# Physical Science

## Grade 7

Written by Tracy Bellaire

### About this Book

The experiments in this book fall under thirteen topics that relate to three aspects of physical science: **Structural Form and Function, Heat and Temperature, Chemistry of Pure Substances and Mixtures.** In each section you will find teacher notes designed to provide you guidance with the learning intention, the success criteria, materials needed, a lesson outline, as well as provide some insight on what results to expect when the experiments are conducted. Suggestions for differentiation are also included so that all students can be successful in the learning environment.

### About the Author:

Tracy Bellaire is an experienced teacher who continues to be involved in various levels of education in her role as Differentiated Learning Resource Teacher in an elementary school in Ontario. She enjoys creating educational materials for all types of learners, and providing tools for teachers to further develop their skill set in the classroom. She hopes that these lessons help all to discover their love of science!



Published in Canada by:
On The Mark Press
15 Dairy Avenue, Napanee, Ontario, K7R 1M4
www.onthemarkpress.com

# At A Glance

| Learning Intentions | Structural Forms | Forces on Structures | Form and Stability | Structure and Function | Under Construction | Design and Production | Temperature Change | Heat Transfer | Heat in Our Homes | Solutions | Mixtures | Mixing and Separating | Physical or Chemical? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Knowledge and Understanding Content** | | | | | | | | | | | | | |
| • recognize and classify structural forms and the materials used in their construction | • | | | | | | | | | | | | |
| • identify internal and external forces; describe the effects of internal and external forces on structures | | • | | | • | | | | | | | | |
| • recognize and describe the importance of symmetry and center of gravity on a structure when supporting a load | | | • | | • | | | | | | | | |
| • identify and describe supports used to strengthen structures and fasteners used to contribute to their function | | | | • | • | | | | | | | | |
| • investigate the impact of ergonomic design and other factors that determine product success in the market place | | | | | | • | | | | | | | |
| • use the particle theory of matter to compare how heat affects the motion of particles in a solid, a liquid, and a gas | | | | | | | • | | | • | | | |
| • describe and investigate how heat is transferred through conduction, convection, and radiation | | | | | | | | • | | | | | |
| • describe various sources of heat energy, and investigate how it is acquired, used, and conserved in our homes | | | | | | | | | • | | | | |
| • identify the components of a solution, and describe the difference between saturated and unsaturated solutions | | | | | | | | | | • | | | |
| • distinguish between pure substances, mechanical mixtures, emulsions, suspensions, and solutions | | | | | | | | | | | • | | |
| • investigate the interactions of solids and liquids, and how a material can be recovered from a mixture or solution | | | | | | | | | | | | • | |
| • differentiate between physical and chemical changes and determine their versatilities | | | | | | | | | | | | | • |
| **Thinking Skills and Investigation Process** | | | | | | | | | | | | | |
| • make predictions, formulate questions, and plan an investigation | | • | • | • | • | | • | • | | • | • | • | • |
| • gather and record observations and findings using drawings, tables, written descriptions | • | • | • | • | • | • | • | • | • | • | • | • | • |
| • recognize and apply safety procedures in the classroom | • | • | • | • | • | • | • | • | • | • | • | • | • |
| **Communication** | | | | | | | | | | | | | |
| • communicate the procedure and conclusions of investigations using demonstrations, drawings, and oral or written descriptions, with use of science and technology vocabulary | • | • | • | • | • | • | • | • | • | • | • | • | • |
| **Application of Knowledge and Skills to Society and the Environment** | | | | | | | | | | | | | |
| • evaluate the importance to society, the economy, and the environment to consider specific factors in design and manufacturing of products | | | | | | • | | | | | | | |
| • assess the environmental and economic impact of using conventional and alternative forms of thermal energy | | | | | | | | | • | | | | |
| • assess the environmental benefits of technologies that reduce heat loss or transfer | | | | | | | | | • | | | | |
| • assess the environmental impacts of processes that change a product through physical or chemical changes | | | | | | | | | | | | | • |

