Directions: Use this document as a guide with the .tns file on your TI-Nspire CXII calculator.

Student Tasks:	Student Responses/Observations
Coding Challenge 1: The color LED is controlled with the statement color.rgb(red value,green value,blue value). Each value ranges from 0 to 255, where 0 is off, 255 is full-on, and 128 is moderately dim. Write a program named "c1" that turns on the Hub's color LED to red. Can you change the code to make a dim red?	How did you change your code to make the LED dim red?
Science Activity 1: On the next page, hover the cursor over a center point in a box then [ctrl] + [center-click] to grab and drag one primary color box over another. Press [center-click] to release. --What secondary color is created from mixing two primary colors? --What happens when all three overlap? --Make these three secondary colors: Yellow, Cyan, and Magenta --What primary colors did you mix to get each of the secondary colors?	Answer questions in the space below:
Coding Challenge 2: Use the color mixing simulation as a clue to figure out the R, G, and B values for the secondary colors of cyan, yellow, and magenta. Write a program that displays all three. --Use sleep(2) for a two-second pause between colors.	
Coding Challenge 3: Use the color mixing simulation as a clue to figure out the R, G, and B values for white. Write a program that displays white and two darker shades of white (grayer). Use sleep(2) for a two-second pause between shades.	

Science Activity 2: On the next page, check out the range of electromagnetic radiation (EMR) that exists in the universe.

Humans perceive a narrow region called visible light. There are many different wavelengths that humans do not perceive and are seen as black with our eyes. Technologies exist that detect these invisible wavelengths and convert them to visible, such as infrared night vision goggles.

Direct your TV remote toward your eyes. Press any button.

Do you see the light flashing? Probably not since the remote flashes invisible infrared light signals to change the channel.

Next, point the remote at your cell phone camera or a web camera.
Does the camera detect the light?
It probably does because the camera detects the infrared.

Some cameras have a filter to block this unwanted light, so try different cameras

Science Activity 3: Use the simulation to explore the R, G, and B values and wavelengths of different colors. Try to find the values of the primary and secondary colors. The color wavelength has a very small unit nanometer (nm). One billion nanometers equals one meter!	Find the numeric values for a favorite color. Be creative and give your color an exciting name.

Coding Challenge 4: Use the R, G, and B values for a favorite color in activity 3 to write a program that displays this color. Use the [ctrl] + [T] key combination to insert a comment in the program with the name of your favorite color.

Science Activity 4: See the page showing a mood ring along with the mood colors the ring's stone could make depending on the "mood" (finger temperature) of the wearer.

Use your knowledge of color along with the previous activities to find the R, G, and B values for all of the colors listed.
Record the values in the spreadsheet provided. Use these as a reference in the next challenge program.

Coding Challenge 5: Use the R, G, and B values you recorded in the activity 4 spreadsheet to write a program to display each mood ring color on the color LED. Use sleep(2) for a two-second pause between each mood color.

The following activities explore the science of color at a deeper level.
At this point, you can keep exploring or you can move to Part 2 – Coding your Ring

Science Activity 5: Use the simulation of the Hub's color light-emitting diode (LED). There are three elements within the bulb. Each produces a different primary color. The brightness of each primary color can be changed. Many colors result from mixing brightnesses of the primary colors. The rgb.color(value, value, value) statement sets the brightness of each element in the color LED. Explore how a few different colors are produced by the color LED.	**What affects the colors made by the light-emitting diode (LED)?** **A The intensity of each LED element** **B The combination of primary elements turned on in the bulb** **C The color.rgb(value,value,value) values.** **D All of the above**
Science Activity 6: The human eye has a lens that focuses light onto the retina at the back of the eye. Cone cells are one type of cell in the tissue of the retina. There are three kinds of cone cells, each sensitive to a range of wavelengths containing either red, green, or blue colors. When colored light enters the eye, each cone cell produces a weak to a strong stimulus that travels along the optic nerve and enters the brain. Inside the brain, we perceive color based on the stimuli from these three types of cone cells.	**Identify the process of how humans perceive the green color of Hub's LED.** **A Green light enters the eye and stimulates all type of cone cells equally and sends the name of the color to our brain.** **B Infrared EMR is focused on the brain and stimulates the cone cells in the eye.** **C 570nm wavelength EMR is focused on the cone cells in the retina, stimulating the green cones, which in turn, sends a signal to the brain.**

Science Activity 7: Try some of these fun experiments if you have the supplies available.

- In a dark room, view a green plant with a red lightbulb. How does it appear? Explain why.
- Place a blue plastic filter over an eye and view a green plant with that eye. How does it appear? Explain why.
- View a plant grow lamp. What color does it appear? Explain why it is that color?

How could you design the best magenta colored grow lamp in the previous image, using only primary colored LEDs? **A Use magenta LEDs in the lamp.** **B Use only red and blue LEDs in the lamp.** **C Use red, green, and blue LEDs and don't turn on the green.**	**Observe the previous image. Why do the green leaves appear black?** **A Because it's a blacklight (ultraviolet).** **B Because the lamp does not produce green light, green light is not reflected from the leaf to your eye.** **C We do not have a cone that detects green.**

Science Activity 8: Color vision is a human perception based on the stimuli received by our brain from the three kinds of cone cells in the retina of the eye.

Differences among people's eyes result in slight differences in the perception of a particular color. Some people may perceive that color differently from others, similar to how some people do not have 20/20 vision.

These differences in color perception are called "color blindness". On the next page, check your color vision.

Science Activity 9: Georges Seurat was a 19th century French painter. He painted with the **pointillism** method. This technique applies different colors of paint dots to the canvas so that adjacent colors optically interact to produce new perceived colors and an entire scene. This technique from art is applied to the technology of television screens. A modern TV or cell phone screen is composed of millions of tiny color LEDs packed tightly behind a glass screen.	Try this fun experiment if you have the supplies available. - Use a real magnifying glass to view a computer, cell phone, or TV screen up close. What do you see? A TV or cell phone picture is produced by turning on each LED in a way similar to how Seurat painted with the picture on the next page using pointillism! - Use a digital camera to take a closeup picture of a computer screen and then zoom in as far as allowed on the image. What do you see?