



Discussion Guide (for use during or after reading)

1. What is natural light? (What Is Light?, p. 4-7)
 - a. Light is a type of energy. Natural light comes from the sun. It is called white light and allows us to see. Plants use sunlight to make food and oxygen that support all life on Earth, including us!
2. Support the following claim from the text using evidence and reasoning: "Without light, you would not have food to eat or air to breathe." (What Is Light?, p. 4-7)
 - a. Plants use sunlight and a process called photosynthesis to transform light energy into food and fuel. Animals eat those plants and therefore also rely on light for survival. Although not all animals eat plants, they do eat something that somehow relies on sunlight to survive. Therefore, without light, we could not survive the way we do now.
3. Describe light waves. What is a wavelength? (What are Light Waves?, p. 8-9)
 - a. Light waves are a series of peaks (high points) and valleys (low points) that carry light through air, water, and space. Wavelength measures the distance between the peaks of a wave. Light waves are special because they travel so fast. Light can circle Earth seven times in one second!
4. Explain how objects both absorb and reflect light. (Absorption and Reflection, p. 10-11)
 - a. When light hits an object, it can pass through the object, be absorbed, or be reflected. Most objects absorb some of the light that hits them. They also reflect light. The light that is reflected reaches your eyes and allows you to see. We see the light an object reflects, not the light it absorbs.

5. Describe the differences between objects that are opaque, transparent, and translucent. (Moving Light Along, p. 12-13)
 - a. Objects that are opaque do not let light pass through them. They absorb some light and reflect the rest. Shadows form when opaque objects block the path of light.
 - b. Transparent objects let most of the light through them. We can see through transparent objects, like windows.
 - c. Translucent objects let some light pass through, but only certain colors of light. Translucent objects can also scatter light, which makes the objects on the other side appear blurry.
6. What is refraction and how is it caused? (Bending Light, p. 14-15)
 - a. Refraction happens when light bends as it passes from one substance to another. For example, as light passes through air and into water, it refracts or bends. When you look at a straw in a glass of water, it appears bent. This is because light moves more slowly through water than it does through air.
7. Explain why we can see rainbows when the sun shines through raindrops. (What Are Colors?, p. 16-21)
 - a. We can see rainbows when the sun shines through raindrops because as light travels through air and to water, it refracts. Each raindrop acts like a prism and separates the light into different colors. Each color has its own wavelength. Longer wavelengths bend less than shorter wavelengths, causing the colors of white light to divide into the visible spectrum of colors we can see.
8. Describe how light travels into our eyes. (How Do You See?, p. 22-23)
 - a. As light enters the cornea, it refracts slightly. It then passes through the pupil, a small opening in the eye, to a lens that refracts the light again so it can strike the retina. The lens focuses the image on the retina so it is clear, but it is upside down. The retina changes the image into signals that can be sent and understood by the brain.
9. What is the electromagnetic spectrum? (Invisible Light, Words to Know, p. 26-27 and 39)
 - a. Electromagnetic energy is made up of electric and magnetic waves. The electromagnetic spectrum is the entire range of electromagnetic energy, including visible light as well as forms of light that cannot be seen by the human eye. The electromagnetic spectrum includes infrared waves, radio waves, x rays, and ultraviolet waves.
10. Who was Alhazan and what was his claim to fame? (Who's Who: Alhazan, p. 32-34)
 - a. Alhazan was a scientist and mathematician born in 965. He wrote the *Book of Optics* that helped revolutionize the study of sight at that time. People and scholars of his time believed it was our eyes that emitted light rays that allowed us to see. Alhazan believed that everything reflects light rays that then enter our eyes and used the study of eye anatomy to help prove his point. Alhazan also studied other concepts of sight using tools such as a camera obscura.