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# Introduction to the Teacher

Welcome to the world of physics and to the exploration of our universe!

As a physics teacher for a number of years, I have learned that the most misunderstood science is physics. It has generally been associated with a high degree of complexity and mathematical mystery. However, the study of the world through the eyes of a physicist actually begins with the beauty of questioning and wonderment. Although the answers that one seeks can lead to complex ideas that *do* require abstract mathematical thought, the initial stages of this process are very simple and very exciting. It was this excitement that propelled me at an early age to pursue science as a career. This pursuit amazed me because in primary school, much to my embarrassment, I could barely do arithmetic.

I realised early on that the passion to learn and to understand had no real boundaries. My simple childhood questions and ideas instilled in me this unparalleled passion, which I hope to unlock in the minds of your students.

Many young adults' perceptions and conceptions about science are locked into a mental framework based upon early educational experiences (some good, some not so good), which may limit their full potential as critical thinkers. To unlock that potential and to tap their childhood passion to learn becomes a challenge; answering that challenge is the purpose of this book.

Be sure to convey to your students all the information in your sections of the book. You may also want to make one copy for each student of the physics newspaper, *Cafe Universe Times,* in the back of the book. The newspaper reviews some of the material in the book in an interesting way and offers students additional activities.

The book is organised around a set of simple observational activities that stimulate questioning and answering. The activities encourage generating answers to stimulate individual creativity. This approach allows young thinkers the flexibility to make mistakes and make misjudgments, and thus necessitates re-examination of the problem. Through these observational activities, a proc-

 

ess develops by which students observe, become part of the observation, formulate explanations, develop a language to discuss their ideas, formulate explanations against additional experiments, and encourage active discussions with peers, all of which become the heart of critical analysis.

This process crosses all academic disciplines and is certainly not limited to the sciences, as is evidenced by how we learn to appreciate great masterpieces in literature, art, and music. To compartmentalise science as distinct from other academic studies is a mistake. An even flow among disciplines should exist so that all students understand and appreciate the art of science and the science of science.

If we boil away all the fat, what remains is the true essence of the matter; I believe this book is fat free. Without further ado, turn the page for your first sample from the healthiest menu in the cosmos!

# Educational Objectives

- To motivate students who are not necessarily attracted to science and mathematics. Throughout the book, observational activities that integrate drawing, counting, measuring, predicting, recording, hypothesising, and verifying are used. These activities establish the language of science.
- To develop and sharpen the students' ability to think critically by encouraging

  *questioning*

  *hypothesising*

  *observing*

  *verifying*

  *researching*

  *re-examining*

  *experimenting*

  *defending*

  *exploring*

  *discussing*

- To inspire a sense of questioning and wonderment as the students examine the world that surrounds them.
- To stimulate the students' passion for learning.

 

# 1 An Appetiser

## Becoming a Physicist

### To the Teacher

#### Objective

Students will formulate questions and analyse the answers to questions.

#### Equipment

pencil

paper

lots of imagination

#### Procedure

Divide the class into small groups, with each group discussing a set of questions you have raised, such as those that follow. Have each group select a member as the group physicist who will record all the answers. At the end of the activity, each group physicist will present the group's answers to the class.

# 1 ★ An Appetiser

## To the Student

Scientists and, in particular, physicists are much like detectives or spies. They generate questions and search to find answers to questions such as "What is . . . ?" "How is . . . ?" and "Why is . . . ?" Finding such answers isn't necessarily easy. When found or proposed, the answers may not be good enough for physicists. Oh, no! They seek answers to help them understand why things work as they do, and they are not satisfied until they can explain it to others clearly. Some individuals, sceptics, don't necessarily believe every answer scientists or physicists suggest. Thus physicists have a heavy burden: they must prove (or show the validity of) every detail, no matter how minute. Until every "What is . . . ?" "How is . . . ?" and "Why is . . . ?" in the universe is answered, there will be scientists and, in particular, physicists.

Your group physicist (you may call her or him the group physicist from now on if you would like to) will pose some questions for you to discuss, such as the ones that follow. You will write down some of your answers, then discuss your answers among your group. Keep writing and discussing until you come to one, two, or three answers to each question that you all agree are possible. When you have finished, the group physicist will write down the agreed-upon answers and present them to the class for discussion.

## Questions

1. Why do objects fall to Earth?
2. Do all objects "fall" to Earth?
3. What is the shape of your head?
4. Why is it this shape?
5. Why are some clouds white?
6. Why are other clouds dark?
7. Are all clouds white or dark?
8. Why is the sky blue?

 