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How to Use This Book

As classroom teachers we are well aware of the myriad tasks that face you on a daily basis in your professional life. Time is your worst enemy. Research, planning, and preparation are all activities which must precede instruction. This book was written in an attempt to assist you in preparing, in a time-efficient way, for quality science instruction. The structure of this book was designed with you in mind. The book is divided into a number of sections. The first section deals with how the book can be used in an inquiry-based environment. Information is also provided on how trade books can be selected for your classroom as well as a number of websites that you and your students can use to find additional information.

Subsequent sections of the book are referred to as modules and provide you with the in-depth information, activities and connections to help you in your classroom. Features of every module include:

- **Science background:** Provides a brief explanation of the science concepts needed for a basic understanding of the science discipline being discussed. A number of diagrams are included to assist in clarification of the ideas presented. More importantly, references to the activities are also provided in context within the section.

- **Annotated bibliography:** This comprehensive list of books includes a brief summary of each title. This bibliography was written to assist you in locating children's literature that can be used with each activity.

- **Activities:** Each activity is presented in a lesson plan format that provides you with information relating to the objectives that the activity addresses, a list of materials needed for the activity, and the procedure to follow in conducting the activity. A section on related children's literature specific to the activity is given and the books listed are described in the annotated bibliography. The final section of each activity consists of connections to other subject areas that may be explored. Inquiry-based student lab pages are provided for most of the activities to assist you in the lessons.

As you use this book it is important to realise that activities can be adapted to meet the needs of your students and your classroom environment. There is no set formula for accomplishing this task. The expert on your students' capabilities and behaviour is you. We cannot make absolute suggestions as to how you will adapt anything in this book to your particular situation with your particular students. Each of the activities can be adapted for students who are very talented simply by letting them do more of the exploring. You may wish to ask more questions at the end of each investigation, or have students use journals to record predictions, prior knowledge, and then what they learnt from the investigation. You may ask them how their results can be applied in the real world around them. These strategies are effective in making the activities more challenging for the students.

Each of the activities can be adapted for students who are not skilled in science investigation simply by giving more direction. Depending on the activity, you may prefer to lead the students through the activity by example, step by step, with the entire class in unison. For some students it may be best to read and review the instructions as a group before beginning the investigation. Perhaps the best procedure for some activities is to have the students complete one task each day over a period of several days. Some of the activities within this book may not be appropriate for your students to complete. In that case, you may want the students to simply watch, and/or take notes, and/or answer questions regarding activities you choose to do as demonstrations.

For the activities that you choose to do as student-centred, hands-on and minds-on science experiences, you have many choices for organising your class. You may consider grouping the students in your classroom; in most activities, groups of two to five can be effective. While large groups require fewer materials and equipment as a class unit, they are sometimes difficult to manage. Large groups may also cut down on the active participation of each student. Groups of three are favoured by the authors, although the research on ideal group size is not definitive. The key is to structure the activities in a way that works for you as the manager of a classroom environment.

The materials, including equipment and supplies, required for each activity are appropriate for a small group or individual. Many of the listed items are inexpensive or easy to locate, but some science equipment must be purchased if not available in your school. For sources of the equipment, you may wish to consider commercial suppliers if you have a budget for purchasing materials. If you only have a small budget for science, you may consider contacting your senior school or local secondary school science department as a source of materials and equipment, such a balances. In most science departments, supplies of the kind required in this book are not rare. For example, hydrochloric acid is usually stored in concentrated forms in large bottles, and making a dilute solution for you does not represent a problem for the science specialist. In fact, being used as a resource by a primary/middle school teacher would be a compliment for most upper secondary science teachers.

Understanding Mass and Density

Purpose:

- Measure the mass of various objects using a balance.
- Determine the density of each object using displacement.
- Draw conclusions about the relationship of mass and density.

Materials Needed:

same-sized cubes made from various materials
large graduated cylinder
water
balance
calculator

Introduction: All objects have a certain mass and this mass is explained in terms of weight. However, objects of the same dimensions can have different densities. This explains why some types of wood can float in water and others cannot. In this activity, students will have the opportunity to determine the mass of various objects with the same dimensions but made from different materials.

