LET'S DO IT!

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Teacher Edition

Science Is A Verb!

Part 4

Teacher Edition

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Introduction to the lab manual:

This lab manual provides structure for teachers who wish to engage students in hands-on interactive learning but also provides support for teachers who are more comfortable with enquiry based learning. If you are a teacher who is taking his or her first "dive" into hands-on Science, the background material is designed to provide enough structure to help support the organisation of the lab and its materials. Most of the materials are commonly found in local supermarkets and department stores at a nominal cost. A few materials, like scales and hand microscopes can be found on-line. The lab sheets can be given to students so they follow step-by-step, or they can be told a general structure to follow.

The critical portion of any lab is to have a thorough discussion of the results and their thinking after the experiment is completed. It is suggested that you take as much time as the experiment to have this discussion with students. The real learning occurs not from the hands-on experiment, but from a deep discussion of the experiment, while making connections to the concept they are learning. For this reason, it is suggested that the students do the experiment FIRST and then have the students learn the concepts. They will have a better understanding of the concept if they first conduct an experiment, gain the experience and then discuss a new concept.

Even without a strong Science background, get into the habit of asking questions. The process of asking questions and being inquisitive will generate more excitement for students and will engage them in a deeper way of learning Science. "I don't know" is as important to learning as having all the answers. Together you can learn Science and discover the major ideas that Scientists' research.

If you are an experienced teacher, the Teacher Guided Questions to Enquiry are designed to provide prompts for students. These questions are not intended to be assessment questions, but ones that will engage students in the general direction of the benchmark. The teacher may select one or two, but not all of them, to have students start on an open enquiry approach to learning. The students will engage in their own experiment, create their own procedures and make conclusions from their data. For this reason, there are no answers to those questions. They are open ended and can be used to formulate interesting experiments for advanced students. The slight variation in some of the questions in each of the labs is designed to provide a sufficient number of prompts at various levels of Bloom's Taxonomy to engage students.

Throughout the year, encourage questioning, student dialogue and the scientific process. There is no one exact scientific method as is often suggested. The process of learning about the world and universe, drawing conclusions from facts and building these facts into strong scientific theories is the work of Science. Science is always growing, stretching and expanding its knowledge base. It is about challenging well-supported ideas to discover weakness. This is exactly what students should be encouraged to do! And in the end, Science is not something to study, it is something to do!

Science is a VERB!

Science is a Verb

PHYSICAL SCIENCES

What happens When Light is Absorbed?

Description: Students will observe a laser beam in a cup of water, as green food coloring is added, to observe that the green coloring absorbs red light.

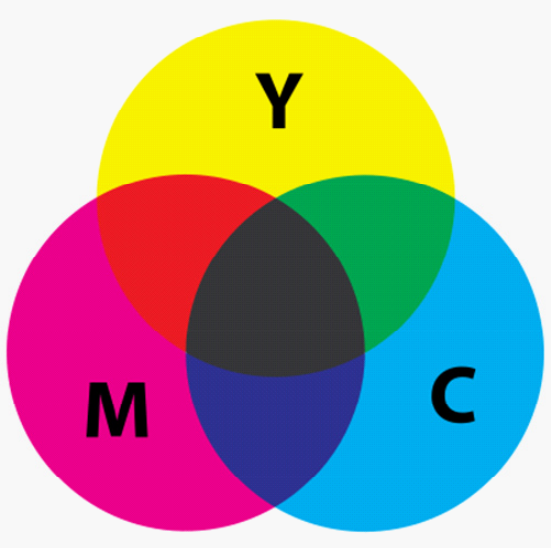
Student Materials (per group):

- Cup
- Water
- Green food coloring
- Milk
- Stirrers

Background and Misconceptions:

It is recommended that the students complete the lab entitled "Does Light Travel In A Straight Line" along with this lab. That lab deals with reflection and refraction of light.

In this lab, absorption is the main topic. When light is absorbed, its colors are subtracted. Red is completely absorbed by green materials. The reason we see light is because it is reflected to our eyes. When you see red paper under white light, the red paper is absorbing all the colors EXCEPT red and this light travels to our eyes. (It should be noted that RED from a pigment is actually a combination of magenta and yellow pigments). Blue and green light are subtracted. If you hold a red sheet of paper under a blue or green light, it will appear to be black. Blue and green light contain no red light. Black is the absence of color. So a white light that shines on black paper will appear black because it is absorbing all the light.



If you try these experiments by examining pieces of paper under different colors of light, make sure you find pure red, blue or green light bulbs. Many bulbs are not truly one color. As a result, the results may be distorted from the descriptions here. Likewise, you can use filters to examine different colors of paper, but they must be high quality filters that will filter almost all the light except the color of the filter. In other words, the red filter must filter out all the colors except red, so that most other pure colors will appear to be black or gray.

Please note that a major misconception exits about the primary colors of light and the primary colors of pigments. They are two sets of different colors. The primary colors of light are red, blue, and green. The primary colors of pigments are cyan, magenta and yellow. The primary colors of pigments are a result of the absorption and reflection of light.

Teacher Guided Questions to Inquiry:

Use these questions to get the students started on their own inquiry!

1. What happens when light is absorbed?
2. How can you make a laser beam disappear?
3. What happens when red light strikes green paper?

Additional Hints:

- Use only hand held keychain lasers. Do not use the green laser pointers.

What happens When Light is Absorbed?

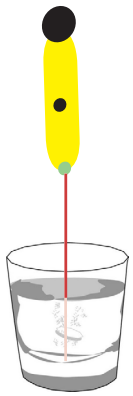
TEACHER ANSWER KEY

Description: Light can either be reflected, refracted, or absorbed. In this experiment, you are going to explore what happens when a red laser beam shines through green food coloring.

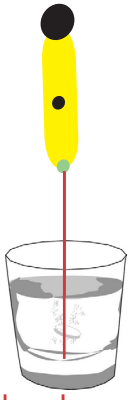
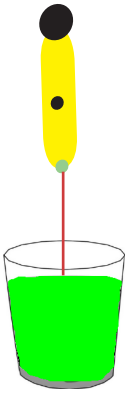
Materials:

Cup	Water
Laser	Milk
Green food coloring	Stirrers

Procedures:

1. Hold the laser above the water like in the picture. 2. Draw the laser you see inside the water. 3. Do you see the laser beam?	 You can barely see it in the water.

What happens When Light is Absorbed?

4. Add a couple drops of milk. 5. What happens to the laser beam? 6. Draw what you see.	 You can see the beam of light in the water.
7. Begin to add green food coloring to the water. 8. What do you notice? 9. Draw what you see.	 As more food coloring is added, the beam completely disappears.

What happens When Light is Absorbed?

Questions:

1. What happens when red light goes into something that is green?

It completely disappears.

2. What happens when light is absorbed?

It disappears.

3. How is light that is reflected different from light that is absorbed?

Reflected light is redirected light. It is just changing direction. Absorbed light disappears and can't be seen.