Create a Paint - STEM

Research and Development

Students explore the process of creating a craft paint with common art and household ingredients. They learn about components in paint – Fillers, Thickeners, Pigments, Dyes, Binders, and Additives. They experiment with the paint components to develop their own paint recipes for their business. At the end, they provide their Ingredient list, instructions to produce, and a product name.

Grade Range: 4 to 8
Time: 40 min

Synopsis: There are many types of paint. Some are used to decorate and create art while others are made to cover walls and add color. Some paints not only add color, but they also protect the object, like a car. Paints are usually mixtures of solids in liquid. The solid Fillers in paint help to hide the surface underneath. They also affect the paint properties – some fillers in this experiment make the paint liquid thick and others make the dried paint hard. Paint color comes from solid Pigments and liquid Dyes. The Binder is added to act like a glue - it helps the solids stick to the surface, but it dries clear and does not change the appearance much (it might make it glossy, though). Additives are used to change the look or improve the properties of the paint.

Safety: Acrylic medium is not washable – paints will stain. Remind students to minimize paint messes. Use care and adult supervision when measuring powders to avoid airborne particles. Clean up all spills promptly.

Materials: Newspaper, craft paper or plastic table covers to protect tables/desks.
Supplies – Clear plastic cups, plastic spoons, Ziploc bags, paint brushes, scissors, paper
Fillers and Thickeners – Plaster of Paris, Chalk, Flour, Cornstarch
Pigments – Colored chalk, Eye Shadow Powders, Art Supply Mica
Binders – Elmer's Glue, Elmer's Glitter Glue, Acrylic Medium
Dyes – Food Color Gel, Inks
Additives – Shaving Cream, Glitter

Setup/Cleanup: Students should work in teams of 4-5. All the ingredients are placed through the classroom. Adults should help manage distribution when needed. Place newspaper or table covers to manage mess. Collect solid and acrylic paint waste in trash bin. Water and glue mixture can go down the drain with water.

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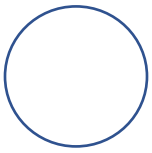
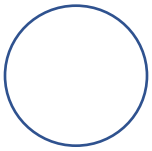
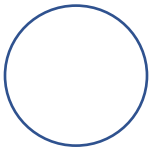
Mentor's Experimental Sheet – Test Binders for Paint

1) Color 3 circles with colored chalk on a plastic milk jug or on paper. A white plastic milk jug can be cut into strips for this test. Blow away any powder.
2) Place one drop of White Glue on the circle labeled Glue and spread the drop of glue in a thin coat over the chalk circle using a paint brush. Wash the brush when done.
3) On the circle labeled Acrylic Medium, paint a thin layer of acrylic coating with a paint brush. Wash this brush, also.
4) Let the painted chalk circles dry. You can do another activity while waiting.
5) When the test samples are dry, take a Dry Paper Towel and use your finger and the towel to rub each chalk circle and try to remove it. Describe what happens.
6) Now take the Towel and dampen it with water. Be careful not to rub paper too hard or you will create a hole. Rub the Wet Paper Towel on each chalk circle and try to remove it and record your observation.

Chalk Test	Dry Rub Test Result	Water Rub Test Result
No Binder 	**The chalk circle should rub off – some trace might remain.**	**The remaining chalk circle should rub off completely without a trace.**
Glue 	**No change – the circle is still there. The glue protects the chalk in the way that the binder helps the pigment in paint adhere.**	**The chalk circle should rub off. Some effort might be required. The glue dissolves in water. This makes a good washable paint.**
Acrylic Medium 	**No change – the circle is still there. The acrylic protects the chalk in the way that the binder helps the pigment in paint adhere.**	**No change – the circle is still there. The acrylic does not dissolve in water – it is not water soluble and makes an excellent paint binder.**

Conclusion: _____

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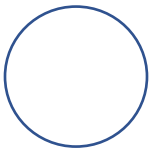
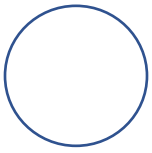
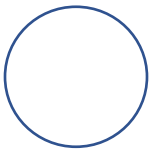
No Binder 		
Glue 		
Acrylic Medium 		

Conclusion: _____

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Mentor's Experimental Sheet – Paint Fillers

1) Chalk and Plaster come from the calcium minerals in Limestone – the rock can be crushed and used as filler in paint. Crush or grind colored chalk and collect the chalk powder and place in a cup. Consider whether chalk is hard or soft as a mineral.
2) Take 2 more cups and place 1 spoon of flour in one and 1 spoon of cornstarch in the other. Do you think these fillers are harder or softer than chalk? Record all your observations about how are the solids similar or different?
3) Add 1 spoon of water to each cup and stir. Write your observations. Is one mixture with water thicker?
4) What happens if you add 1 more spoon of each filler?
5) Create the question about this experiment 7 "What would happen if…?" and your write your hypothesis. Get adult approval to test your question.

Filler	Observations	Observations with Water
Chalk or Plaster powder	**Chalk and plaster are denser – they seem heavier and the same measured amounts will weigh more.**	**Chalk and plaster powder settle in water. If you add more plaster powder to water, you make a paste that could plaster a wall. It will dry and harden quickly.**
Flour	**Flour is lighter it might seem fluffy but it clumps more than cornstarch.**	**Flour mixes in water but does not dissolve. Adding more flour to water creates a paste – it might be runny or thick and becomes a glue for Papier Mache**
Cornstarch	**Cornstarch is light and fluffy and sticks to things.**	**Cornstarch mixes with water but does not dissolve. 2:1 Cornstarch to water is the recipe for Oobleck. It pours like a liquid into your hand but is solid if you squeeze it. It is called a Non-Newtonian fluid because of this odd flow!**

What would happen if _____?
Hypothesis: _____
Conclusion: _____

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Experimental Sheet – Paint Fillers

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Filler	Observations	Observations with Water
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Flour		
Cornstarch		

What would happen if _____?
Hypothesis: _____
Conclusion: _____

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Research Sheet – Craft Paint Recipes and Ideas

1) These are just a few recipes found on the internet.

Craft Recipes	
Papier Mache Paste	1 spoon water + 1 spoon flour
Oobleck Recipe	1 spoon water + 2 spoons cornstarch
Plaster Paste	1 spoon water + 2 spoons plaster
Outdoor Chalk Paint	1 spoon water + 1 spoon cornstarch
Chalk Paint for Paper	Crush 1 Chalk into Powder + 2 spoons water + 1 spoon glue
Puffy Paint	1 spoon glue + 1 spoon flour + 2 heaping spoons shaving cream – Mix in a sealed Ziploc bag then cut the tip to pipe out
Clear Paint Suncatcher	1 spoon acrylic + dye

2) Discuss with your team what type of paint you want to make. Create a recipe for your paint and using the ingredients provided and write DETAILED instructions on how to make your paint.
3) Make the paint and test it out. Do you want to modify it? If so, write out the new instructions.
4) Give your recipe to another team and have them try it out. Did they make the same thing?

PAINT RECIPE	MODIFIED PAINT RECIPE