

Seeing Color with CD's

Grade Level/s MS, HS

Materials: CD's, flashlights, LED's of different colors

Subject: Physical Science

Standards

Disciplinary Core Ideas –PS4

Crosscutting concepts:

Cause and Effect

Patterns

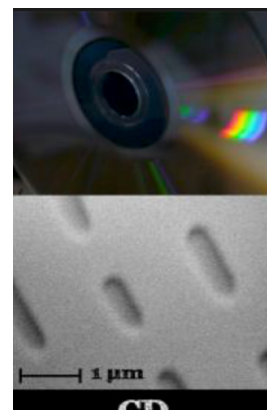
Structure and Function

Science and Engineering Practices:

Asking questions and defining problems

Planning and carrying out investigations

Developing and using models



Objective: Understand the visible spectra using a CD and a CD spectroscope.

Advanced Preparation of materials:

Purchase or collect CD's for each student.

Make 8 CD spectroscopes – link to instructions on last page.

Part 1: Explore the colors reflecting off the CD.
How many colors do you see?
Describe the shapes of the colors.
What other shapes do you see reflected on the CD?

Part 2: What if we change the angle at which you look at the CD?
What if we change the light source?
Explore using the different types of lights available.
EX: LED's, incandescent, florescent, sunlight

Underlying Science:

Why does a CD split light into its' different colors?

A CD is made up of two layers of plastic protecting a thin layer of aluminum on which the music or data is stored. This information is stored in pits organized in circular tracks. Lines of shiny aluminum will “reflect well” next to lines of pits which “reflect poorly”. The space between these lines and pits are very close together. In fact, they are so close together that they act as a diffraction grating for light. The reflections will interfere with each other constructively and destructively.

White light is a mixture of colors. When we look at different light sources with our eyes they might appear to be the same shade of white. Using the CD reveals that they are composed of totally different colors or spectra.

Light reflected off the CD is due to diffraction, but the amount of light is large. The best way to look at the colors or spectra of light is to reduce the amount of light like a pinhole.

We will investigate the spectra of light using a spectroscope with a slit.

Spectroscope Activity

Hold the tube upright and point the top slit at a light source. Press your eye to the viewing hole. Photo on page 3 –viewing with a spectroscope.

On the CD, look for a clear, solid line of light broken up into color bands: this is the spectrum of light reflected from the light onto the CD.

Adjust the angle at which you look through the viewing hole at the CD to find the best view of the light spectrum.

Different types of light sources:

Fluorescent light – produces bright lines produced by the spectrum of the mercury gas inside the tube.

Incandescent light – by comparison, makes a continuous spectrum of the spectrum (rainbow) of colors.

Underlying Science

All light is made up of waves of electromagnetic radiation. A spectroscope spreads each different wavelength to a different position within a spectrum of light.

When the light enters the tube, it is spread into a spectrum perpendicular to the CD tracks.

This is why the slit and the viewing hole are located at right angles.

Each color bends at a particular angle. For you to see the spectrum, the light must diffract off the CD and reflect into your eye. Adjusting the tilt of the CD allows you to properly bounce the spectrum into your eye.

Resources:

aapt.org/k12/TPTlessons.cfm OSA – Optical Society

CD Spectroscope www.exploratorium.edu/snacks/cd-spectroscope

Get Naked Physics –Kitchen Science Experiments –CD Science

For more information or questions contact:

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Safety Considerations: Never use diffraction gratings to look directly at the SUN!

