

How to use this pack

This pack has been produced with secondary school science, in particular chemistry, in mind. The experiments in this pack could be used with students up to the age of 16, at the teacher's discretion. We have included a post-16 supplement, *The colour supplement*, of more advanced material for those who wish to take things further.

The 10 prints are all of paintings in the National Gallery, London, and have been selected because they illustrate a variety of different issues which are of interest and concern to both the scientists and the art historians at the Gallery. One print, *The Incredulity of Saint Thomas* by Cima, is also in the Salters' A-level Chemistry course. Another, *An Experiment on a Bird in the Air Pump* by Joseph Wright, has been chosen because it illustrates an early experiment, rather than for technical matters relating to the condition of the painting itself.

We suggest that, if you have room, you display the prints on laboratory walls, so that when work relating to them is done, the images are familiar. Your students may not like some of the images, and it is unlikely that they will see all of them as 'beautiful'; but we hope that they will come to find them interesting at some level.

Throughout the text of this pack you will find that words in **bold** are explained in the Glossary.

The Paintings

- 1) *Saint John the Baptist with Saint John the Evangelist and Saint James* by Nardo di Cione
- 2) *The Virgin and Child before a Firescreen* by a follower of Robert Campin
- 3) *Portrait of Alexander Mornauer* by the Master of the Mornauer Portrait.
- 4) *An Allegorical Figure* by Cosimo Tura
- 5) *The Incredulity of Saint Thomas* by Cima da Conegliano
- 6) *Bacchus and Ariadne* by Titian
- 7) *'The Stonemason's Yard'* by Canaletto
- 8) *An Experiment on a Bird in the Air Pump* by Joseph Wright
- 9) *Winter Landscape* by Caspar David Friedrich
- 10) *Boating on the Seine* by Pierre-Auguste Renoir

*The experimental
section*

In this section there are suggestions for experiments and activities related to the work discussed in the paintings section. The experiments and activities are suitable for school and college laboratories and are designed to show how science, and in particular chemistry, is relevant to art. The material could also be used in science, chemistry or art clubs as extra-curricular activities, and as project ideas for the CREST awards scheme.

*The colour
supplement*

This section is primarily for post-16 students and for teachers. However, interested pre-16 students will also benefit from reading the section.

The *Colour supplement* includes sections on the biology and chemistry of vision, the visible spectrum, the mixing of colours, and the causes of colour in objects. It ranges through aspects of biology and physics as well as chemistry and art. This may help to demonstrate – as does the rest of the pack – that the boundaries between the conventional ‘subjects’ are not facts of nature but are man-made.

About the National Gallery

The National Gallery building and its contents belong to the British nation. The Collection consists of about 2300 western European paintings dating from about 1250–1900 AD. It is possibly the finest and most comprehensive collection of its kind anywhere in the world, and contains numerous masterpieces by famous artists – *eg* Rembrandt, van Gogh and others – as well as first-rate works by less well known, or anonymous, painters. Major art galleries, such as the National Gallery, London, are important repositories of paintings which, through accidents of history, have survived to the present day. Each painting is unique and irreplaceable. Its survival is partly due to the skill of its maker, who would have been familiar with techniques of proven quality, and partly due to the care taken of it by a succession of previous owners. It is the responsibility of the present generation to ensure that these objects continue to survive. None of the paintings in the National Gallery was painted to hang there, and many have been damaged either through accident or by design – *eg* large paintings are sometimes reduced in size, and all are threatened by atmospheric pollution and ultraviolet radiation. The Gallery's prime purpose is to ensure that the paintings' condition remains stable and that no deterioration takes place. This is achieved by employing a small team of scientists and restorers, and it is due to their efforts that this pack exists.

Science at the National Gallery

The National Gallery has a scientific department which employs six chemists. Their main concerns are:

- the analysis of pigments – these are largely inorganic chemicals;
- the analysis of media – organic chemicals; and
- preventative conservation – *eg* looking at issues of climate control and the effects of pollution.

Each of the scientists employed by the Gallery is a specialist in a particular area, such as organic, inorganic or analytical chemistry. Their work provides vital support for the work of the conservation department, which deals with the care of the paintings (both the side the public sees, and their backs). For example, when cleaning a painting the conservators need to know what materials they are dealing with, so that they can use appropriate chemicals. It is also important to know what pigments an artist used, for two reasons:

- to be able to distinguish between the artist's original work and later retouchings; and
- to ensure that any retouchings can be chemically different, so that future generations can distinguish between original paint and a restoration.

It is perhaps worth mentioning here that all retouchings are done using stable materials which can easily be removed again without affecting the original paint, and which do not themselves discolour.

Paintings (particularly those painted on wood panels) are very susceptible to changes of humidity. Modern air conditioning can be governed automatically by sensors that control the input of damp or dry air according to the prevailing conditions in a particular area.

Light damages all organic components of a painting, including the varnish and medium. It can also cause fading of certain pigments (particularly organic ones, such as lakes), and ultraviolet (UV) light is particularly harmful. The National Gallery filters out UV light.

Pollutants are monitored, and nitrogen oxides (such as NO_2) and sulfur dioxide (SO_2) are regarded as potentially damaging – not just to certain colours (ultramarine is the prime example, it discolours in acid conditions), but also to canvas supports. Air conditioning can filter out many of these pollutants.

Changes of temperature are not usually a problem to paintings, unless of course such changes are very extreme.

The National Gallery can sometimes offer free science tours to groups of school students. These take place in the Gallery in front of the paintings, and should be booked by telephone one term in advance. If you have timetabling problems why not book a joint visit with your art department?

For further details and bookings contact the education department by telephone on: 0207 747 2424; or by e-mail at: education@ng-london.org.uk

Information on all Gallery activities can be obtained from its website: www.nationalgallery.org.uk

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The Gallery regrets that visits to the Scientific or Conservation Departments are NEVER possible.