Spinach Leaf Chromatography

Photosynthesis and Respiration Unit

Objective

- Identify the pigment chlorophyll and other colored pigments, and explain how the color that is seen is the color of light reflected off the pigment

Question

- How does chromatography show us the true colors of plants that undergo photosynthesis?

Hypothesis

- Answer the following question with what you think may happen in this lab:

What do you think will happen to the "plant liquids" when placed into rubbing alcohol?

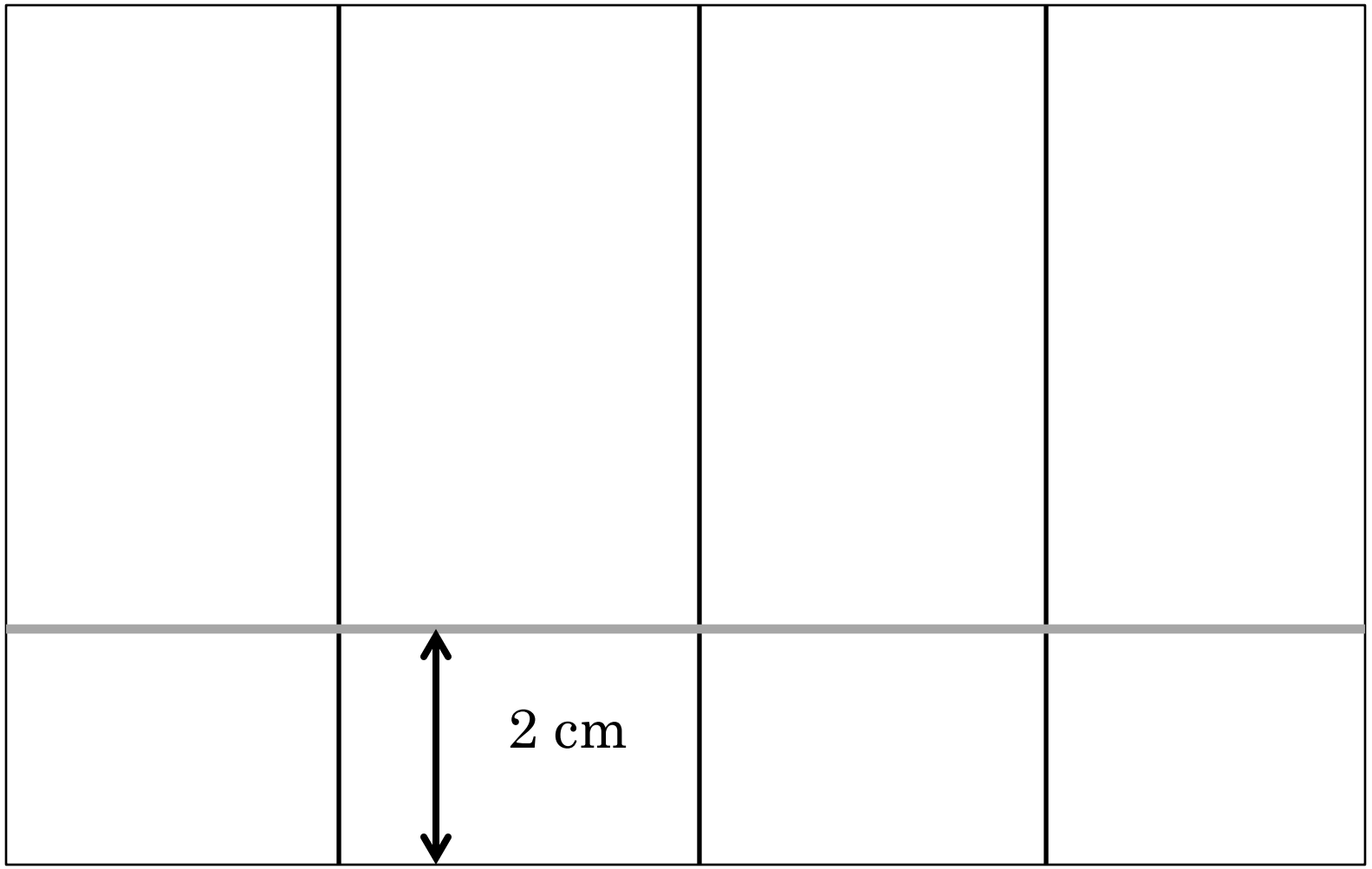
Pre-Lab Questions

1. Why is energy required for life?
2. How does energy enter the living world?
3. Why do plants have green leaves?
4. What is chlorophyll and how does it help with photosynthesis?

Procedure

1. You will be working with the people at your table. Gather all supplies
2. Get a piece of chromatography paper. Cut the chromatography paper into 4 similar sections.
3. Using a pencil a ruler, draw a pencil line across each section of the chromatography paper 2 cm from the end of the chromatography paper.
4. On the pencil line of one of the sections, make a mark with a marker
5. On the pencil line of another section, mark the dye of an M&M on the line (wet the M&M)

