

## Teacher's Guide

Hi, I would like to thank you for trying this extracurricular activity, and I hope you and your students will enjoy this lesson and find it useful. The main objective of this module is to emphasize the importance of studying science and to show the students that the simple things they see and experience in everyday life can be explained through science.

The approach in this module will be highlighting the scientific way of thinking. Starting from observation of some things then wondering about it. From here, a fantastic journey of knowledge starts; from collecting data and designing experiments to interpretation and drawing conclusions to reaching to answers. These answers may raise many other questions, and the journey continues, taking the students from one level of knowledge another, revealing little secrets in an endless and exciting way of learning. So it is not expected from this module, or from the teacher, to answer all the students' questions, but to let them search for the answers.

The module is designed in five segments, after each segment an activity or a question will be given and left to be discussed, so that you and your students will be involved in that activity or in finding the answer.

**The first segment:** is an introduction about the topic, after which I will leave you with your student for some brain storming in which you prepare the student for the lesson and create the interest around the topic of colors. You may like to ask the students about:

1. Their favorite colors.
2. The causes of colors.

Write on the board the questions and listen to their answers. This should take up to 3 min.

After the **second segment:** ask the student how can we prove that the light is composed of many colors? What observation from nature emphasizes this? Answer: Rainbow. What experiment can we do? Answer: using a prism to analyze the sun light. If you have a prism, perform the experiment and discuss with the students what happened to light when it passes a prism. Answer: A prism is a specially shaped crystal. When white light shines

through a prism, the light is separated into all its colors, explain that the water drop acts as a prism to form a rainbow. If you do not have a prism at school, then use the video experiment provided in this CD. This should take up to 3 min

In **segment three**: I answer the question **why the sky is blue**, but I leave the students with a question **why not violet?** It should be left for the students to search for the answer themselves. The answer is: The light of the sun is not the same of all intensity of each color, it peaks at the green yellow region, and the less intensity of the violet color shifts the shed back towards the blue color. In addition our eyes are more sensitive to the blue color.

By the end of this segment I give the students a question: how would the sun look like on the moon? What is the color of the sky on the moon? Record all the answers and ask the student to provide an explanation for their answer. You may give them a hint that in space or on the moon, there is no atmosphere to scatter the sun's light. Guide them to conclude that the sun would look white and the sky looks dark or black, instead of blue. This should take you 5 min.

In **segment 4** I start addressing another cause of colors; existence of **pigments**. Pigments are certain compounds with a certain feature in their chemical structure. They contain many co-planar double bonds close to each other (conjugated). This feature enables them to absorb certain wave length(s) and reflecting the complementary waves which gives the color of the pigment.

After I explain the why the leaves are green? And why they change their color in fall?

I will then leave you with your students to perform an experiment to separate the pigments from a leaves by chromatograph. This will need some pervious preparation; the leaves should be cut into small pieces and soaked in about 5-10 ml acetone in a covered container for one day.

Segment 5: We come to the end of this module, I hope you have enjoyed it; it will be great if the students have a lot of questions and if they start searching for answers.