

Diffraction

Overview:When light passes through diffraction gratings, it splits (diffracts) the light into several beams traveling at different directions. If you've ever seen the “iridescence” of a soap bubble, an insect shell, or on a pearl, you've seen nature's diffraction gratings.

What to Learn:Ever play with a prism? When sunlight strikes the prism, it gets split into a rainbow of colors. Prisms un-mix the light into its different wavelengths (which you see as different colors). Diffraction gratings are tiny prisms stacked together. The direction that the beam gets split and diffracted depends on the spacing of the diffraction grating and also the wavelength of the incoming light.

Materials

- feather
- CD or DVD
- diffraction grating

Experiment

1. Take a feather and put it over an eye.
2. Stare at a light source through the feather, like an incandescent light.
3. You should see two or three lights and a rainbow X.
4. Aim the CD so the light hits the CD and makes rainbows.
5. Look at the light source through the diffraction grating.
6. Draw what you see for all three. Were they the same?
7. Take this on a “light treasure hunt” to find different light sources. Good choices are candles, incandescent bulbs, fluorescent bulbs, neon signs, halogen lamps, streetlights, stoplights, and anything else you can think of that gives off light (except the sun).
8. Complete the table as you view the different light sources through your diffraction gratings.

Diffraction Data Table

[illegible]

Reading

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The feather works because there are tiny “hairs” on the feather that are acting like tiny prisms.

Diffraction gratings were first discovered by James Gregory, right around the time Newton performed his famous prism experiments with bird feathers. The first diffraction gratings took a long time to construct, as they were individual hairs strung between screws.

A diffraction grating bends the light and splits it into different beams. You can see this very well when you use a monochromatic light source, like a laser, instead of a multi-wavelength light source.

Exercises

1. Which light source gave the most interesting results?
2. What happens when you aim a laser beam through the diffraction grating?
3. How is a CD different and the same as a diffraction grating?
4. Why does the feather work?

Answers to Exercises: Diffraction

1. Which light source gave the most interesting results? (This varies with data.)
2. What happens when you aim a laser beam through the diffraction grating? (It splits into three beams of light, as shown in the second video.)
3. How is a CD different and the same as a diffraction grating? (A CD has a spiral of finely-spaced data tracks while the diffraction grating has a series of parallel lines. The CD splits the light the same way as the diffraction grating. The CD splits the beam into more than three beams.)
4. Why does the feather work? (There are tiny “hairs” on the feather that are acting like tiny prisms.)