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# Making artists pigments

The use of pigments in art goes back at least 40,000 years to the cave paintings in Lascaux and other sites.

These largely used iron oxides for reds and yellows and charcoal for black.

As time went on, people discovered how to prepare other pigments and make a greater range of colours. Unfortunately for us, many of the pigments easily made, and commonly used in the past, are compounds of lead, mercury, arsenic or chromium which are all toxic but there are safe options that can be carried out in the classroom.

The instructions below are for small-scale (almost microscale) preparations.

## Each group will need

|  |  |
| --- | --- |
| **For all** |  |
| Small beaker (or other container) | Stirring rod |
| Access to a balance | Filter paper & funnel |
| Small flask or similar for filtration |  |
| **Dark Red** |  |
| Copper sulphate (s)\* | Potassium Sodium Tartrate (Rochelle’s salt) (s)\* |
| sodium hydroxide (s)\* | Glucose \* |
| Access to water bath |  |
| **Azurite/malachite** |  |
| Copper sulphate (s)\* | Sodium Carbonate (s)\* |
| **Cobalt violet** |  |
| cobalt chloride (s)\* | Disodium hydrogen phosphate (s)\* |
| **Prussian Blue** |  |
| Potassium hexacyanoferrate III \* | Iron II chloride\* |
| Access to a hotplate |  |

\* You may decide to provide some or all of these as the solutions made up as described in each section.

**Dark Red**

This can be made by producing copper I oxide.

1. Dissolve 2.0g of copper II sulphate in 15 cm3 of distilled water.
2. Dissolve 3.5g of Potassium Sodium Tartrate (Rochelle’s salt) and 1.2g of sodium hydroxide in 10 cm3 of water.
3. Dissolve 1g of glucose in 5 cm3 of water.
4. Mix the three solutions
5. Warm in a hot water bath (~70°C) for 5-10 minutes.

*The colour of the solution slowly changes, through dark blue, green, brown, until a bright red precipitate appears.*

1. Once there is no further change being seen, filter the suspension and rinse with distilled water and leave to dry.

This particular pigment, once washed, need not be completely dried before making up into paint.

This reaction is, in effect, Fehling’s test

RCHO + 2Cu2+ + 5OH- → Cu2O (s) + RCOO- + 3H2O

**Azurite/malachite**

1. Dissolve 2.0 g of copper sulphate in 10 cm3 of water.
2. Dissolve 1.5 g of sodium carbonate in 10 cm3 of water
3. Pour the solutions together and a blue precipitate forms.
4. Filter the precipitate, wash with distilled water and leave to dry.

This gives you the blue pigment **Azurite**,

3 Cu2+ + 2 CO32- + 2 OH- 🡪 Cu3(CO3)2(OH)2 2Cu(CO3)Cu(OH)2

If you don’t wash it, the colour will slowly change to a greenish-blue: this is another pigment called **malachite**.

2 Cu2+ + CO32- + 2 OH- 🡪 Cu2(CO3)(OH)2

Azurite was known from ancient times as it can be found in some natural mineral deposits. But it was not common until the Middle Ages. It was the most important blue pigment in European painting throughout the middle ages and Renaissance until Prussian Blue was invented.

**Cobalt violet**

1. Dissolve 1.0 g of cobalt chloride in 10 cm3 of water.
2. Dissolve 1.0 g of disodium hydrogen phosphate (Na2HPO4) in 10 cm3 of water\*
3. Pour the solutions together and a purple precipitate forms.
4. Filter the precipitate and wash with distilled water.
5. Allow to dry then grind up and mix with oil to make a paint.

\* The phosphate is in excess to ensure that all the cobalt is precipitated.

**Prussian Blue**

1. Dissolve 0.125 g of potassium ferricyanide in 25 cm3 of water.
2. Dissolve 0.3 g of Iron II chloride in 15 cm3 of water
3. Pour the solutions together and a blue precipitate forms.
4. Slowly add the iron chloride to the potassium hexacyanoferrate III , with stirring if possible, and then put the beaker on a hotplate and boil for 5 – 10 minutes.
5. Filter the precipitate while still hot.
6. Once cooled, wash with distilled water and leave to dry – preferably in an oven at around 100°C.

The reaction is:

Fe2+ + Fe(CN)63- 🡪 Fe3[Fe(CN)6]2

Technically speaking, the pigment formed here is Turnbull’s blue. You could also use an iron III salt and potassium hexacyanoferrate II, which makes Prussian blue.

Artists argues over the differences between these pigments for centuries until in the 1990s it was found that they were chemically identical.

Prussian blue was the first artificially produced pigment available to artists and went on the market in 1724.

**Making Paint**

Tempera paint is made using egg yolk, pigment and water.

1. Only make as much paint as you think you are likely to use. This paint cannot be stored and used on another day. That being said, if you are making a blend of pigments it may be useful to make more of the pigment blend than you will use in one sitting. The dry mixture can be saved and used to make more paint later.
2. Start by grinding the pigment in a mortar and pestle, if needed. Some pigments require a rather long grinding time to be fine enough to disperse evenly.
3. Put a small amount of pigment into a dish or onto a suitable surface. Add water to the finely ground the pigment until you have a uniform paste. If needed, add a few small drops of ethanol to help it to mix. Good dispersion is critical to making good paint.
4. Obtain an egg and a 250-mL beaker. Break the egg and let the white of the egg drain into the beaker; retain the yolk in the shell. Pour the yolk back and forth between the halves the shell to remove more of the white. Alternatively, this can be done by carefully holding the yolk over the fingers and allowing the white to drain between the fingers. In this case, wash hands thoroughly afterwards
5. Gently place the yolk in its membrane on a paper towel. By lifting up the edge of the paper towel allow the yolk to roll to the edge. This helps to remove any remaining egg white. Egg white in the paint will cause it to drag on application and dry more quickly.
6. When the yolk is at the edge of the paper towel pierce it with a toothpick or the end of a paperclip and let the yolk drain out of the membrane into a 50 cm3 beaker.
7. Add about 5 cm3 of water to the yolk and stir. It is now ready to be mixed with pigment.
8. To make paint add together equal amounts of pigment paste and egg yolk mixture. Mix thoroughly. To obtain the consistency that you want you may need to add water.
9. A useful painting technique is to create layers of paint. The layers can be the same or different colours. Some paints will be more translucent or transparent than others; use this to your advantage. The paint will allow itself to be painted over once it is dry. Too much water can disturb the dried paint.