# Table of Contents



OTM-2150 ISBN: 9781770788626

# Table of Contents

Student's Name: _____ Date: _____

# Teacher Assessment Rubric

| Success Criteria | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|
| **Knowledge and Understanding Content** | | | | |
| Demonstrate an understanding of the concepts, ideas, terminology definitions, procedures and the safe use of equipment and materials | Demonstrates limited knowledge and understanding of the content | Demonstrates some knowledge and understanding of the content | Demonstrates considerable knowledge and understanding of the content | Demonstrates thorough knowledge and understanding of the content |
| **Thinking Skills and Investigation Process** | | | | |
| Develop hypothesis, formulate questions, select strategies, plan an investigation | Uses planning and critical thinking skills with limited effectiveness | Uses planning and critical thinking skills with some effectiveness | Uses planning and critical thinking skills with considerable effectiveness | Uses planning and critical thinking skills with a high degree of effectiveness |
| Gather and record data, and make observations, using safety equipment | Uses investigative processing skills with limited effectiveness | Uses investigative processing skills with some effectiveness | Uses investigative processing skills with considerable effectiveness | Uses investigative processing skills with a high degree of effectiveness |
| **Communication** | | | | |
| Organize and communicate ideas and information in oral, visual, and/or written forms | Organizes and communicates ideas and information with limited effectiveness | Organizes and communicates ideas and information with some effectiveness | Organizes and communicates ideas and information with considerable effectiveness | Organizes and communicates ideas and information with a high degree of effectiveness |
| Use science and technology vocabulary in the communication of ideas and information | Uses vocabulary and terminology with limited effectiveness | Uses vocabulary and terminology with some effectiveness | Uses vocabulary and terminology with considerable effectiveness | Uses vocabulary and terminology with a high degree of effectiveness |
| **Application of Knowledge and Skills to Society and Environment** | | | | |
| Apply knowledge and skills to make connections between science and technology to society and the environment | Makes connections with limited effectiveness | Makes connections with some effectiveness | Makes connections with considerable effectiveness | Makes connections with a high degree of effectiveness |
| Propose action plans to address problems relating to science and technology, society, and environment | Proposes action plans with limited effectiveness | Proposes action plans with some effectiveness | Proposes action plans with considerable effectiveness | Proposes action plans with a high degree of effectiveness |

OTM-2150 ISBN: 9781770788626

Name: _____ Date: _____

# Student Self-Assessment Rubric

Put a check mark (✓) in the box that best describes you:

| | Always | Frequently | Sometimes | Seldom |
|---|---|---|---|---|
| • I listened to instructions. | | | | |
| • I was focused and stayed on task. | | | | |
| • I worked safely. | | | | |
| • My answers show thought, planning, and good effort. | | | | |
| • I reported the results of my experiment. | | | | |
| • I discussed the results of my experiment. | | | | |
| • I used science and technology vocabulary in my communication. | | | | |
| • I connected the material to my own life and the real world. | | | | |
| • I know what I need to improve. | | | | |

1. I liked _____

_____

2. I learned _____

_____

3. I want to learn more about _____

_____

OTM-2150 ISBN: 9781770788626



# Introduction

The activities in this book have two intentions: to teach concepts related to physical science and to provide students the opportunity to apply necessary skills needed for mastery of science and technology curriculum objectives.

Throughout the experiments, the scientific method is used. The scientific method is an investigative process which follows five steps to guide students to discover if evidence supports a hypothesis.

1. **Consider a question to investigate.**
   For each experiment, a question is provided for students to consider. For example, "Does temperature of a solvent affect solubility?"

2. **Predict what you think will happen.**
   A hypothesis is an educated guess about the answer to the question being investigated. For example, "I believe that a heated solvent can dissolve much more solid than a cold solvent". A group discussion is ideal at this point.

3. **Create a plan or procedure to investigate the hypothesis.**
   The plan will include a list of materials and a list of steps to follow. It forms the "experiment."

4. **Record all the observations of the investigation.**
   Results may be recorded in written, table, or diagram format.

5. **Draw a conclusion.**
   Do the results support the hypothesis? Encourage students to share their conclusions with their classmates, or in a large group discussion format.

The experiments in this book fall under thirteen topics that relate to three aspects of physical science: **Structural Form and Function, Heat and Temperature, Chemistry of Pure Substances and Mixtures.** In each section you will find teacher notes designed to provide you guidance with the learning intention, the success criteria, materials needed, a lesson outline, as well as provide some insight on what results to expect when the experiments are conducted. Suggestions for differentiation are also included so that all students can be successful in the learning environment.

