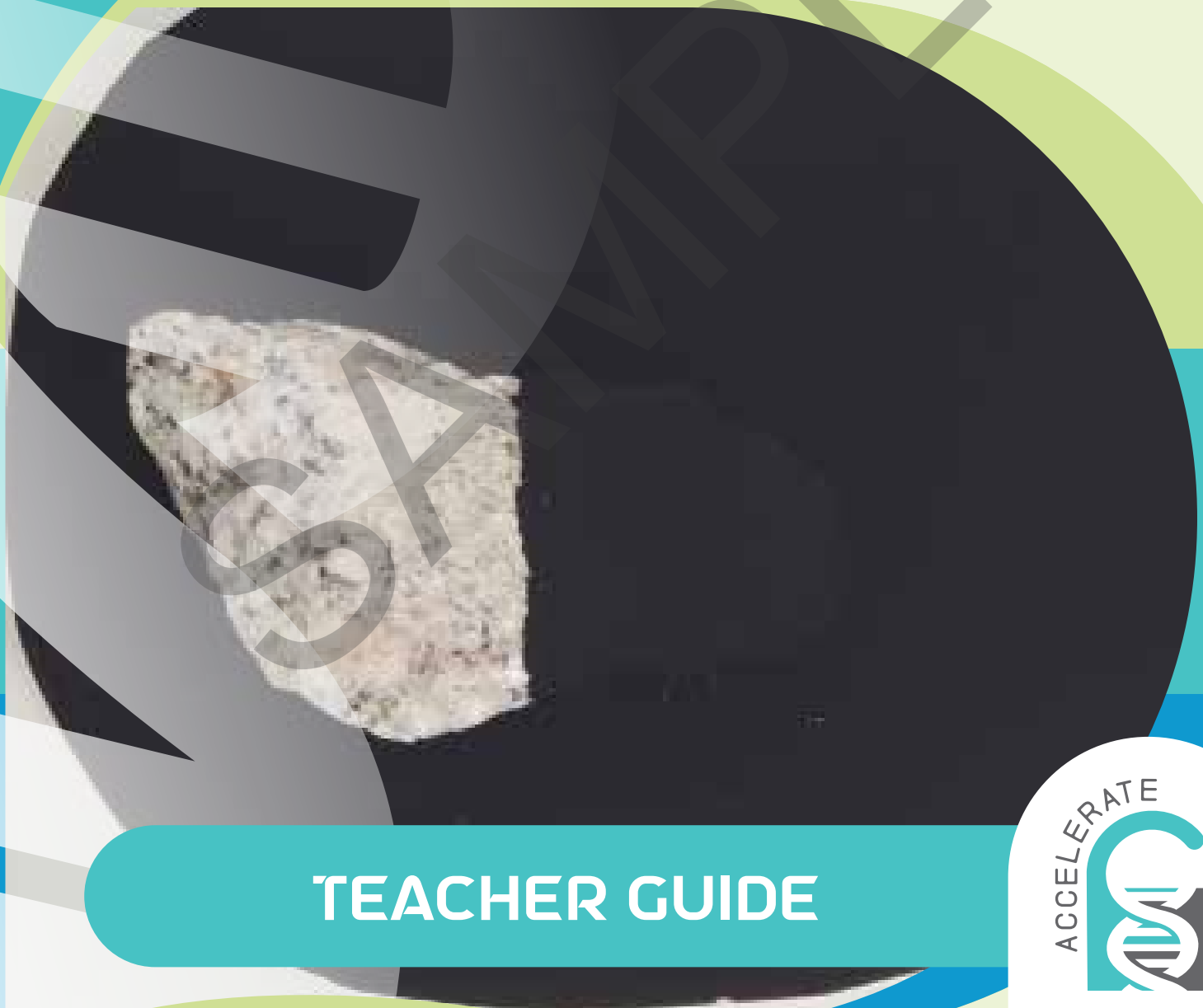
THE LIGHT TRAP



TEACHER GUIDE

ACCELERATE

PLANNING

Here's a suggested schedule for this kit! The activities should be completed in order, but you can choose when the lessons take place over time.

ACTIVITY INFORMATION	SECTION(S)	TIME	DAY/LESSON
ACTIVITY 1: PAINTING IT BLACK Paint with the world's blackest paint. Total time: 30 min	☐ The Power of Paint	30 minutes	Day 1
ACTIVITY 2: (ALMOST) A PORTABLE BLACK HOLE Learn about Vantablack® Total time: 2 h 30 min	☐ So Dark, It Doesn't Seem Real!	30 minutes	Day 2
	☐ Vantablack® (through "Science Meets Art)	30 minutes	Day 3
	☐ Reminder: Paint the 2nd Coat	30 minutes	Day 4
	☐ Vantablack® (through end)	60 minutes	Day 5
ACTIVITY 3: TRAPPING LIGHT Experiment with albedo. Total time: 1 h 30 min	☐ Shadow and Light	30 minutes	Day 6
	☐ Trap or Release	30 min	Day 7
	☐ Reflecting L		
ACTIVITY 4: PUTTING THE PAINT TO THE TEST Test the paint to	☐		

activity 2

(ALMOST) A PORTABLE BLACK HOLE

Color is used in many ways in art and science.
In this activity, the student will learn about an unusual black coating, color pigments, and explore the connections between science, art, and society.