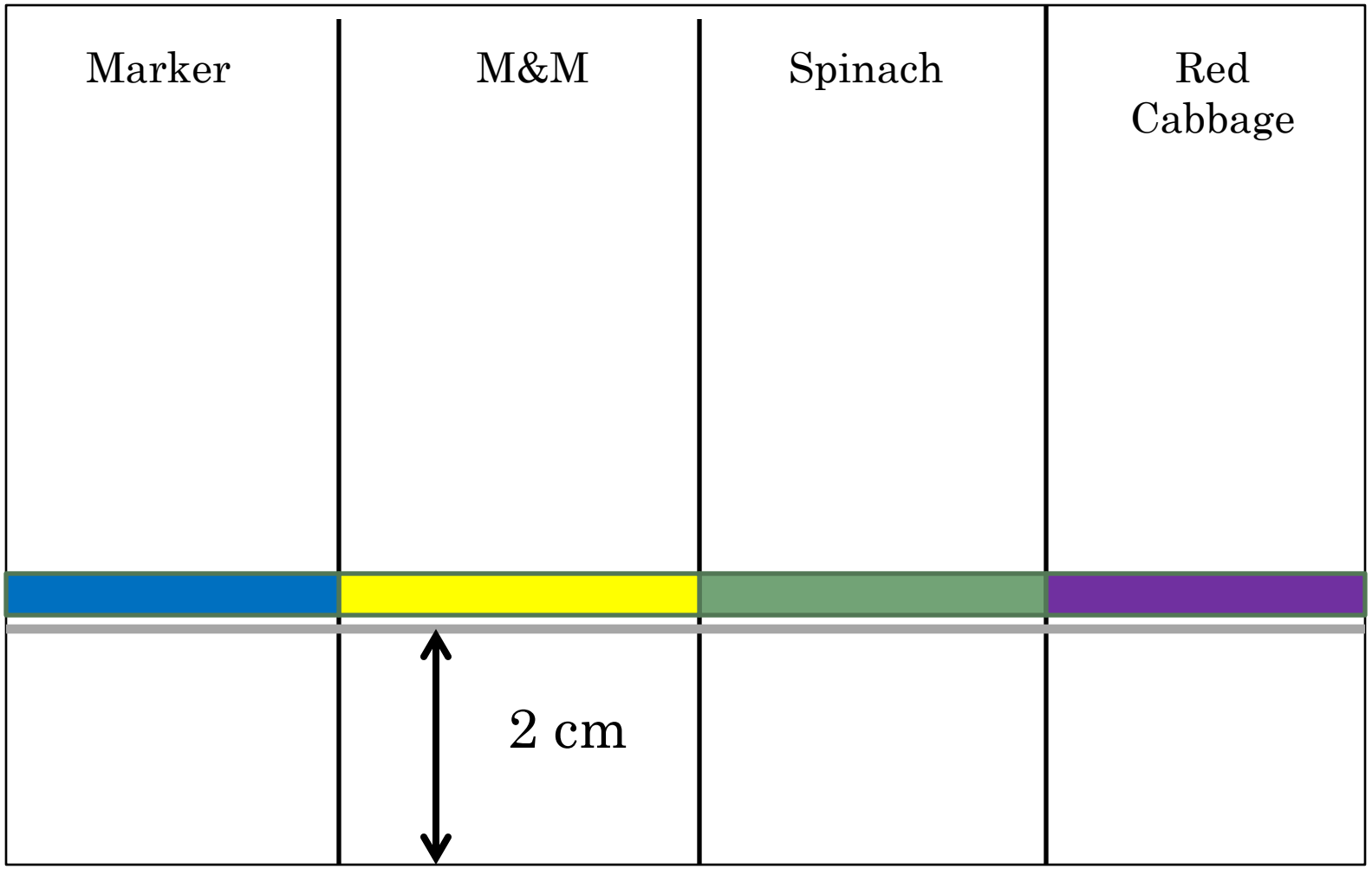
Chromatography Paper Set-Up



Procedure

6. Using a coin, try to extract “plant juice” from the spinach leaf and a cabbage leaf. Make sure to smear the liquid on the line of filter paper.
7. Let the “plant juice” dry for a couple of minutes on the filter paper.
8. Place the chromatography paper with “plant juice” marks into the Petri dish containing the rubbing alcohol.
9. Wait five to ten minutes for this process to take place. Place the strips on a piece of paper towel

Chromatography Paper Set-Up



Procedure

10. Measure how far each band traveled in centimeters.
11. Write the measurements and the colors of the bands in the chart
12. Identify the pigment each band could represent and fill it in the chart.

Data and Observations:

Dye Item	Distance Band Traveled (cm)	Band Color(s)	Identity
Marker			
M&M			
Spinach			
Red Cabbage			

Draw what your chromatography paper looks like for each dye item			
Marker	**M&M**	**Spinach**	**Red Cabbage**

Pigments: reflect this

- *Chlorophyll a – blue-green color*
- *Chlorophyll b – olive green*
- *Xanthophyll – yellow*
- *Carotene – orange yellow*
- *Anthocyanin – purple, blue, and/or red*

Analysis and Conclusion

- 1. Describe the data collected in the experiment.
- 2. Why is chlorophyll green?
- 3. During the fall, leaves change colors as the temperature decreases and the days get shorter. Why do leaves change color in the fall?
- 4. How could you predict the color a leaf will change during the fall?

Key Concepts - Light

- **Sunlight** is made up of different **waves**, and the type of light **wave** our eyes can detect is known as **visible** light.
- **Visible** light or white light contain all the **colors of the rainbow**.
- When we look at an object, the **color** of light we see is the **color** of light **reflected** off the object.
- The rest of the **colors** in **visible** light get **absorbed** by the object.
- For example, if I am looking at a **red** fire truck, **red** light is **reflecting** off the fire truck and the other colors are **absorbed** by the fire trucks.

