

Prussian Blue

To make **Prussian Blue**, you need to react together two chemicals. These are iron(II) sulphate and potassium hexacyanoferrate(III). They react to form a blue precipitate. This can be washed, powdered, and mixed with linseed oil to make a beautiful deep **blue** artists' pigment.



Eye protection must be worn



You are going to use some unfamiliar chemicals. Remember to ask a teacher if you are not sure what to do.

Job 1

The first job is to make the **iron(II) sulphate solution**. Get a 25cm³ conical flask and a 10cm³ measuring cylinder. Write the number **1** on the flask so you know which it is.



Weigh out 2g of iron(II) sulphate into the conical flask.

Measure 4cm³ of **distilled** water in the measuring cylinder. Use the plastic pipette to get it just right – take your time!

Add this water to your conical flask, and **SWIRL** the flask until the solid dissolves.

Job 2

Now you need to make the **potassium hexacyanoferrate(III) solution**. Get another 25cm³ conical flask and your 10cm³ measuring cylinder. Write the number **2** on the flask so you know which it is.

Carefully weigh out 1g of potassium hexacyanoferrate(III) into the conical flask.

Measure 3cm³ of **distilled** water in the measuring cylinder. Use the plastic pipette to get it just right – take your time!

Add this water to your conical flask, and **SWIRL** the flask until the solid dissolves.

Job 3

You are now ready to make your **Prussian Blue** colour by adding the potassium hexacyanoferrate(III) solution (**flask 2**) to the iron(II) sulphate solution (**flask 1**).

When you do this, you must:

- add the potassium hexacyanoferrate(III) solution **DROP-BY-DROP** using a plastic pipette, and
- **SWIRL** the contents of the flask as you add each drop

Take your time – get it right! Remember to add the contents of flask **2** to flask **1**!

You are now ready to turn your liquid into an artists' pigment

Lead Yellow

To make **lead yellow**, you need to react together two chemicals. These are potassium iodide and lead nitrate. They react to form a yellow precipitate. This can be washed, powdered, and mixed with linseed oil to make a beautiful deep **yellow** artists' pigment.



Eye protection must be worn

Job 1 Weigh out 4g of potassium iodide. Put it into a boiling tube. Measure out 10cm³ of distilled water, and add it to the boiling tube. Stopper the boiling tube, and **SWiRL** to dissolve the solid. Take care – make sure it is **all** dissolved.



IRRITANT

Job 2 Put your gloves on, and weigh out 4g of lead nitrate. Take care – this is **toxic**. Put it into a second boiling tube. Measure out 10cm³ of distilled water, and add it to the tube. Stopper the tube, and **SWiRL** to dissolve **all** the solid.



TOXIC

Job 3 You are now ready to make your **lead yellow** colour by adding the two chemicals together. Carefully pour the potassium iodide solution (pale yellow) into the lead nitrate solution (pale white).

Lead White

To make lead white, you need to react together two chemicals. These are sodium chloride and lead nitrate. They react to form a white precipitate. This can be washed, powdered, and mixed with linseed oil to make a white artists' pigment.



Eye protection must be worn

Job 1 Weigh out 2.5g of sodium chloride. Put it into a boiling tube. Measure out 10cm³ of distilled water, and add it to the boiling tube. Stopper the boiling tube, and **SWiRL** to dissolve **all** the solid.

Job 2 Put your gloves on, and weigh out 6g of lead nitrate. Take care – this is **toxic**. Put it in a second boiling tube. Measure out 10cm³ of distilled water, and add it to the boiling tube. Stopper the boiling tube, and **SWiRL** to dissolve **all** the solid.



TOXIC

Job 3 You are now ready to make your lead white colour by adding the two chemicals together. Carefully pour the sodium chloride solution (colourless) into the lead nitrate solution (the pale white).

Liquid to artists' pigment

Once you have made your coloured liquid, you must separate the coloured solid from the water. The solid then has to be washed and powdered. To use the powder as an artists' pigment, you have to mix it with linseed oil. The linseed oil will let you spread the paint on paper, and when it dries it begins chemical reactions which seal the colour to the paper.



Eye protection must be worn



You are going to use some unfamiliar chemicals and equipment. Remember to ask a teacher if you are not sure what to do.

