

Egyptian Paste

Materials:

Item	Amount per student	Amount for 24 students
Nepheline Syenite	39 g	936 g
Flint	37 g	816 g
Kaolin	6 g	144 g
Ball Clay	6 g	144 g
Sodium Bicarbonate (NaHCO_3)	6 g	144 g
Sodium Carbonate (Na_2CO_3)	6 g	144 g
Copper Carbonate (CuCO_3)	3 g	72 g
Chromium Oxide (Cr_2O_3)	0.5 g	12 g
Manganese Oxide (MnO_2)	4 g	96 g
Cobalt Carbonate (CoCO_3)	0.25 g	6 g

Equipment:

Item	Amount per student	Amount for 24 students
Weigh boats or sample cups	11	264
Aluminum foil	~ 6" x 6"	1 roll
Paper clips	1	1 box
Coffee Can with sawdust	1	3-4
Gloves	2	1 box
Dropper bottles with distilled H_2O	1	12
Copper Wire	6"	12 feet

Staff Notes: Heavy Metal containing solid waste jar, labeled "Egyptian Pastes Waste".

Safety Issues:

1. Several of these pigments are hazardous....
2. ?

Procedure:

Week 1

1. Making the Base Mix

Calculate how many grams of each chemical you will need to make 50 g of base mix with the following proportions: (Hint: think about how many grams of each you would use to make a 100 g batch....) If you are unsure of your calculations, check with AEM before proceeding. Using the top-loading balance, weigh out the amounts you calculated and combine them in a 250 ml beaker. When handling these powders, be gentle so you don't raise clouds of dust! Stir the base mixture slowly, with a stirring rod or spatula, until it is homogeneous.

Percentages of materials in Egyptian Paste "Base Mix"

Nepheline Syenite	39 %
Flint	37 %
Kaolin	6 %
Ball Clay	6 %
Sodium Bicarbonate (NaHCO ₃)	6 %
Sodium Carbonate (Na ₂ CO ₃)	6 %

2. **Coloring the Base Mix**

Divide your base mix into lots: one for each color you want to use. Keep in mind that the small amount of pigment you'll be using makes it impractical to mix less than 10 g at a time. If you only want a little of one color, get together with a partner, and share.

Calculate the amount of pigment needed for **your** lot sizes, using these weight percents:

Color	Pigment	Weight Percent
White	None	---
Turquoise	Copper Carbonate CuCO ₃	3 %
Green	Chromium Oxide Cr ₂ O ₃	0.5 %
Purple	Manganese Oxide MnO ₂	4 %
Blue	Cobalt Carbonate CoCO ₃	0.25 %

For example, to make 15 grams of turquoise paste, you would use a mass of the CuCO₃ corresponding to 3% of 15 g. Mathematically, that translates to:

$$0.03 \times 15 \text{ g} = 0.45 \text{ g of copper carbonate}$$

+ enough base mix to give a total mass of ~15 g.

These weight percentages are only estimates, so don't stress about weighing out exact masses, but do record whatever you actually measure & use! Also, note that all of these mixtures look about the same before firing (except the green), so label your weigh boats/sample cups!

3. **Making the Pastes**

Mix together each pigment with its base mix thoroughly, then add water dropwise (don't add water until the pigment is thoroughly mixed into to base mix). Every five grams of the base & pigment mixture will use about 35 small drops of water. Be careful not to add too much water: the paste should have the consistency of silly putty or play dough, and should not be sticky. The paste will be smooth and lump together on the spatula when it is ready for use. Note observations in your LNJ about the color, texture, consistency, etc.

4. **Shaping the Pastes**

To explore the firing options, make four small, nearly identical pieces (such as beads, with or without holes). (See Week 2, Step 3, options a-d below.) To make holes in beads, use a strand of copper wire or an unfolded wire paper clip, and then string the bead on another (different) length of wire to dry. With your remaining pastes, **PLAY!** But work quickly, before the paste dries out and gets crumbly. If this happens, you can add a little more water to bring it back. Beads, small figures, and pinch pots are your best bets:

small pieces will dry and fire better. Place all of your pieces on aluminum foil, in your lab drawer, to dry for the week. Describe each piece in your LNJ, including what pigments were used.

CLEAN UP: Place any unused base mix and any leftover pastes in the solids waste jar labeled "Egyptian Pastes Waste". Clean the benchtop without using water, since adding water only makes a bigger mess!

Week 2

1. Examine your dry paste pieces, and record your observations. If they are cool to the touch, they are not dry and should be allowed to dry until the next lab period.
2. Sharing the kiln with other students, fire your four test pieces in the kiln. **HOW?**
3. When the pieces are done firing, use tongs to remove them from the kiln and let them cool on the benchtop for at least 5 minutes. After 5 minutes, you have FOUR options to experiment with:
 - a) Allow one bead to cool slowly, on the counter
 - b) Drop one bead into a beaker of water for more rapid cooling
 - c) Place the remaining two beads into a coffee can full of sawdust. Put the lid on, and wait 5 minutes. Allow one of these beads to continue cooling on the benchtop
 - d) Drop the other sawdust-treated bead into a beaker of water.Note the appearance of the beads during each stage of this process, and describe them in your LNJ.
4. Fire and cool your remaining pieces using your choice of options.

CLEAN UP: Any broken bead parts or discarded items go in the solid waste jar you used last week.

Reflections:

1. The can of sawdust creates a reducing environment, as carbon from the wood is oxidized to carbon dioxide. What part of the paste is reacting, and what is the reaction?
- 2.