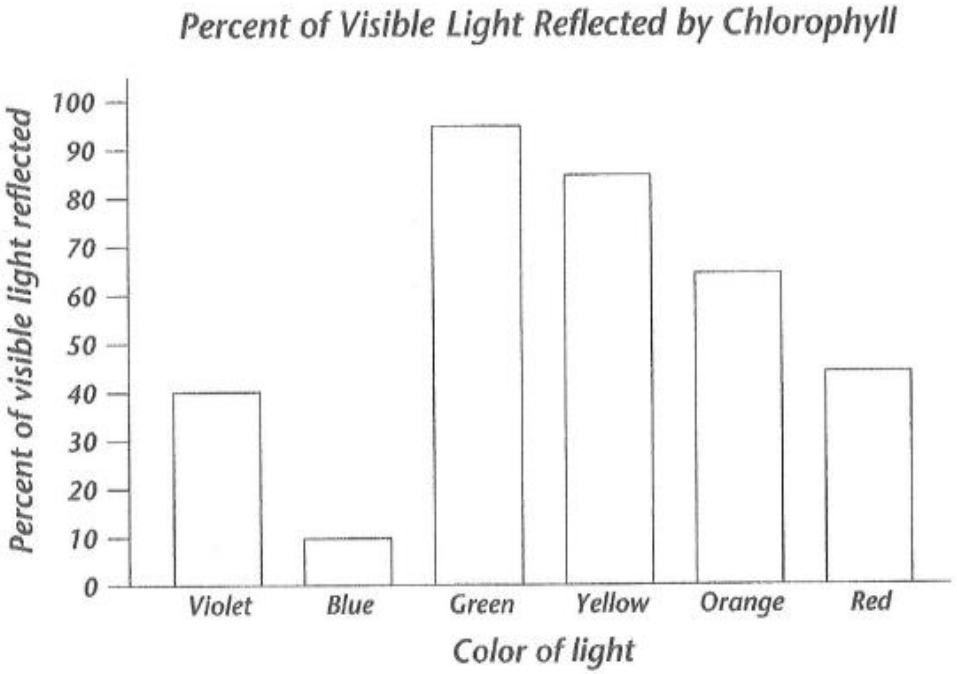
Key Concepts – Lights and Plants

- **Chloroplasts**, in organisms the produce their own food through photosynthesis, absorb **sunlight**.
- **Pigments** are chemicals that give an object color. The **pigment**'s color is seen by us when that specific color of light **reflects** off the chemical.
- In the **chloroplast**, there is a pigment known as **chlorophyll**.
- **Chlorophyll** is the **pigment** or chemical used to **trap** sunlight energy used for the process of **photosynthesis**.

Key Concepts – Lights and Plants

- **Chlorophyll** reflects **green** light. Plants appear **green** because of the **chlorophyll reflecting green** light and absorbing the other colors of light.
- **Chlorophyll** mostly absorbs two colors of light in green plants. **Chlorophyll** absorbs **red** and **blue** light the best out of all the colors of the rainbow.
- During the **fall**, chlorophyll breaks down in plants, and leaves start to turn colors. Other pigments in the plant become **dominant** and start **reflecting** different colors of light commonly found on plants in the fall.

Processing



1. Which color of light does chlorophyll reflect the most? About what percent of light of this color does chlorophyll reflect?

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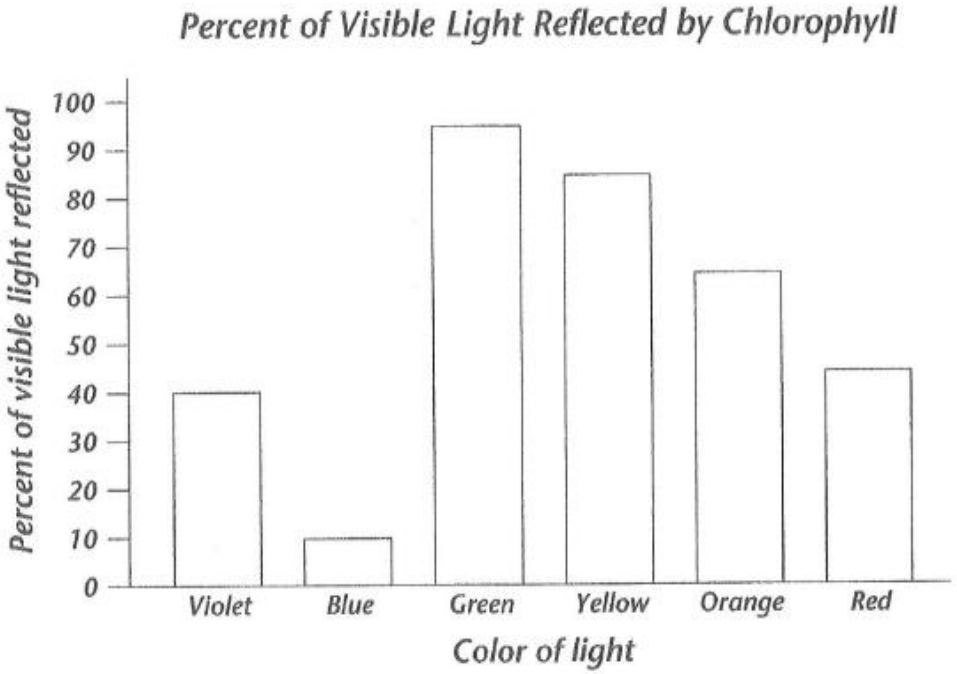

