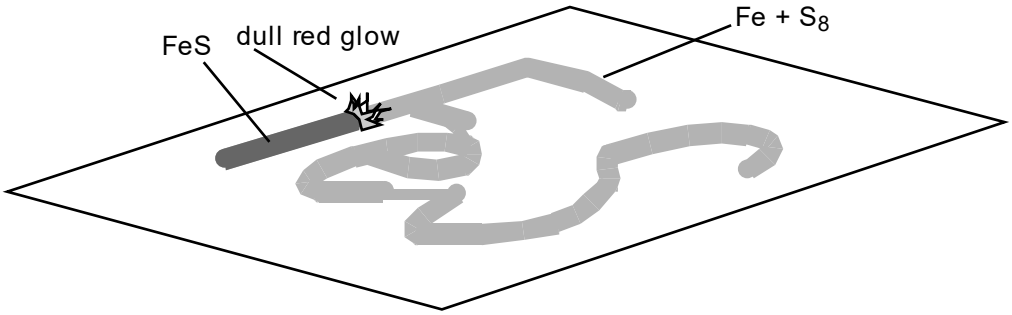
EQUIPMENT
- metal or ceramic pad

REAGENTS
- iron filings
- sulfur (S_8)

PROCEDURE
- Form a trail or pattern with a mixture of 12 g iron and 12 g sulfur powder on a metal or ceramic fibre pad.
- One end of the trail is then ignited with a small, hot bunsen flame (see diagram).

RESULTS A glowing red band moves along the trail as iron and sulfur combine to form iron sulfide.

$8Fe(s) + S_8(s) \rightarrow 8FeS(s)$



DEMONSTRATION 8.12

ZINC AND SULFUR

When a mixture of zinc and sulfur are ignited, a violent reaction occurs.

EQUIPMENT

- large insulating mat
- bunsen burner

length of strong wire

REAGENTS

- powdered sulfur, S_8 (1 g)
- powdered zinc, Zn (6 g)

PREPARATION

- Place insulating mat and burner into the otherwise empty fume hood.
- Using a small evaporating basin, weigh out 6 g of zinc and 1 g of sulfur.
- With a small spatula mix the two powders until the colour of the mixture is uniform.
- Place the powder directly on and in the middle of the insulating mat.

PROCEDURE

- Turn on ventilation and light the burner.
- Heat the tip of the wire to red heat.
- At arm's length, plunge the red-hot tip of the wire into the centre of the powder pile.

CAUTION

- **This is a violent reaction.**
- **Step back as soon as the reaction has been initiated.**
- **Warn the audience not to look directly at the reaction site.**

RESULT

Almost immediately a violent reaction will occur with much hissing and sparking, and the emission of a flash of bright light and dense smoke. The smoke consists of ZnS, ZnO and SO_2. The solid remaining on the insulating mat is yellow and grey.

The reactions that are thought to occur are:

$$8Zn(s) + S_8(s) \xrightarrow{heat} 8ZnS(s)$$

$$2Zn(s) + O_2(g) \zeta 2ZnO(s)$$

$$S(s) + O_2(g) \zeta SO_2(g)$$

DEMONSTRATION 8.13

ZINC IN HYDROCHLORIC ACID

A strip of metal is placed in a beaker containing acid. Gas is evolved on the metal's surface and the metal is eaten away.

EQUIPMENT

- 1 L beaker

REAGENTS

- strip of zinc (about 20 cm long)
- hydrochloric acid, HCl (5 M, 500 mL)

PROCEDURE

- Fill the beaker with about 500 mL of 5 M hydrochloric acid.
- 5 M hydrochloric acid can be made by diluting 10 M acid twofold.
- Place the strip of zinc into it.

RESULTS

Hydrogen gas will evolve at the surface of the zinc.

The reaction that occurs is:

$Zn(s) + 2H^+(aq) \zeta Zn^{2+}(aq) + H_2(g)$

The gas may be collected and tested with a lighted splint.

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.14

POTASSIUM CHLORATE AND SUGAR

A mixture of potassium chlorate and sugar is prepared five times with small amounts of salts added to four of them. The mixture are reacted sequentially and violent reactions occur, in which characteristic coloured flames are produced.

EQUIPMENT

- 5 small evaporating dishes
- pasteur pipette with teat
- nickel spoon and spatula
- insulating mat
- mortar and pestle

REAGENTS

- potassium chlorate, $KClO_3$ (30 g)
- sugar, $C_{12}H_{22}O_{11}$ (10 g)
- sulfuric acid, H_2SO_4 (18 M, 1 mL)
- barium chloride-2-water, $BaCl_2 \cdot 2H_2O$ (3 g)
- strontium nitrate, $Sr(NO_3)_2$ (3 g)
- sodium chloride, NaCl (2.5 g)
- copper(II) chloride-2-water, $CuCl_2 \cdot 2H_2O$ (2.5 g) (Hygroscopic, hence must prepare fresh or keep dry)

PREPARATION

- Into each of the 5 dishes weigh out 6 g of potassium chlorate and 2 g of granulated sugar. Grind it gently so as to mix the two substances together
- Exercise great care.

CAUTION **!**

Potassium chlorate is a strong oxidising agent.
A mixture with a flammable material becomes explosive !
Grind with non-metal implements (wood or plastic).
Do not store this mixture!
Handle with care!

