honors (not AP®)

Scattering

Unit: Light & Optics

NGSS Standards/MA Curriculum Frameworks (2016): N/A

AP® Physics 2 Learning Objectives/Essential Knowledge (2024): N/A

Mastery Objective(s): (Students will be able to…)

- Explain why the sky is blue and the sun looks red at sunset.

Success Criteria:

- Explanations account for observed behavior.

Language Objectives:

- Explain why the beaker in the "sunset in a beaker" demo looks light blue, but the light coming through it looks yellow or red.

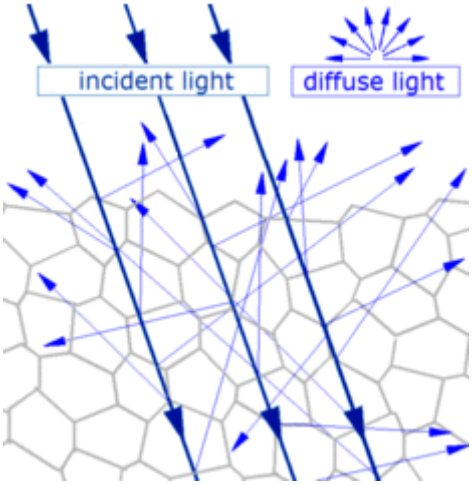
Tier 2 Vocabulary: light, scatter

Labs, Activities & Demonstrations:

- sunset in a beaker

Notes:

scattering: a change in the direction of rays of light caused by irregularities in the propagation medium, collisions with small particles, or at the interface between two media.



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Icebergs appear blue because the irregularities are small enough that blue light (shorter wavelengths) has a higher probability of being scattered than longer wavelengths.

Iceberg at Glacier Lagoon - Jökulsárlón, Iceland.

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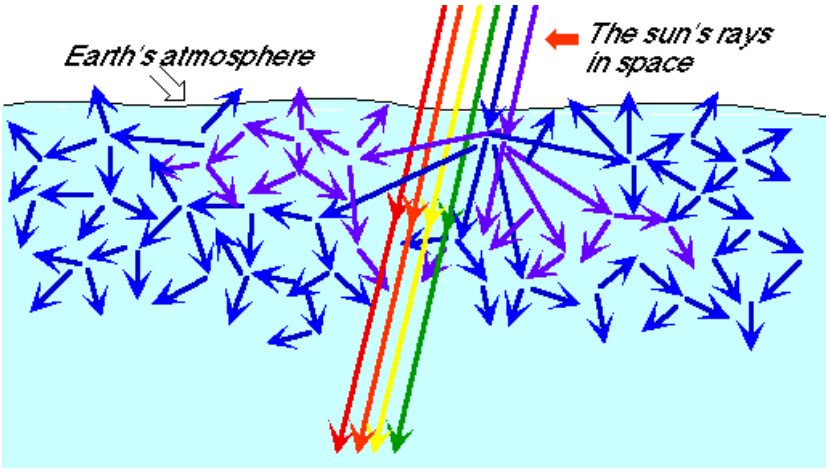
Rayleigh scattering: scattering of light because of collisions with small particles in the medium. Rayleigh scattering is named after the British physicist Lord Rayleigh.

Rayleigh scattering is responsible for the color of the sky. Small particles (0.5–1 micron) scatter visible light as it passes through Earth's atmosphere. Because light at the blue and violet end of the spectrum is about five times as likely to be scattered as light at the red end of the spectrum, the majority of the scattered light in our atmosphere is blue.



This is also why the sun appears yellow during the day—the combination of red, orange, yellow and green light appears yellow to us.

Water vapor molecules are much larger—ranging in size from 2–5 microns. For these larger particles, the probability of scattering is approximately the same for all wavelengths, which is why clouds appear white.

At sunset, because the angle of the sun is much lower, the light must pass through much more of the atmosphere before we see it. By the time the light gets to our eyes, most of the colors are removed by scattering, except for the red end of the spectrum, which is why the sun appears red at sunset.