

Name \_\_\_\_\_

Date \_\_\_\_\_

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## Light Can Do So Much!!

Use the materials in front of you to determine if the following statements are true or false. Then briefly explain your answer on a separate sheet of paper. If you need help, use the hint cards, and don't worry if you don't get through all of them. We will discuss them as a group.

1. T We can detect the whole electro-magnetic spectrum. **We can only see the visible wavelengths (around 10-6 meters), but we can detect the other wavelengths in other ways. We feel heat from infrared and UV light. We use microwaves to heat our food, radio waves to watch TV, x-rays and gamma rays for medical reasons.**
2. T Light is a form of energy. **For example, light provides energy to plants for photosynthesis.**
3. F Light with a large wavelength has more energy than light with a small wavelength. **A large wavelength has a lower frequency, which has less energy than a higher frequency with a smaller wavelength.**
4. F A leaf is green, because chlorophyll absorbs the frequency of light that corresponds to green. **Chlorophyll reflects green light, which is why we see green when we look at a leaf. It absorbs every other color frequency of visible light.**
5. F Black is a color. **Black is the absence of color. An object appears black to us, because it absorbs all visible frequencies and doesn't reflect any light.**
6. F White light is the absence of color. **White light is a combination of all the colors together. Objects appear white to us, because every frequency of visible light is reflected back to our eye. When every color combines, we see white.**
7. F The color of an object is a property of the object itself. **An object only appears to have a certain color when light is reflected off of it. A shirt might look yellow in white light, but if we shine only blue light on it, it will appear grayish**

**black. The shirt absorbs blue light and reflects red and green, which combine to make yellow. If we shine only blue light on it, it will get absorbed, and the shirt will appear black to us.**

8. **T** If red, blue and green light are combined, white light is formed. **Red, blue, and green are the three primary colors of light. They can be combined in any combination to form the colors of the rainbow.**  
**(Red + Green = Yellow, Blue + Red = Magenta, Blue + Green = Cyan)**

9. **F** The sky is blue because it reflects the ocean. **The atmosphere is filled with nitrogen and oxygen molecules, along with many other particles. As light penetrates through the atmosphere, the high frequency blue light gets scattered by these particles. The color left in the sunlight is reddish yellow. Therefore, the sky appears blue to us, and the sunlight appears yellowish red. When we see the sun set, sunlight has to travel a longer distance through the atmosphere. Therefore, the sunlight encounters more particles. More and more blue color is scattered from the sunrays. Not only blue frequencies, but green frequencies also get scattered. The only color that is left when the light reaches our eyes is reddish orange. This is why we see a beautiful orange sunset in the evenings. Sunsets are even more brilliantly orange in Arizona, because there is a lot of dust and other pollutants in the air to scatter the light.**

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are needed to see this picture.

10. **F** Light stops when it hits you or any object. **Light will get absorbed into a material, reflect off of it, or refract into it (such as water and glass). If light stopped every time it hit an object, we wouldn't be able to see anything, because it wouldn't reflect back to our eyes for us to view the image.**

13. **T** Light travels in a straight line. **We cannot see around a corner, unless we have a mirror for light to reflect.**
14. **F** I can determine the exact location of any object just by looking at its image in the mirror. **I can determine the direction and angle of the object. This is because the angle of incidence equals the angle of reflection. However, I could not tell the distance from me that the object was located along the specific angle.**
15. **F** Light travels at the same speed in air and in water. **Light will slow down as it travels from air to water. When you place a pencil in a glass of water at an angle and look at it from the side, the pencil will appear bent. This is because light slows down, and will refract away from the surface of the water.**
16. **F** All frequencies of light will refract in glass at the same angle. (Think about a prism.) **As light travels through glass, different frequencies will travel at different speeds. Therefore, they will refract or bend at different angles. As light travels through one side of a glass prism each frequency will refract differently. When it travels out, through the other side, angle differences will be even more apparent, and the colors will separate out of the white light. This is why we see the colors of the rainbow when we shine light through a prism.**

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17. **T** Light rays can be bent. **As light travels from air to water, the speed slows down and the rays bend away from the surface of the water.**

### **Homework:**

Using the properties of light, explain the following situations. (Use a separate piece of paper) .

1. If you shine a bright red light onto a rose and its leaves, the leaves will feel warmer than the flower.

**The red flower absorbs all colors of light except red. The green leaves absorb all colors of light except green. If you shine only red light on the flower and leaves, the flower will not absorb any of the light, because it reflects red light. The leaves will absorb all of the red light, though. Because light is energy, when objects absorb it, the temperature rises. This means that the green leaves will feel warmer, than the red flower, because they have absorbed the light.**

2. A fish will appear farther away and closer to the surface to a fishermen sitting at the edge of a pond.

**The light reflecting off the fish travels from the water to the air. As it enters the air, it speeds up and refracts (bends) toward the water surface. To the fishermen, sitting at the edge, the fish will appear closer to the surface and a bit behind the actual location.**

3. If I shine a blue light on a yellow shirt, the shirt will appear grayish black.

**A yellow shirt reflects red and green light, which combine to produce the color yellow. But if you shine only blue light on a shirt, there is no red or green light to reflect. Therefore, the shirt will not reflect any light, and the shirt will appear black.**

4. People usually wear white or light colored clothes in the summer, and black or dark colored clothes in the winter?

**The more light a material absorbs, the darker its color is going to appear. Also, the more light a material absorbs, the more energy it absorbs. This will raise the temperature. Therefore, dark colored clothes might help keep you warmer in the winter by absorbing more sunlight than light colored clothes.**

**Search the web to find an interesting phenomenon concerning light. Be able to explain why it occurs. If you can find the right materials, demonstrate for your class.**