

Frescos

Materials:

Item	Amount per student	Amount for 24 students
Lime (CaO)	0.2 g	
pH paper	1 cm	24 cm
Slaked lime (aged and wet Ca(OH) ₂)	300 mL	
Sand	400 mL	
Very thin tracing paper	2 sheets	48 sheets
Red clay tiles	2 tiles	48 tiles
Pigments: student synthesized materials	N/A	N/A
Other pigments available may vary....		

Equipment:

Item	Amount per student	Amount for 24 students
Paintbrushes	~3-4	~100

Staff Notes:

Safety Issues:

Procedure:

Explorations of the Lime and Lime Plaster

1. To first observe the slaking reaction (or hydration process) of lime (CaO), you'll want to carry out the following procedure in the hood. Put about 0.2 g into a beaker and add about 10 mL of water. Record your observations in your LNJ. Be sure to note whether the beaker is hotter or colder than before and any other changes that you find interesting. Write the chemical reaction that is taking place in your LNJ.
2. Characterize the pH of this freshly slaked lime by solution using a glass rod to dot a small amount of the lime onto a tiny piece (0.2 - 0.5 cm) of universal indicator pH paper which is placed on your watch glass. Check the pH of the lime plaster that we provide for the fresco process in the same way. Note what pH is indicated and state whether this is acidic or basic.

Making the Fresco: Day 1

1. Obtain TWO red clay tiles that have been soaked in distilled water overnight to fully hydrate them. Dry them until the surface is no longer shiny. (Note: each of you must make one tile

of an element for our Fresco Periodic Table! The second tile is yours for whatever you would like to keep for posterity.... ;-))

2. Mix your *arriccio* using 2 parts fine sand to 1 part slaked lime, by volume. Each tile requires about 100 mL total for its *arriccio*. Mix it well, and add water, if needed. You'll want it to be damp, but not too wet! Think about the consistency of play-dough.
3. Apply the plaster evenly over the rough side of your tiles at a thickness of about 3 mm. It will not be as thick as you might want for a wall fresco.
4. Let the plaster dry and carbonate for about 10 minutes and then use a spatula or other large flat object to smooth the surface. Try to make it relatively uniform. Let it dry and carbonate further until next week in your lab drawer. Write the chemical reaction of this process called "carbonation" in your LNJ.
5. If you would like to use a *sinopia*, be sure to take a thin sheet of paper for each fresco tile and draw your sketch before lab next week. Use a tracing wheel or large pins to poke holes along the outlines of the drawing.

Making the Fresco: Day 2

1. Don't forget to bring your *sinopia*, if you're using one for either tile! You'll want to plaster and paint each tile separately this week, since you'll want to be sure to apply your pigments well before carbonation of the plaster occurs.
2. Mix your *intonaco* using one part finely powdered sand to one part slaked lime. You can add more sand if the mixture seems too wet.
3. Thoroughly wet the *arriccio* and the red tile, and then apply the *intonaco* plaster evenly to a thickness of about 2 mm. Let dry for about 10 minutes.
4. Polish the *intonaco* using the round edge of a large spatula. Work the spatula in only one direction to orient the sand with its flat side up. Remove any large granules that pop up and replace any missing plaster. The smoother the final surface, the better!
5. Test the fresco surface for painting readiness by applying a small brush stroke of water. If the water absorbs into the plaster, it is ready to be painted.
6. If using a *sinopia*, transfer the outline of the cartoon by either pouncing it onto the surface or gently incising it into the surface.
7. Select pigments that you believe would be fresco compatible and prepare them by grinding them in a small amount of distilled water. Use a flat metal spatula and a glass plate to

simulate a glass muller that would be used for larger projects. The pigment is ready if a droplet of it mostly floats and does not sink when dropped into a beaker of water. Apply the pigment as a dilute wash of color. For bolder colors, apply several layers of pigment waiting 10 to 15 minutes between each layer to allow the color to lock into the plaster. Some common fresco pigments are listed in this table.

<u>Pigment Name</u>	<u>Color</u>	<u>Chemical Formula</u>
China Clay (kaolin)	White	$\text{Al}_2\text{O}_3 - 2\text{SiO}_2 - 2\text{HOH}$
Bianco San Giovanni	White	CaCO_3
Ivory and Bone Black	Black	C
Raw Sienna	Ochre	Clay silicates & hydrated $\text{Fe}(\text{OH})_2$
Burnt Sienna	Ochre	More oxidized form of Raw Sienna
Raw Umber	Umber	Clay silicates, hydrated iron oxides, & MnO_2
Burnt Umber	Umber	More oxidized form of Raw Umber
Ultramarine Blue (lapis lazuli)	Blue	$\text{Na}_7\text{Al}_6\text{Si}_6\text{O}_{24}\text{S}_2$
Egyptian Blue	Blue	$\text{CaO} - \text{CuO} - 4\text{SiO}_2$
Terra Verte	Green	Fe/Mg/Al/K silicate

8. Name or number your tiles for your records in your LNJ. Record the names of each pigment used for each tile and paint a small sample for reference.
9. After the painting is complete, allow it to fully dry and to carbonate until next week.
10. Plaster and paint the second tile in the same manner.
11. After the frescos are dry, their surface is like an eggshell and rather permanent! Compare the dried colors of the pigments to the reference samples in your LNJ. Note in your LNJ which pigments remained true to color, and which were affected by the fresco material.

Reflections:

1. What adjustments would you make in your procedure to change or improve your finished product?