

Student Guide

Blue Pigments

Introduction:

Paint consists of a binder, such as oil, resin or gum, mixed with a colorant. Throughout history painters have used a wide variety of organic and inorganic substances to produce color in their work. Inorganic colorants are typically finely ground powders called pigments. In addition to their colors, pigments have unique properties such as particle size, shape, and translucency; solubility; or reactivity to temperature changes and pH. These physical and chemical properties can be examined to distinguish pigments. Since some pigments are characteristic of certain time periods, pigment identification can help with dating and verification. Because pigments react and age differently, identifying the pigments present may influence decisions about the conservation treatment of a painting or painted object.

Objectives:

- Make qualitative observations of unknown pigments
- Use chemical tests to identify unknown pigments
- Use microscopy to identify unknown pigments

Supplies (per group):

Pigment sample I, II, III, and IV
Microscope
Microscope slides
Cover slips
Microspatula
Distilled water
8 Test tubes (small)
Droppers or pipets
Bunsen burner or short (votive) candles
Matches or lighter
Hydrochloric acid (HCl), 10%
Sodium hydroxide (NaOH), 5%

Safety: HCl and NaOH are corrosive. Minimize contact with skin. Wear gloves and goggles.

Procedure:

Microscopy:

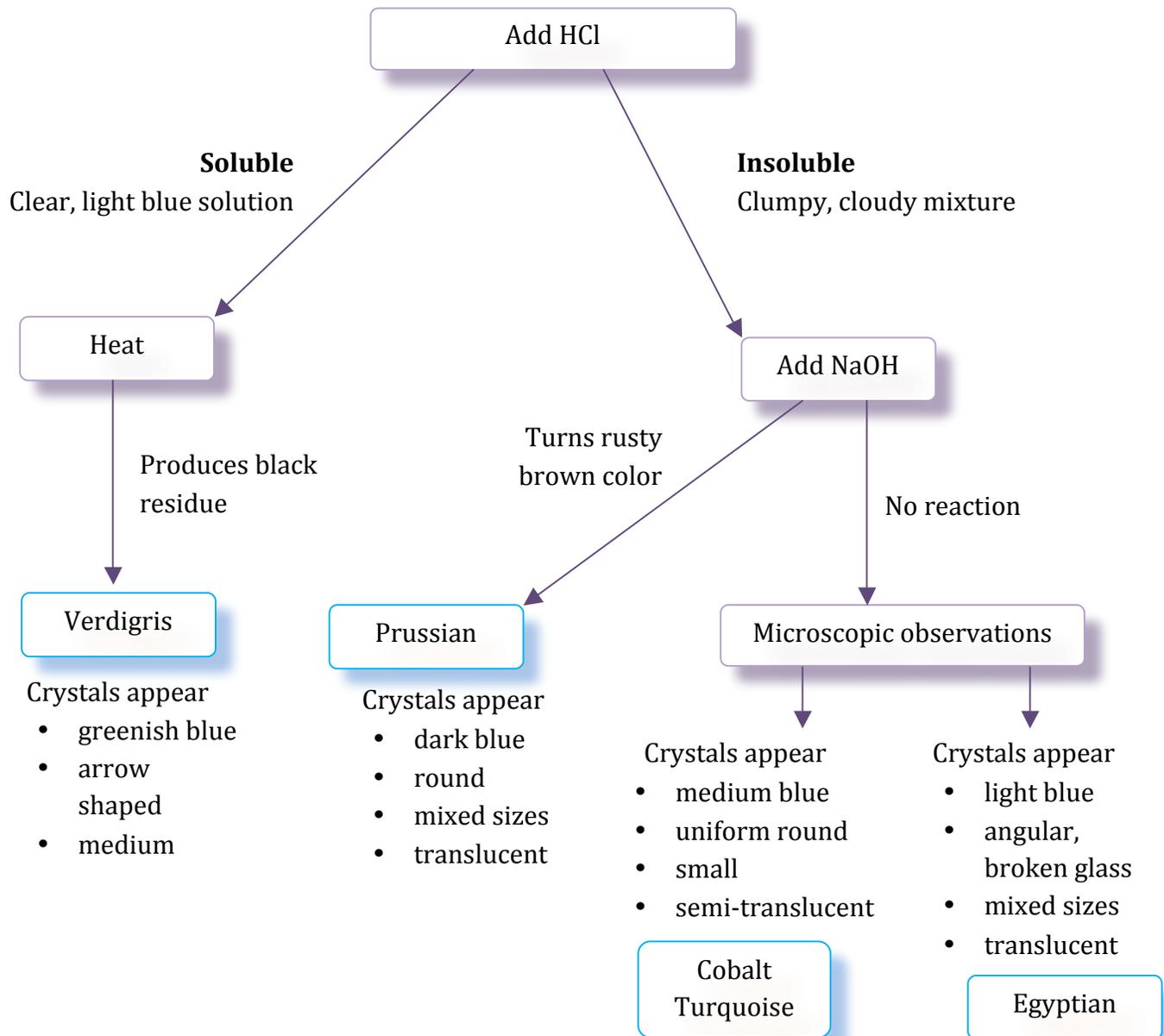
1. Obtain 4 microscope slides and covers. Label your slides I, II, III, and IV.
2. Using the tip of a microspatula, take a tiny amount of Pigment I for your first slide. Place a few crystals of the pigment in the center of the slide. Add 1 small drop of distilled water to the slide and then cover. Be careful not to add too much water.
3. Repeat Step 2 for Pigments II, III, and IV.
4. View your prepared slides under the microscope. Observe. For each pigment, take note of its relative particle size, shapes, color, uniformity, and degree of transparency.