## Assessment and Evaluation:

Students can complete the Student Self-Assessment Rubric in order to determine their own strengths and areas for improvement. Assessment can be determined by observation of student participation in the investigation process. The classroom teacher can refer to the Teacher Assessment Rubric and complete it for each student to determine if the success criteria outlined in the lesson plan has been achieved. Determining an overall level of success for evaluation purposes can be done by viewing each student's rubric to see what level of achievement predominantly appears throughout the rubric.



# Structural Forms

## Learning Intention:

Students will learn how to recognize and classify structural forms and the materials used in their construction.

## Success Criteria:

- identify structural types as either solid, frame, shell structures
- identify structures as either man-made or natural
- determine the types of materials used to make man-made and natural structures
- determine the properties of the materials
- recognize and describe structural combination forms
- make connections to our environment by identifying structures all around us

## Materials Needed:

- a copy of "Structural Forms" Worksheet 1 for each student
- a copy of "What Type Is It?" Worksheet 2 for each student
- a copy of "Properties of Materials " Worksheet 3 and 4 for each student
- a copy of "Structures All Around" Worksheet 5 for each student
- clipboards (one for each student)
- pencils, pencil crayons, chart paper, markers

## Procedure:

1. Discuss with students the meaning of a structure. Lead students in a brainstorming activity/ discussion about different structures that can be found in the natural and man-made environments. Record student responses on chart paper. Give students Worksheet 1. After reading and discussing the information on this sheet, refer back to the student responses that were recorded during the brainstorming activity. For each response given, ask students to identify if the structure is man-made or natural, and then identify if it is a solid, frame, or shell type structure. Pose the question, could any of them be a combination of structural types? For example, a house is a combination of a frame and a shell structure. Give students Worksheet 2 to complete.
2. Come back together as a large group and have a discussion about the different materials that man-made structures and those in the environment are made of. Make a list of their responses on chart paper. Discuss the meaning of properties of materials. Refer back to the list of materials on the chart paper, and ask students to name some properties of those materials. Give them Worksheets 3 and 4 to complete.
3. Explain to students that they are going to take a walk around the neighborhood to observe natural and man-made structures. Instruct them to take note of whether the structures they see are natural or man-made, and if they are solid, frame, shell structure types, or a combination. Give each student a clipboard and Worksheet 5 to complete as they walk through the neighborhood.

## Differentiation:

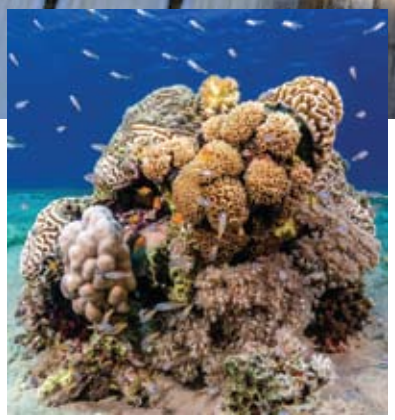
Slower learners may benefit by working together with a peer or in a small group with teacher direction to discuss different properties of materials while completing Worksheets 3 and 4.
**For enrichment,** faster learners could access the internet and research a man-made or natural structure of their choice. Instruct them to find out how exactly this structure was made and what materials were used to make it.

Worksheet 1

Name: _____

# Structural Forms

A structure is a supporting framework that is made to hold a load or to enclose a space. Structures are made from one or more parts. There are many structures all around us. They can be classified by their design into three groups: frame, solid, and shell structures.



Solid structures are sometimes called mass structures. They are usually made from one solid piece of a strong material. A solid structure has little or no space inside and relies on its own weight to resist the forces that act upon it. Generally, the thicker a solid structure is, the stronger it is. An example of a solid structure is a concrete barrier such as a dam, which is able to resist the force of water upon it. We can find solid structures in nature too. Some examples of natural solid structures are mountains or coral reefs.

Frame structures are made up of parts fastened together to create one arrangement. These parts are called its structural components. None of these structural components are able to singularly support a load, but when components are fastened together, they are able to support and strengthen each other. An example of a frame structure is a bicycle. We can find frame structures in nature too. An example of a natural frame structure is a tree.