Job 1

The first job is to separate the coloured solid from the water.

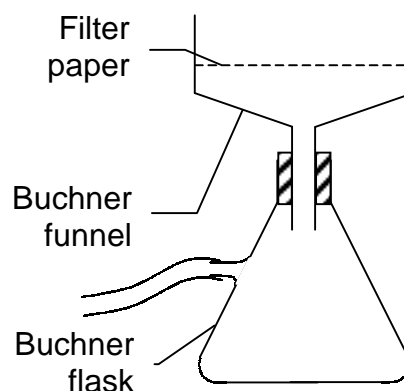
Set up a Buchner funnel, filter paper and Buchner flask as shown in the diagram on the right.

Connect the Buchner flask to a water pump.

Turn on the water supply.

Carefully pour your liquid into the Buchner funnel.

The water will be sucked away leaving your coloured solid behind.



Job 2

Now you need to remove any remaining water from your solid.

Carefully scrape your solid into a small beaker using a spatula.

Measure about 10cm³ of propanone in a measuring cylinder.

Take great care not to spill propanone on your skin or get it in your eyes. Don't **SNIFF** it, either.

Pour the propanone into the beaker, and stir the mixture with a stirring rod.

Put a new piece of filter paper in the Buchner funnel.

Pour the mixture in the funnel and filter it as you did in **Job 1**.



Job 3

You are now ready to make the dried solid into an artists' pigment.

Transfer the solid to a mortar. Grind it **CAREFULLY** with a pestle.

Add just enough linseed oil to make a thick paint.

Don't add too much at once! If the paint gets too runny you've had it!



You are now ready to get painting!

[Teacher Guide for Paints](#)

Contents:

Activity notes

Students' checklists

Technicians' notes

[Activity notes](#)

It is difficult finding safe chemicals from which to make paints. Red and yellow are especially tricky. For red, we have investigated using red lead, iron oxide or copper(I) oxide from the reaction between glucose and Fehling's reagent. The first two are unsatisfactory because little chemistry is involved (just mixing and grinding), and it is difficult to achieve a significant quantity of red solid in the last one. For yellow, various chromates give good colours, but it can be unsafe to isolate the solids. As a result, we have settled on Prussian blue, a lead white (lead chloride) and a lead yellow (lead iodide). These still need to be treated with respect and, as with all our activities, the students wear eye protection, overalls and gloves. An additional precaution is to seal the final pictures in plastic.

The only major problem comes from students who use too much linseed oil. This makes a sloppy mess and is not suitable for painting. We have found that the students get better results when they paint onto rectangles of white hardboard (easily available from hardware stores) rather than onto paper.

Prussian Blue, Lead Yellow, Lead White – students' checklist

Check you have:

- 1 x 10cm³ measuring cylinder
- 1 x test tube rack
- 5 x boiling tubes
- 1 x wash bottle with distilled water
- 2 x plastic pipettes

Prussian Blue, Lead Yellow, Lead White – technicians' notes

For 5 groups of students:

5 x 10cm³ measuring cylinders
5 x test tube racks
25 x boiling tubes
5 x wash bottles with distilled water
10 x plastic pipettes

On the side bench:

Digital balances
marker pens

iron(II) sulphate with spatula
potassium hexacyanoferrate(III) with spatula
lead nitrate with spatula
potassium iodide with spatula
sodium chloride with spatula

Artists' pigments – students' checklist

Check you have:

- 1 x 100cm³ beaker
- 1 x 10cm³ measuring cylinder
- glass rod
- spatula
- pestle and mortar
- 1 x Buchner funnel
- 1 x Buchner flask
- 1x water pump
- filter paper
- yoghurt pots

Artists' pigments – technicians' notes

For 5 groups of students:

5 x 100cm³ beakers
5 x 10cm³ measuring cylinders
5 x glass rods
5 x spatulas
5 x pestles with mortars
5 x Buchner funnels
5 x Buchner flasks
5 x water pumps
filter paper to fit Buchner funnels
yoghurt pots

On the side bench:

drying line with bulldog clips

With teacher:

propanone labelled "Propanone – **flammable**"
linseed oil
white spirit

brushes
A3 art paper or rectangle of white hardboard