Chemical Tests:

1. Obtain 8 small test tubes. Label the test tubes I, II, III, and IV. Each pigment will require 2 tests, so you will need two tubes for each number.
2. Using the tip of a microspatula, place a tiny amount of Pigment I into your first test tube. You need only a few particles; You do not need to cover the bottom of the test tube.
3. Repeat Step 2 with Pigments II, III, and IV and their respective test tubes.
4. In each of these 4 tubes, add 3 drops of the dilute HCl. Swirl each tube to mix and allow mixture to settle. Observe and record the characteristics of each mixture. View against white background. Acid soluble pigments will dissolve and appear as a homogenous colored solution. Acid insoluble pigments will settle at the bottom of the tube in a clumpy, cloudy mixture.
5. Using the tip of a microspatula, place a tiny amount of Pigment I into one of your remaining test tubes.
6. Repeat Step 5 with Pigments II, III, and IV.
7. If the pigment was soluble in acid in Step 4, test its second sample in heat. Using tongs, hold the test tube over a Bunsen burner or candle flame for about 5 minutes. Once cooled, wipe exterior of test tube to remove soot, etc. Observe and record color changes.
8. If the pigment was insoluble in acid in Step 4, test its second sample with NaOH. Add 3 drops of the dilute NaOH to the test tube. Swirl each tube to mix and wait about 2 minute for reaction. Observe and record color changes.
9. Using your observations and the pigment identification chart provided, determine the identities of Pigments I, II, III, and IV.

Clean up: The contents of the test tubes with NaOH and HCl should be disposed of in the proper container.

Pigment Identification Flow Chart



Student Name _____ Date _____ Period _____

**Blue Pigments
Answer Sheet**

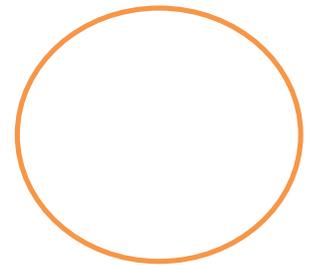
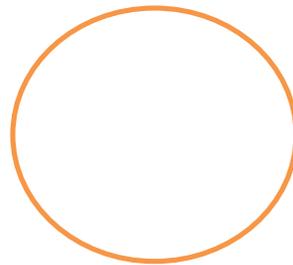
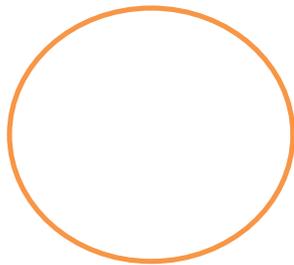
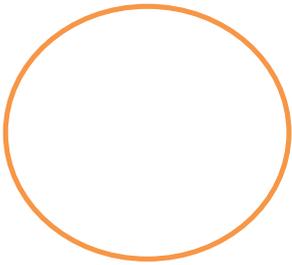
Microscopy (Label the circles with the magnification used):

Test Tube I

Test Tube II

Test Tube III

Test Tube IV



Observations

Pigment	Particle Size	Particle Shape	Color	Uniformity	Degree of Transparency
I					
II					
III					
IV					

Chemical Tests:

First set of test tubes with dilute HCl (Label as soluble or insoluble):

I	II	III	IV

Second set of test tubes with heat (Record color change ONLY for the test tubes requiring heat):

I	II	III	IV

Second set of test tubes with NaOH (Record color change ONLY for the test tubes requiring NaOH):

I	II	III	IV

Determine the identities of the four pigments:

I	II	III	IV

Analysis Questions

1. Discuss the difference between qualitative data and quantitative data.

2. Which physical property was used to determine which chemical test should be completed? Define the physical property. List 3 other physical properties that could be used to identify the pigments.

3. Why is it necessary to use more than one chemical test to identify the pigments?

4. Using the internet, research the famous artist Vincent van Gogh and his painting, "A Starry Night". Write a reflection of what the painting says to you.