In a shell structure, the outside layer of the structure holds the object together. Shell structures have a solid surface and a hollow interior. Strong shells can be made from weak materials, as it is the shape of a shell structure that gives it its strength. An example of a shell structure is the wing of an airplane. We can find shell structures in nature too. An example of a natural shell structure is a snail's shell.

OTM-2150 ISBN: 9781770788626

Worksheet 2

Name: _____

# What Type Is It?

Classify the structures in the pictures below.

a) solid, frame, or shell structure? **AND** b) man-made or natural?

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

a) _____

b) _____

OTM-2150 ISBN: 9781770788626

Worksheet 3

Name: _____

# Properties of Materials

Structures can be made of different materials. List the kinds of materials that are used to make these man-made structures:








_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Materials have different properties. Some materials are hard and some are flexible. Hard and flexible are different properties. Use descriptive words to tell about the properties of the man-made structures in the pictures above.

_____ _____

_____ _____

_____ _____

OTM-2150 ISBN: 9781770788626

Worksheet 5

Name: _____

# Structures All Around

Take a walk in your neighborhood to observe natural and man-made structures. Draw and label four structures that you see. Also, determine if they are solid, frame, or shell structures.

| | |
|---|---|
| **Circle:** natural or man-made?<br>solid, frame, or shell? | **Circle:** natural or man-made?<br>solid, frame, or shell? |
| **Circle:** natural or man-made?<br>solid, frame, or shell? | **Circle:** natural or man-made?<br>solid, frame, or shell? |

Do any of the structures that you observed incorporate a combination of structure types? If so, describe the parts of the structure that make up each type.

_____

_____

_____

_____

OTM-2150 ISBN: 9781770788626

Worksheet 1

Name: _____

# Physical & Chemical Changes

Solids, liquids, and gases are all matter. When a change to matter occurs, it can be a **physical** or **chemical** change.

**Physical change** means a change in color, size, or shape. A physical change is a change that can be reversed, or changed back. A change in state such as an ice cube melting to water, is a physical change. By putting the ice cube back into the freezer, the change can be **reversed** and the ice cube can be formed again. Water, ice, and water vapor are all water.

**Chemical change** means a change in a substance that makes it different from its original matter. A chemical change is a change that can't be reversed, or is very difficult to reverse. A chemical change occurs when a substance changes color, or when a substance gives off bubbles or gas. When we put wood on a campfire, it burns and changes to ashes, gas, soot, and smoke. This is non-reversible as we cannot change the ashes back to wood.

Look at these examples. Tell whether the change is **physical** or **chemical.**

| **Change** | Is it **physical** or **chemical**? Why? |
|---|---|
|  | |
|  | |
|  | |
|  | |
|  | |

OTM-2150 ISBN: 9781770788626

Worksheet 2

Name: _____

# Reversible or Non-Reversible?

Now you will do some investigating into the types of change. Conduct the following four experiments and decide which changes are reversible and which are non-reversible. Let's get started!

## EXPERIMENT #1

### Materials needed:

- a beaker of water
- 2 or 3 antacid tablets

### What to Do:

1. Drop the antacid tablets into the beaker of water.
2. Record your observations by drawing what happened.
3. Make conclusions about what you observed.

| I Observed... | I Conclude that... |
|---|---|
| | ***(check the boxes that apply)***<br>The change is: ☐ reversible<br>☐ non-reversible<br>The change is: ☐ physical<br>☐ chemical<br>I know this because _____<br>_____<br>_____<br>_____<br>_____ |

Worksheet 5

Name: _____

## EXPERIMENT #4

### Materials needed:

- lemon juice
- a saucer
- cotton swabs
- blank paper
- lamp

### What to Do:

1. Pour some lemon juice into the saucer.
2. Dip a cotton swab into the lemon juice. Use the cotton swab to write a message on the blank paper. Let the lemon juice dry.
3. Hold the paper close to the light. Be sure the paper does not touch the light.
4. Record your observations by drawing what happened.
5. Make conclusions about what you observed.

| I Observed... | I Conclude that... |
|---|---|
| | ***(check the boxes that apply)***<br>The change is: ☐ reversible<br>☐ non-reversible<br>The change is: ☐ physical<br>☐ chemical<br>I know this because _____<br>_____<br>_____<br>_____<br>_____ |