

Sources of Visible Light

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CONCEPT

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Sources of Visible Light

- Define visible light.
- Describe incandescence, and list sources of incandescent light.
- Identify three ways that luminescence can occur.



Imagine scuba diving and coming upon a jellyfish. Would you be startled if the jellyfish suddenly started to glow with bright yellow light, like the jellyfish in the picture above? If so, then the jellyfish would have done its job. Jellyfish give off light to startle possible predators. The light they emit is visible light.

The Light We See

Visible light includes all the wavelengths of light that the human eye can detect. It allows us to see objects in the world around us. Without visible light, we would only be able to sense most objects by sound, touch, or smell. Like humans, most other organisms also depend on visible light, either directly or indirectly. Many animals—including predators of jellyfish—use visible light to see. Plants and certain other organisms use visible light to make food in the process of photosynthesis. Without this food, most other organisms would not be able to survive.

Q: Do you think that some animals might be able to see light that isn't visible to humans?

A: Some animals can see light in the infrared or ultraviolet range of wavelengths. For example, mosquitoes can see infrared light, which is emitted by warm objects. By seeing infrared light, mosquitoes can tell where the warmest, blood-rich areas of the body are located.

Incandescence

Most of the visible light on Earth comes from the sun. The sun and other stars produce light because they are so hot. They glow with light due to their extremely high temperatures. This way of producing light is called **incandescence**.

Incandescent light bulbs also produce light in this way. When electric current passes through a wire filament inside an incandescent bulb, the wire gets so hot that it glows. Do you see the glowing filament inside the incandescent light bulb in the **Figure 1.1**?



FIGURE 1.1

Q: What are some other sources of incandescent light?

A: Flames also produce incandescent light. For example, burning candles, oil lamps, and bonfires produce light in this way.

Luminescence

Some objects produce light without becoming very hot. They generate light through chemical reactions or other processes. Producing light without heat is called **luminescence**. Luminescence, in turn, can occur in several different ways:

- One type of luminescence is called fluorescence. In this process, a substance absorbs shorter-wavelength ultraviolet light and then gives off light in the visible range of wavelengths. Certain minerals produce light in

this way, including gemstones such as amethyst, diamond, and emerald. At the following URL, move your mouse over the minerals in the picture to see the magic of fluorescence.

<http://www.fluomin.org/uk/>

- Another type of luminescence is called electroluminescence. In this process, a substance gives off light when an electric current passes through it. Gases such as neon, argon, and krypton produce light by this means. The car dash lights in the **Figure 1.2** are produced by electroluminescence.



FIGURE 1.2

- A third type of luminescence is called bioluminescence. This is the production of light by living things as a result of chemical reactions. The jellyfish in the opening photo above produces light by bioluminescence. So do the fireflies in the **Figure 1.3**. The fireflies give off visible light to attract mates. You can learn more about bioluminescence in the video at this URL: http://www.ted.com/talks/edith_widder_glowing_life_in_an_underwater_world.html

Illumination

Many other objects appear to produce their own light, but they actually just reflect light from another source. Being lit by another source is called **illumination**. The moon in the **Figure 1.4** is glowing so brightly that you can see shadows under the trees. It appears to glow from its own light, but it's really just illuminated by light from the sun. Everything you can see that doesn't produce its own light is illuminated by light from some other source.

Summary

- Visible light includes all the wavelengths of light that the human eye can detect. Humans and virtually all other organisms depend on visible light to survive. Humans and many other animals use it to see. Plants use it to make food for themselves and most other organisms.
- Most of the visible light on Earth comes from the sun. The sun produces light because it is so hot. Glowing with visible light because of a high temperature is called incandescence.



FIGURE 1.3



FIGURE 1.4

- Producing light without a high temperature is called luminescence. Types of luminescence include fluorescence, electroluminescence, and bioluminescence.
- All objects you can see that do not produce their own light are reflecting light from another source. This is known as illumination.

Vocabulary

- **illumination:** Being lit by and reflecting light from another source.
- **incandescence:** Production of visible light by an object that is so hot it glows.
- **luminescence:** Production of visible light that does not involve high temperatures but instead occurs through chemical reactions or other means.
- **visible light:** Range of wavelengths of electromagnetic waves that the human eye can detect.

Practice

Watch the amazing ocean animals in the video at the following URL. Then write a concise paragraph describing different ways they make use of visible light. http://www.ted.com/talks/david_gallo_shows_underwater_astonishments.html

Review

1. What is visible light?
2. Define incandescence, and give an example of an incandescent light source.
3. What is luminescence?
4. Make a table comparing and contrasting three ways that luminescence can occur.
5. On a sunny day, white sand on a beach seems to glow with light. What process explains why the sand is so bright?