2. Which color of light does chlorophyll absorb most? About what percent of light of this color does chlorophyll absorb?

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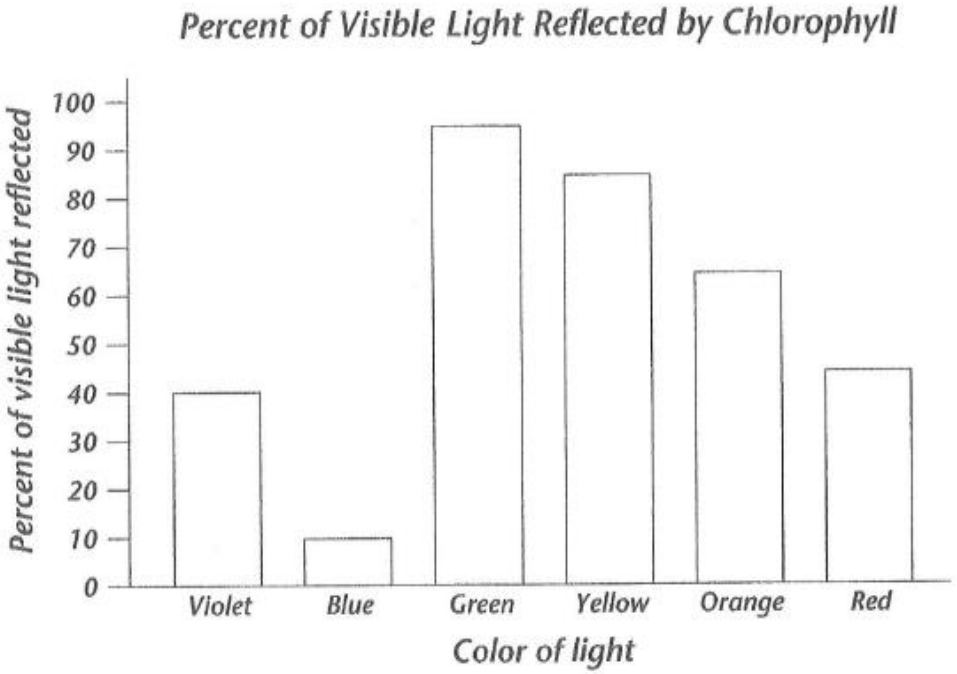

3. The colors that are reflected less than 50% contribute very little to what the eyes sees. Which colors does your respond to when you look at a "green" leaf?