LEARNING GOALS:

I can explain how synthetic materials come from natural resources and impact society.

SO DARK, IT DOESN'T SEEM REAL!

CONTENT

• Color and light vs. dark are concepts that are explored in both art and science. In this activity, your student will be introduced to a super-black coating called Vantablack®, learn about different types of pigment, and explore the connections between science, art, and society using an example that spans popular culture, science, and engineering.
• The initial phenomenon in this kit is a series of images that show the unique properties of Vantablack®, a super-black coating made by the company Surrey Nanosystems.
• As your student will find out soon, Vantablack® is not a paint or a pigment. It is a coating made from microscopic "forests" of carbon tubes that trap light between them.
• The name Vantablack® comes from Vertically Aligned NanoTube Arrays. (This information is presented later in this section of the Student Workbook.)
• Most viewers' initial thought when seeing photos of Vantablack® is that the photos must be edited and a black circle was simply pasted on.
• Vantablack® reflects so little light (about 0.035 %) that it completely masks any surface features of the object it coats. The effect has been described as "looking into a void" by Surrey Nanosystems, and it can be a bit unsettling (but also thought-provoking!).
• Many other photos, gifs, and videos of Vantablack® can be found with a quick Internet search, if you or your student are interested.

THINK ABOUT IT!

Question 1: Were the photos of the super-black coating surprising and unusual? Why or why not?
Answer: There are no wrong answers here.

How to Help: *Simply encourage your student to be descriptive, reflective, and understanding that the super-black coating is not the type of material one would see every day. You could ask them what words they would use to describe Vantablack® and its properties, or how they felt while looking at the images. It's possible they have heard of or seen pictures of Vantablack® before, and that's okay; ask them to think back to the first time they observed it and what they thought or felt at that time. Or, ask them how they would describe the phenomenon to someone else.*

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MAKING SUPER-BLACK PAINT BETTER

CONTENT

• In this part, the process of improving the formula of black paint is detailed. Often, students think that science and art are completely separate. However, this situation is an example of how science can improve the tools and/or materials used by artists, and how the race to the blackest black paint for art may bleed over into science and engineering.

• As the "Learn more" section at the end of the Student Workbook mentions, researchers have been trying to perfect a coating that would be suitable in artistic and technical applications.

• The unintentional use of the engineering process by Semple is an excellent example of how scientific and engineering practices can be used in everyday life and other fields of work, which may be inspiring to students who do not yet think of themselves as scientists or engineers.

THINK ABOUT IT!

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Question 1: How would you decide whether Vantablack® is better than other super-black paints?

Answer: While answers will vary, the student will likely mention how dark the paints or coatings are, how durable they are, and/or their application procedure.

How to Help: *Remind the student that there is a balance between effectiveness and practicality. For instance, if a paint reflects very little light but is challenging to coat onto a surface, it may be considered less useful than a paint that reflects more light but can simply be applied with a brush.*

Question 2: Explain how science and art were connected throughout the creation of super-black paints and coatings. Have you ever experienced a connection between art and science?

Answer: Your student may be reminded of a personal connection between art and science, such as drawing pictures of scenes in nature, using fertilizer and other soil additives to plant a garden, mixing perfume to create new scents, enjoying the different colors of fireworks, playing an instrument, using software and wave patterns to make electronic music, deciding on the proportions of ingredients when baking, etc.

How to Help: *Here's a topic to extend the discussion: The terms "science" and "art" are typically used differently in language, but have some overlapping connotations. We often talk about how people can have a process or method "down to a science," which implies the need for technical skills and specialized knowledge. On the other hand, when referring to processes that are complex and require both precision and creativity, we often say that "it's an art." In reality, the line between them is often blurred. Cooking, for instance, requires a knowledge of the chemistry of the ingredients but also a hard-to define sense for what will improve a dish; similarly, writing a novel requires technical knowledge of grammar and syntax but an ability to engage and delight the reader.*

We'd also like to mention that at Home Science Tools, one of our core values is Wonder, which is an emotion that can be sparked by both science and art; people are naturally curious and drawn to objects and phenomena that are unique, strange, mysterious, or beautiful, which are qualities frequently explored in both fields. You might discuss your mutual sense of wonder with your student, whether it was inspired by science, art, or both. Talk about times you were curious about something you observed, and the questions you had about that event or object.

ACCELERATE

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Kit	SU-LITRAP
Instructions	IN-LITRAPT
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