



	Mercury vapors Light waves Reflection
Duration of Lesson	One 45-minute lesson.
Materials/ Specialized Equipment Needed	<p>Materials:</p> <ul style="list-style-type: none"> • Paper • Scissors • Sources of light (strong flashlight, desk lamps, different light bulbs) • Large dark paper (to cover windows) <p>Specialized Equipment:</p> <ul style="list-style-type: none"> • Light-sensitive chemicals and paper • Protective eyewear • Gloves
<p>Teacher Notes:</p> <ul style="list-style-type: none"> • Yellow bubbles refer to one of the six essential elements of science-enhanced CTE lessons. • Orange bubbles refer to one of the core principles of integrating science into CTE. • Blue bubbles refer to a scientific practice as outlined in the TEKS. 	
<p>E1: ENGAGEMENT</p> <div style="border: 1px solid black; border-radius: 10px; background-color: #fff9c4; padding: 5px; margin-bottom: 10px;"> <p>Six Essential Elements: Introduce the CTE lesson to engage the students</p> </div> <div style="border: 1px solid black; border-radius: 10px; background-color: #fff9c4; padding: 5px; margin-bottom: 10px;"> <p>Six Essential Elements: Introduce the CTE lesson to engage the students</p> </div> <div style="border: 1px solid black; border-radius: 10px; background-color: #ffe0b2; padding: 5px;"> <p>Core Principle: Begin with the CTE and not the science</p> </div>	<p>Prepare the classroom by blocking out the windows with dark paper. On one of the pieces of paper, cut out a small circle to create a pinhole camera. Make sure this hole is opposite a blank wall or hang a large white sheet on the wall as a screen.</p> <p>Turn out the lights so the pinhole camera image projects on the wall. Ask the students:</p> <ul style="list-style-type: none"> • What do you notice about the image you are seeing? <ul style="list-style-type: none"> ○ Answers may include: it is upside down, it is projecting what is outside the window, it is in color • By show of hands, how many of you have heard of a camera obscura or pinhole camera? (Point out that this is a pinhole camera.) • Again, by show of hands, who thinks they could explain how this works and why the image is upside down? • What do you think this hole represents in a more modern camera? <ul style="list-style-type: none"> ○ Answers may include: the lens, the aperture • If we wanted to preserve or save this image, how would we do that? What might we need? <p>Before I turn the lights on in this dark room, by show of hands, who has processed photos in a darkroom?</p>
E2: EXPLORATION	<p>1. Pinhole Camera Obscura</p> <ul style="list-style-type: none"> • Display an illustration of how light enters and exits the pinhole camera (similar to the one shown below).



<p>Scientific Practice: Collect and Record Data</p> <p>Scientific Practice: Construct Tables & Graphs to Organize Data</p> <p>Scientific Practice: Analyze Data and Communicate Conclusions</p>	<p>such as fluorescent, halogen, or incandescent. Provide some suggestions for the students, but allow them to design the experiment.</p> <ul style="list-style-type: none">• Expose the material to the light source.• Using a digital camera, photograph or video the light-sensitive material's reaction.• Record observations and organize the images in a creative manner of the students' choice to make additional observations.• Analyze and communicate findings to the class by displaying images and discussing observations. Students can choose their method of presentation such as a PowerPoint, time-lapse video, or a poster.
<p>E3: EXPLANATION</p> <p>Six Essential Elements: Provide opportunities for the students to demonstrate their understanding of the explicit science in this lesson</p>	<p>Lead students in group discussion on the differences between the substances and papers tested in the activity. Start to make connections to modern photographic technology and processes.</p> <p>Ask the students:</p> <ul style="list-style-type: none">• Why do they think a red light is used in a darkroom?• What do they think would have happened if they used a red light in a darkened room instead of exposing the substances to the existing light in the classroom?• Can they name the chemicals used in modern darkrooms? <p>Discuss the different chemicals and processes used in modern darkrooms to process photographic prints. Compare these processes and their results to past processes used throughout the history of photography.</p>
<p>E4: ELABORATION</p> <p>Six Essential Elements: Provide opportunities for the students to demonstrate their understanding of the explicit science in this lesson</p> <p>Core Principle: Approach the science as an essential workplace skill</p>	<p>Ask the students:</p> <ul style="list-style-type: none">• How does the shutter and shutter speed of a camera affect the image? How does this relate to what they saw in their experiments?• How is this relevant to photography and art today? <p>Show Dan Carrillo video on making Daguerreotypes (https://vimeo.com/63639523) (runtime: 4:05) or on wet plates (https://vimeo.com/20011942) (runtime: 4:02).</p> <p>Lead students in a discussion about why a modern artist would choose to use these older techniques. Ask them what they would like to experiment with. Discuss how knowledge and understanding of the science behind these concepts is essential to working with photographic prints and in the overall field of printing.</p>



E5: EVALUATION Six Essential Elements: Evaluate through formal assessments of CTE and science knowledge & skills	Ask students to write a \$2 summary about what they've learned regarding the history of printing and imaging. Each word in their summary is valued at \$0.10, and the total summary must be worth \$2.00 – i.e. they can only use 20 words total. Teacher Note: Rather than tell the students they can only use 20 words, simply provide them the value of each word, and the amount they must “spend”.
Section 3: Lesson Notes	
Resources/ Teacher Notes	<ul style="list-style-type: none">• A Brief History of Photography: Innovations in Chemistry https://www.youtube.com/watch?time_continue=38&v=Mh42xZQL6-k• Making Daguerreotypes https://vimeo.com/63639523• Wet plates https://vimeo.com/20011942