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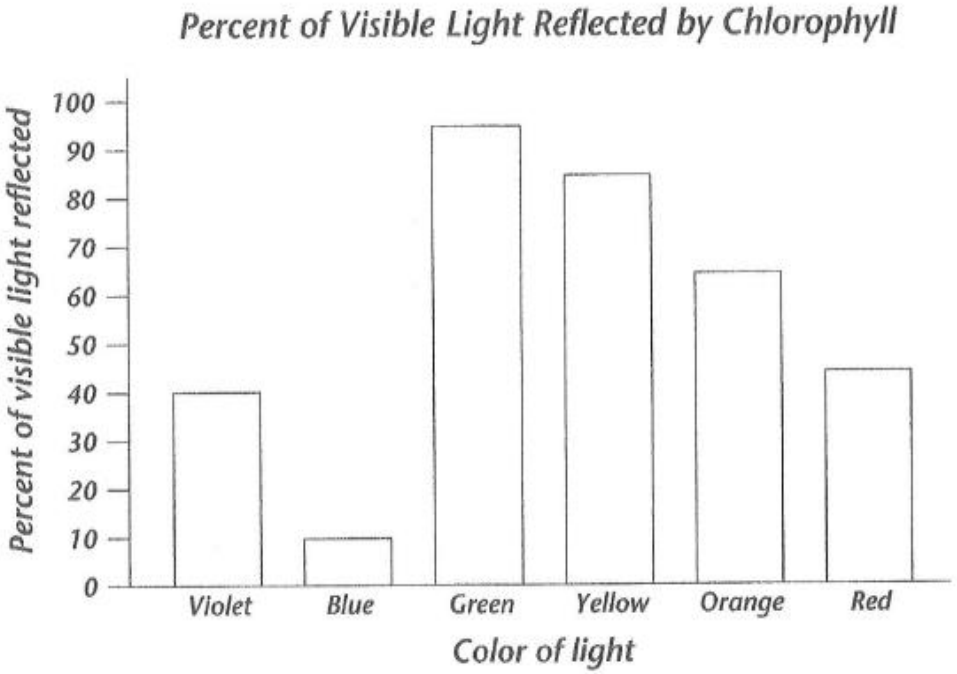

4. Which colors of light do you not see when you look at a "green" leaf?

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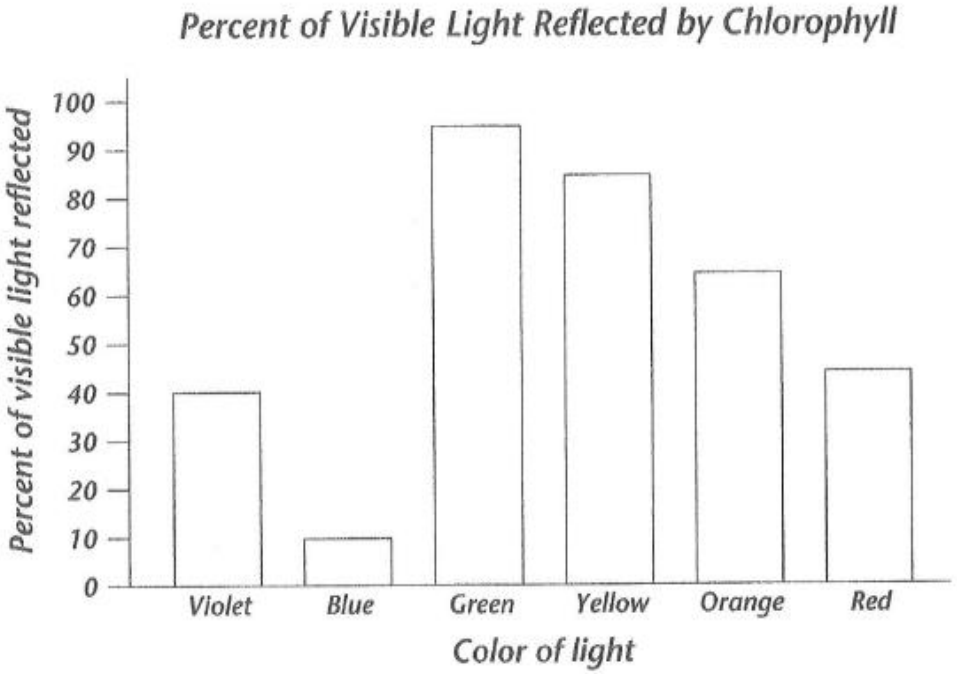

5. Explain in your own words how chlorophyll makes a leaf look green.