- Leave one dish with only potassium chlorate/sugar mixture.
- To the others add the following ground salts:
  $BaCl_2 \cdot 2H_2O$ (3 g) to one dish, $Sr(NO_3)_2$ (3 g) to another, NaCl (2.5 g) to another and $CuCl_2.2H_2O$ (2.5 g) to a fourth dish.
- Place all the dishes with the mixtures on an insulating mat on the demonstration bench.
- Keep the dishes well separated.
- Supply the concentrated sulfuric acid in a small reagent bottle.
- Provide pipette, spoon and spatula.

PROCEDURE

- Perform the demonstration in the fume hood.
- Dim the lecture theatre lights.
- With the spatula make a small depression in the top of each mixture.
- Using the pipette, place one drop of acid into the depression of one of the mixtures.
- Stand well back.
- After each reaction has completely ceased, add sulfuric acid (one drop) to the other dishes sequentially.

CAUTION **Ensure that none of the prepared mixtures are standing near the reaction site!**

RESULTS After one or two seconds, the reaction begins with the evolution of smoke. Quickly, the mixture will burst into flames.

$2ClO_3^-(aq) + 2H^+(aq) \zeta 3O_2(g) + 2H^+(aq) + 2Cl^-(aq)$

$12O_2(g) + C_{12}H_{22}O_{11}(s) \zeta 12CO_2(g) + 11H_2O(l)$

The addition of salts of the alkali and alkali-earth metals will create different coloured flames:

K: violet

Na: intense yellow

Ba: apple green

Sr: crimson

Cu: pale green

DISPOSAL Any residues should be flushed down the sink.

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.15

ALTERNATIVE POTASSIUM CHLORATE AND SUGAR

A test tube of potassium chlorate and sugar with “impurities” in different layers is prepared. When ignited, the mixture reacts violently with the layers producing different characteristic coloured flames.

EQUIPMENT

- pyrex test tube (150 x 25 mm)
- 600 mL beaker containing sand
- Pasteur pipette

REAGENTS

- potassium chlorate, $KClO_3$ (25 g)
- sugar (25 g)
- Barium, Ba (3 g)
- copper(II) chloride, $CuCl_2$ (3 g)
- strontium nitrate, $Sr(NO_3)_2$ (3 g)
- sodium chloride, NaCl (3 g)
- sulfuric acid, H_2SO_4 (18 M)

PREPARATION

- Weigh out the potassium chlorate in the quantities below into an evaporating dish and grind it gently.
- In a separate container, grind 20 g of granulated sugar.
- Add the appropriate amounts of ground sugar and "impurity" (Barium, copper (II) chloride, sodium chloride and strontium nitrate) to the potassium chlorate.
- Carefully mix the substances together and place in test tube (see instructions below).
- Exercise great care.

CAUTION

Potassium chlorate is a strong oxidising agent. A mixture with a flammable material can become an explosive one! Grind with non-metal implements (wood or plastic).

- **Fill the test tube as below:**

Zone	Mixture composition
Top	5 g $KClO_3$ and 5 g sugar
2nd	3 g powdered Copper, 5 g sugar and5 g $KClO_3$
2nd	3g sodium chloride, 5g sugar and 5g $KClO_3$
3rd	3 g strontium nitrate, 5 g sugar and 5 g $KClO_3$
Bottom	3 g of Barium Chloride, 5 g sugar and 5 g $KClO_3$

- Immerse the test tube in a 600 mL beaker containing sand.
- Dim the lights.

PROCEDURE

- Dim the lights in the lecture theatre.
- Place the test tube assembly in the fume hood and add 1–2 drops of concentrated H_2SO_4, into the test tube
- Stand back.

RESULTS

Brilliant exothermic reaction, sparks and flame, with the zones of differing chemical composition producing a variety of colours.

Zone	Nature of the flame
Top	white sparks
2nd	many yellow sparks
3rd	blue/green
Bottom	red

It may be necessary to adjust the amounts of powdered iron and strontium nitrate used to get the most colourful flames.

High Risk Demonstration:

- **Refer to HIRAC**
- **Set up in Red Tray**

DEMONSTRATION 8.16

THE REACTIONS OF CHLORINE WITH METALS

Chlorine gas reacts with the following metals: iron (steel wool), antimony and magnesium to form their chloride salts.

EQUIPMENT

- 3 gas jars
- tongs
- bunsen burner

REAGENTS

- chlorine gas, Cl_2
- steel wool
- antimony powder, Sb
- magnesium ribbon, Mg

PREPARATION

- Fill three wide mouth containers with chlorine gas.

PROCEDURE

- Ignite some steel wool in a flame and plunge into the chlorine gas.
- Sprinkle some antimony powder into the chlorine gas.
- Ignite some magnesium ribbon and plunge it into chlorine.

RESULTS

The steel wool burns in the chlorine forming dense brown fumes of iron(III) chloride, $FeCl_3$, which condense on the container as reddish-black flaky crystals. The antimony powder gives bright scintillations and sparks as it reacts to form white antimony chloride, $SbCl_3$. The magnesium ribbon continues to burn brightly in the chlorine forming white magnesium chloride, $MgCl_2$.