Using the Balance:

1. Ensure that all slides on the balance are set at '0'. If needed, zero the balance by moving the thumb screw under the pan of the balance.
2. Place the first sample on the pan of the balance.
3. Move the '100s' weight from slot to slot until the balance 'trips' when the arm falls to the bottom of its range of movement. Move the weight back one slot.
4. Move the '10s' weight from slot to slot until the balance 'trips' when the arm falls to the bottom of its range of movement. Move the weight back one slot.
5. Move the 'units' weights until you obtain perfect balance of the pointer in the centre of its range of movement.
6. Read and record this reading as the mass of the sample in the appropriate spot in the data sheet.

Procedure: See student lab sheet of instructions.

Behind the Scenes: Cubes for use in mass and density experiments can be purchased from science supply stores or catalogues. However, if you have access to the necessary resources, consider making a set of mass/density cubes. This can be done by finding woods (e.g. mahogany, oak, pine, maple), metals (e.g. aluminium, steel) and plastics (e.g. fibreglass, hard plastics) that are different and having 2.5 cm by 2.5 cm cubes cut from each material.

The mass of the object does not change unless more matter is added to it or removed from it. The weight of an object is determined by the gravitational force exerted on it. On earth, for the most part the gravitational force is constant. However, if you were to travel to another planet or the moon, the gravitational constant would change, thus your weight would change but not your mass.

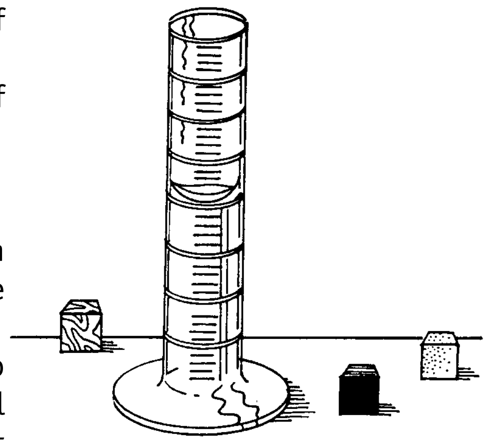
Name

Understanding Mass and Density

Procedure:

Determining Mass

1. Measure the length, width and height of each object and record.
2. Using the balance, determine the mass of each object.



Determining Volume

1. Fill a graduated cylinder about halfway with water. Before placing each cube in the cylinder, record the volume of the water.
2. Tilt the cylinder, then allow the cube to slide slowly into the water. Make all attempts to avoid splashing the water out of the cylinder.
3. Record the volume of both the water and cube on the chart.
4. Subtract the volume of just the water from the volume of both the water and cube. Record this number which represents the volume of the cube.

Determining Density

1. Find the density of each cube by dividing its mass by the volume.

Object	L x W x H (cm)	Mass (g)	Volume of Water (mL)	Volume of Both (mL)	Volume of Cube (mL)	Density (g/mL)
1						
2						
3						
4						
5						
6						

Questions: *Answer the questions on the back of the paper.*

1. Describe what you noticed about the size of all the objects.
2. Describe what you noticed about the mass of each object.
3. When you determined the volume of each object you displaced water. The same thing happens when you sit in a bathtub full of water. What would happen to the water level if a larger person were to sit in the same bathtub?
4. What relationship did you notice between the density and the mass of each object?
5. Water has a density of 1 g/mL. Look at the densities of the objects you used. What do you think would happen to an object whose density was less than 1 g/mL? Greater than 1 g/mL?

Drawing a Thermal Map

Purpose:
- Use a thermometer to measure the air temperature at several points in the school.
- Record the temperature data to make a thermal map of the school.
- Determine which areas are most comfortable for a student to learn.

Materials Needed:
floor plan of the school
thermometer
watch or clock

Introduction: Many teachers may be aware that some parts of a school building are warmer/cooler than others. This exercise permits the students to practise using thermometers while exploring their school.

Procedure:
1. Obtain a floor plan for the school. Make a photocopy for each team of students.
2. If necessary, have the students review how to read a thermometer.
3. Decide where each team of students will measure the air temperature.
4. Designate a certain time to measure the air temperature so that all temperature readings are coordinated.
5. See student lab sheet for further instructions.

Answer Key For Questions: Answers will vary for all questions.

Portals for Expansion:

English
- Read about ways of life in different parts of the world, then discuss how living conditions differ among climatic regions.

Mathematics
- Calculate the differences in the temperatures found, and find the average school-wide temperature.

Science
- Repeat the exercise at various points during the day and compare maps to find where the greatest change occurs.