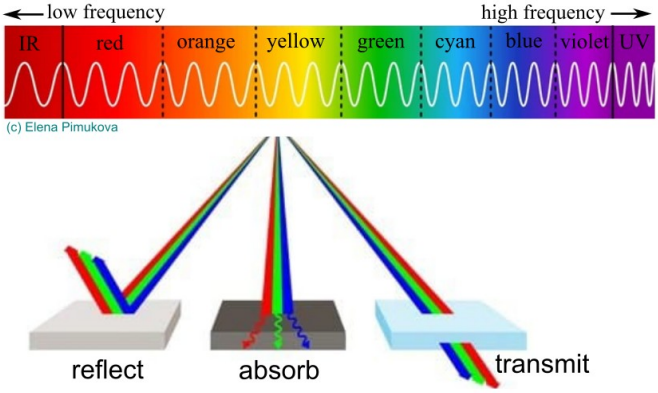
Light and Color

- Light is a wave that travel through empty space
- When light interacts with objects it can be: **reflected**, **absorbed**, or **transmitted**
- A **shadow** is formed when an object blocks light, leaving a dark spot behind it.
- Colors are different **frequencies** of light waves. White light has many frequencies mixed together.
- Our eyes have special cells that respond to the **primary colors of light**: red, green, blue.



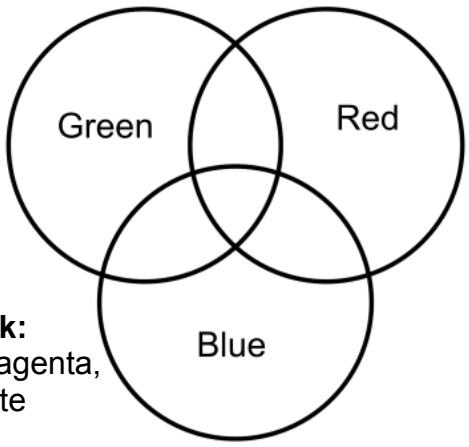
Part 1: Adding Colors

1. Fold a red filter into quarters and use a rubber band to secure it on a flashlight. Repeat with the blue and green filters to make 3 different color flashlights.

2. Set the shoebox with the open side facing you. Shine in the flashlights, using the inside of the box as a screen.

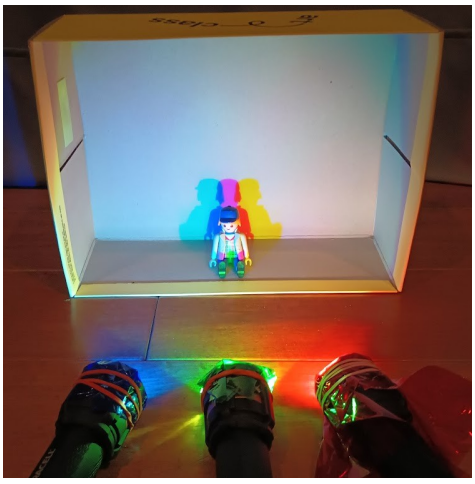
What color do you get when overlapping red + green spots? Overlapping red + blue spots? Overlapping green + blue spots? Overlapping red + blue + green spots? Fill in the Venn diagram with what you see.

Additive model:



Word bank:
Yellow, Magenta, Cyan, White

3. Stand a toy figure near the back of the box. Shine a green light on the figure.
What color is the shadow behind it? _____



4. Leaving the green light on, also shine a red light on the figure.
How many shadows do you see? _____
What colors are they? _____
Discuss: why are there multiple shadows?

5. Now add the blue light on the figure.
How many shadows do you see? _____
What colors are they? _____

Each shadow forms because the figure blocks one of the colors of light. The remaining colors combine to make the shadow!

6. Wiggle around each flashlight to figure out which light is causing which shadow.

The yellow shadow is formed because the figure blocks the _____ light.
The magenta shadow is formed because the figure blocks the _____ light.
The cyan shadow is formed because the figure blocks the _____ light.

Part 2: Subtracting Colors

When light passes through one color filter then another, different colors of light are subtracted away (absorbed) rather than added together.

1. Explore what happens when you shine a red laser pointer through different color gummy bears.
Circle what you see: (more than 1 might be correct)

The red bear	absorbs	/	transmits	/	reflects	red light.
The green bear	absorbs	/	transmits	/	reflects	red light.

2. Repeat the experiment with a green laser pointer.
Circle what you see:

The red bear	absorbs	/	transmits	/	reflects	green light.
The green bear	absorbs	/	transmits	/	reflects	green light.

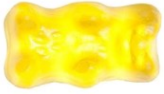
3. Make a prediction. If you stack the bears length-wise in the order red, green, red and shine a red laser pointer at the end, how far will will the light be transmitted?

On the picture above, mark how far the light penetrated.

4. What if you stack the bears in the order red, red, green? How far does the light go?

5. What does the yellow bear do:

To red light?	Absorb	/	transmit	/ reflect
To green light?	Absorb	/	transmit	/ reflect



6. Now use white light (remove a filter from a flashlight). When you shine it through a red bear, what color do you see on the other side? _____

What happens if you shine it through a red bear <u>followed by</u> a green bear?

7. When you shine the white light through a yellow bear, what color do you see on the other side? _____

Make a prediction: what will happen if you shine it through a red bear and then a yellow bear? _____ Test your prediction!

8. Fill in the blanks:
White light contains _____, _____, and _____ primary colors of light mixed together. The red bear transmits _____ light and absorbs _____ and _____ light. The yellow bear transmits _____ and _____ light and absorbs _____ light.

Yellow is one of the colors in the **<u>subtractive light model</u>** because it only absorbs one primary color light and transmits or reflects the rest. From your Venn diagram in Part 1, can you figure out what other colors belong in the subtractive light model (absorb only one primary color)?

Suppose you could make gummy bears in any color you like.
What color gummy bear would absorb red but transmit blue and green? _____
What color gummy bear would absorb green but transmit blue and red? _____

Mixing paint follows the subtractive light model. So a mixture of yellow + cyan paint will absorb blue and red light, and will appear green.

Subtractive color model: