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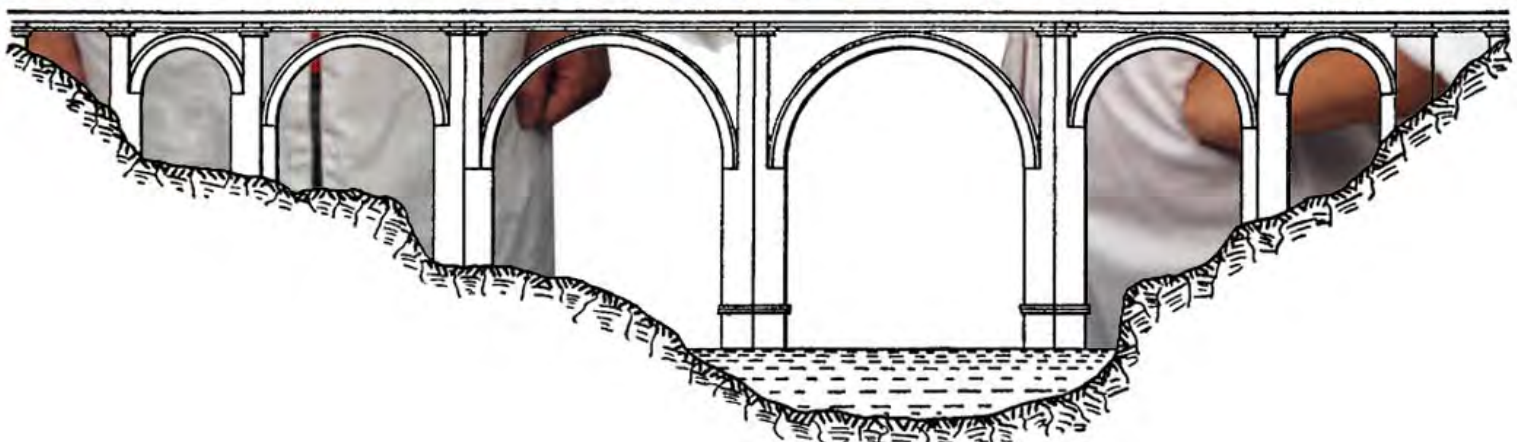
Teacher's Guide

Plankton and Tube's

AMAZING SCIENCE ADVENTURES

PART 2: STRUCTURES - MAN-MADE AND FOUND IN NATURE



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Produced by
Mythic Productions

Video Synopsis:

Structures are all around us. Take a look. Structures include bridges, buildings, chairs, shoes, spiderwebs, beehives, anthills, tables and even your own body. Structures are made by man and also found in nature. All structures have a definite size, shape, and are capable of holding a load. It's shape, size and the materials it is made of depends on the structure's function. They also determine how strong it is. Forces like compression and tension are always acting on structures. As a result, structures must be strong and stable. Builders, designers and engineers have to ensure that they are safe to live and work in.

This program looks at various made-made and nutural structures found all over the world. Through the use of fun experiments and short skits in their science lab, our two engaging hosts, Professor Peter Plankton and Professor Tess Tube help young students explorethe science of structures. They learn that both humans and animals build specific structures with specific functions and that structures have many forms. Students are introduced to the complex, yet intriguing honeycomb structure that bees build. We look at modern day strucutres as well as those used by the First Nations people and other cultures around the world. In addition, students are introduced to the concept of reducing , reusing and recycling, and how structures impact the surrounding environment.

Curriculum Connection:

Recommended for the elementary Physical Science curriculum. See provincial and territorial correlations on page 5.

Program Objectives:

Students will understand that:

- Structures are all around us.
- Structures are both man-made and found in nature.
- A structure has both form and function.
- Structures need to be strong and stable to be useful.
- Structures and the materials they are made from have an impact on the surrounding environment.
- Various materials (e.g., paper and wood) and construction techniques (e.g., folding, adding layers, twisting/braiding, changing shapes) can be used to add strength to structures.
- Forces such as compression and tension are constantly acting on a structure.

Safety Notes

Emphasize the safety precautions you are taking before performing any of the experiments or demonstrations found in this teacher's guide or accompanying video and insist that students only attempt this demonstration under the strict supervision of an adult.

Before beginning any activity:

- Know what is expected
- Prepare a clear work environment
- Wait for permission to start

Safety Tips for you and your students:

1. Read the instructions twice before beginning the activity.
2. Explain the directions in your own words to your partner or team.
3. Get only the materials that are listed.
4. Wear safety goggles (protect eyes, face, hands and body)
5. Follow the instructions one step at a time.
6. If you make a mistake stop and ask for help.
7. Clean your area thoroughly.
8. Tie back all loose and long hair.
9. Don't wear jewelery while conducting eperiments.
10. Keep equipment safe and clean.

Curriculum Correlations:

YUKON - Grade 3: Materials and Structures

NORTHWEST TERRITORIES - Grade 3: Building with a Variety of Materials; Testing Materials and Design

NUNAVUT - Grade 3: Building with a Variety of Materials; Testing Materials and Design

BRITISH COLUMBIA - Grade 3: Materials and Structures

ALBERTA - Grade 3: Building with a Variety of Materials; Testing Materials and Design

SASKATCHEWAN - Grade 3: Structures and Materials

MANITOBA - Grade 3: Materials and Structures

ONTARIO - Grade 3: Strong and Stable Structures

QUEBEC - Cycle 2 & 3: Material Techniques

PRINCE EDWARD ISLAND - Grade 3: Materials and Structures

NOVA SCOTIA - Grade 3: Materials and Structures

NEW BRUSWICK - Grade 3: Materials and Structures

NEWFOUNDLAND - Grade 3: Materials and Structures

Using the Video
STRUCTURES: MAN-MADE AND NATURAL

Preparation:
Preview the video "Structures: Man-Made and Natural", then read the activities in this guide to determine how to use the program and select the activities that will be most effective for your students. Note that the program is fully chaptered so that you can easily replay any segment.

Introductory Activities:
- Ask students to make a list of structure they can see in the classroom
- Ask them to recall structures that are on the school property and nearby neighbourhood, and add them to their list.
- Now direct them to put a check mark beside any structures on their list that are natural, rather than being created by people. Together as a group, try to think of other natural structures you might find in your community (wasp, bird and squirrels' nests; beaver dams; spider webs; beehives; a den or burrow;)
- What materials were used for these natural structures?
- What is the function of the natural structures?
- What structures do we create that have the same functions for us?

Vocabulary Development
- Display or hand out the words from the Vocabulary list on page 7.
- Ask students to work in groups of 3 or 4 to find words that they are able to define.
- As a whole class, listen to two definitions that each group has developed.
- Mark words on the list that no one was able to define.

During Viewing:
- Tell students that the video they are about to watch will provide more information about structures, and will show some experiments related to the strength and stability of structures.
- Ask students to watch especially for the words marked that they could not define.

Immediately After Viewing:
- Discuss the undefined words marked on the list to see if students now understand the meanings.
- Replay relevant chapters of the video to help review these newly acquired meanings.

Extended Learning Activities
- Assign activities from this guide to assist students to develop a greater understanding of the concepts presented in this video.

VOCABULARY LIST

Arch - a curved structure used to span a space while supporting a load

Beam (Bridge) - a long straight structure spanning a gap such as a river or cahsm.

Cantilever (Bridge) - beam or girder fixed at only one end

Compression - a force that squeezes materials together, making an object shorter or smaller, or more dense.

Force - a push or a pull that can cause movement, or change the speed or direction of motion of an object.

Form - the shape of an object or structure.

Function - the purpose for whcih an object or structure exists.

Gravity - a force which tries to pull two objects toward each other; the pull (attraction) of the earth onthings at or near its surface which causes unsecured objects to fall.

Load - the weight placed on structures or objects.

Material - substances used to create or manufacture objects or structures (eg., rubber, steel, wood, etc.)

Purpose - the function of an object or structure.

Span - to stretch from side to side, or end to end

Stability - the ability of a structure to keep its balance and stay in place.

Strength - the ability of a structure to resist a force. (eg., wind, load or gravity)

Structure - somehting built using various parts assembled in a particular way and designed for a specific purpose.

Suspension (Bridge) - a roadway hung across river suspended from wire or chain cables anchored to towers and without support from below

Tension - a force that stretches a material apart. When a material is in tension, it tends to become longer or tighter

Truss (Bridge) - a network of beams arranged in triangles to support a roadway or railway

Activity #1: Natural and Man-Made Structures - Worksheet #1

Structures are very useful. They not only provide us with shelter, but they do many other things as well. Structures are actually much more common than we think. When most people think about structures, the first thing they think about is a building, normally a tall office building. Well, structures are all around us, not just the buildings, but the chairs and tables, the flagpole, the cars. Structures are everywhere. In addition, structures are not just things that have been made by people. Nature provides us with many structures as well. Trees are structures, even a beehive is a structure.

Look at the structures below.
Label each of the structures either MAN-MADE or NATURAL.

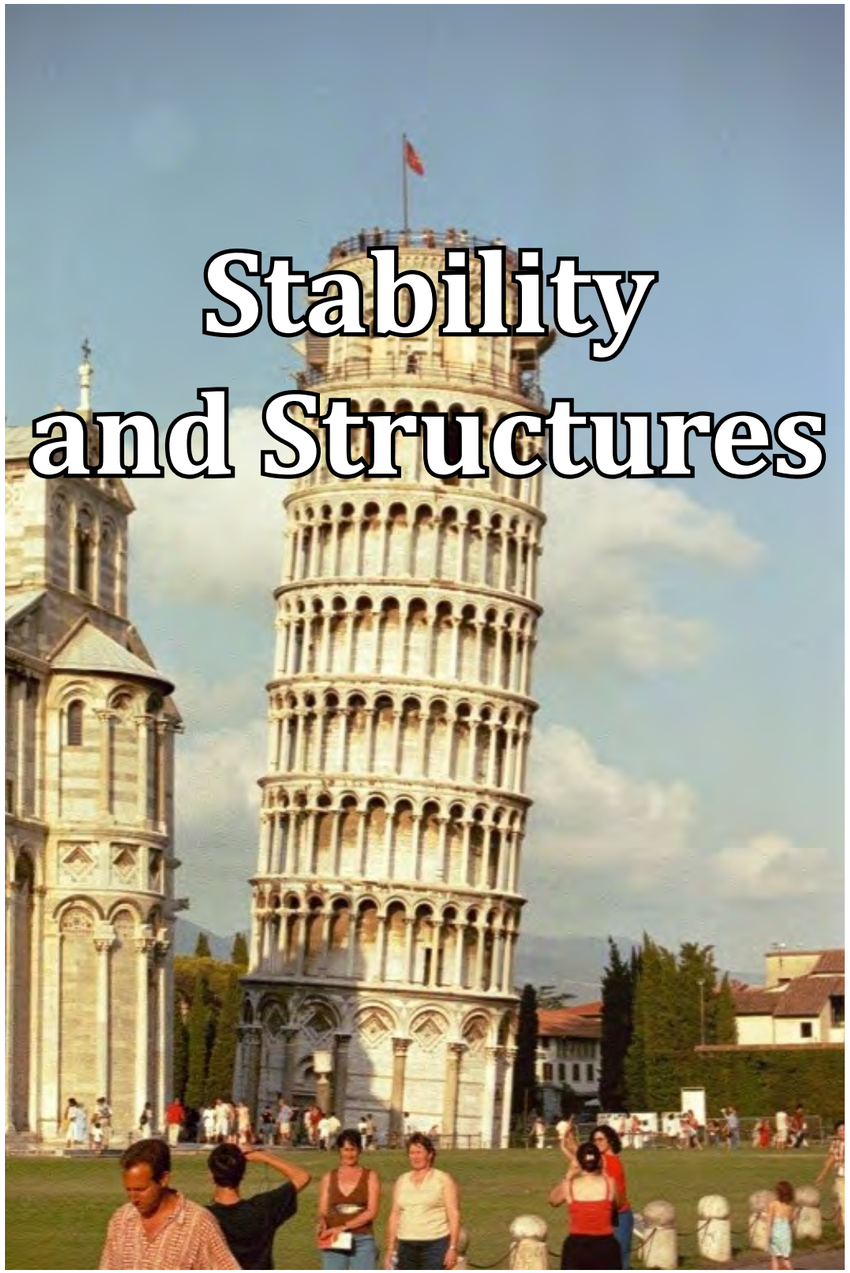
_____ _____ _____ _____

_____ _____ _____ _____

Activity #2: Natural and Man-Made Structures - Worksheet #2

Make a list of other man-made and natural structures. Take a look around your classroom or outside in the school yard. Think about trips you have been on or hikes through nature. What other types of structures can you name? List at least 5 in each category.

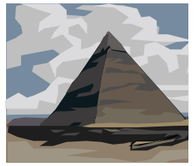
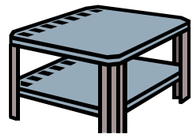
Man-made	Natural



Activity #2: Stablility and Structures

Both people and animals build structures, and both people and animals need their structures to be strong and stable and to last a long time.

Look at the pictures below. For each one, list what makes it strong and what makes it stable.

Object	What makes it strong? (won't break)	What makes it stable? (won't fall)
		
		
		
		
		
		

Activity #3: Stability and Structures
Do different shaped structures have the same stability?

Overview:
Students will explore the question: "Do different shaped structures have the same stability?" Students will be asked to make various shapes and poses with their own bodies to explore the question. Students will investigate what the main characteristics are for a stable structure. The definition of stability will be illustrated through this interactive and engaging lesson.

Materials: See Master sheet of Yoga Poses on page 13.

Instructions :
Explore the definition of stability.

Ask question: "Do different shaped structures have the same stability?" Explain to students that they will pretend to be structures as they act out various poses shown on page 13. The purpose of this activity will be to explore different structural shapes while defining what characteristics will make a stable structure. Have student volunteers make the various poses as demonstated on page 13. Teacher will apply light force on student while student is in the pose. If student moves or loses balance, then the "structure" is deemed unstable. If student does not move, it can be considered stable.

Students will complete Stability & Structures worksheet on page 12. This will be completed as each student volunteer carries out the pose. After the last pose, students will then work in small groups to determine which pose was the most stable, and which was the least stable. They will do this by ranking the poses (1 being the most stable and 12 being the least stable).

Wrap-Up Together as a class, students will share and discuss what the characteristics are of a stable or unstable structure.

Follow-Up Student's can think of other poses that are stable. With this knowledge, they can now investigate real-life architecture when exploring the term, "stability".

Assessment: This activity can be administered near the beginning of the structures unit when helping students form a stronger sense of the term, stability. The activity will be assessed on whether or not the students recognized the characteristics of a stable structure. Key themes that they should be focusing on are: a wide base, a low centre of gravity, tapered structure (top skinny and bottom wide), and having a heavier base.

"http://innovations.oise.utoronto.ca/science/index.php/Stable_Structure_Silhouettes"

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Stability and Structures Worksheet

Name: _____ Date: _____

Do different shaped structures have the same stability? Circle your answer:

YES NO

Which pose was the most stable? Circle your answer in red. Which pose was the most unstable. Circle your answer in blue.

Explain what made a pose the most stable.

_____

_____

_____

Explain what made a pose unstable.

_____

_____

_____

_____

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Stability and Structures Poses - Handout and Ranking Sheet

Students can use this sheet to rank the poses as the most stable (1) to the least stable (12).

Activity #4: Stability and Structures Experiment

Students will work in groups of 3.

Materials:

- One long cardboard tube (from a paper towel roll or rolls of food wrap) for each group.
- A collection of materials that students may use, placed on a "materials table":
    - Tissue paper
    - Rubber bands
    - String
    - Lengths of wire
    - Cardboard
    - Tape
    - Dried beans
    - Plastic straws
    - Paper
    - Yarn
    - Paperplates
    - Paper clips, etc.
    - A fan

The task:

Using some of the things on the materials table, make your tall tube stable enough to remain standing against the force of wind (use a fan), or tremors (shake your table or desk slightly). Test it and make improvements if necessary.

Describe the steps you took to make your tube more stable:

1. _____

_____

_____

2. _____

_____

_____

3. _____

_____

_____

Activity #4: Stability and Structures Review

Replay the tower experiment in Chapter 6 from the “Structures” Video.

Find pictures of the tallest structures structures (towers or skyscrapers) from around the world and sketch or copy pictures into the chart below.

Name and picture of the structure	Country where it is located	Year it was completed	What makes it stable?

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Strength and Structures

Teacher Information:

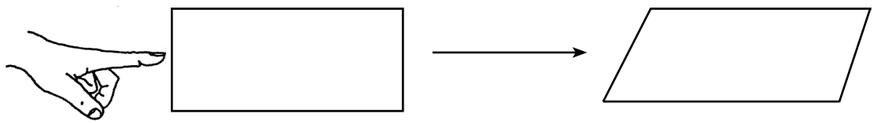
Strong structures must be able to resist forces without breaking or changing. Strength is the capacity to withstand forces that tend to break an object or change its shape. The shape of a structure affects how strong it is. Rectangles, arches, and triangles are the most comon shapes used to build big structures.

Students will examine the shapes of various structures and test the materials for those structures. The study of materials and structures begins with the examination of shape, components, and function of natural and human-built structures. The students investigate and experience the design process as they select and use materials suitable to the task at hand, manipulate and test materials, and build structures. The students will discover that the strength and other characteristics of structures they build are linked to the properties of the materials they use, and to the particular way the materials are configured and joined.

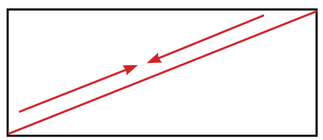
Begin by explaining to students the various shapes used and their strengths or weaknesses.

Rectangle:

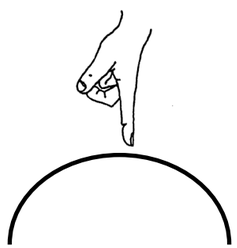
The rectangle is a wobbly, unstable shape. When you push the side, it flops into a slanted parallelogram.



To increase the strength of the rectangle, a diagonal brace is often added. Now when you push the side, the diagonal brace gets squeezed, preventing the rectangle from flopping over.



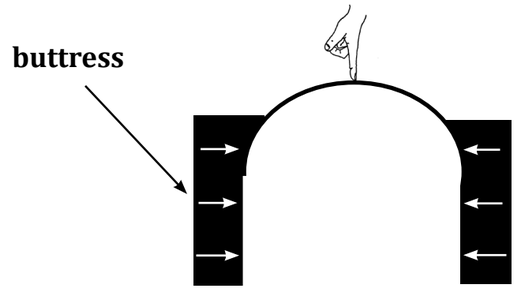
Arch:



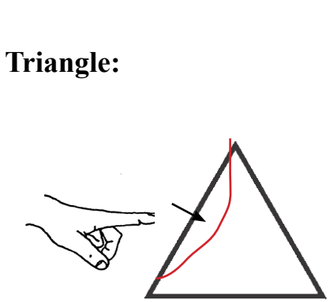
What happens if you push down on an arch not supported on both sides?

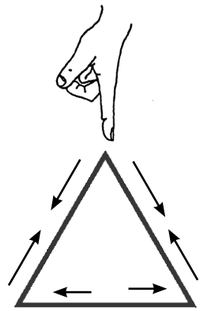
The force of the finger pushes the sides of the arch outwards.

By adding buttresses, one strengthens the arch shape. As the arch tries to expand outward, these external supports called buttresses, push back on the sides of the arch and prevent it from spreading aprt.



Triangle:

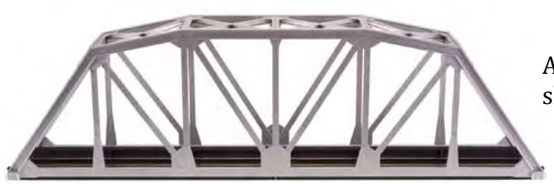




What happens when you push on the side of a triangle?

The outer edge squeezes together, and the inner edge pulls apart. When one side experiences these two forces at the same time, it bends. The weakest part of the triangle is the side.

However, when you push on the top of the triangle, the two sides squeeze together and the bottom sides pull apart. The triangle doesn't bend because each side experiences only one force at a time. When used properly, triangles are the most stable and rigid shapes used in contruction today.



A truss bridge uses the triangle shape to make it strong and stable.

Experiment #1: Straw Shapes

Which shape is more stable, a triangle or a square?

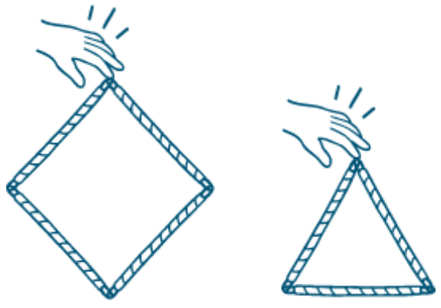
One of the first challenges man faced in the use of structures was how to span a gap. People solved this by simply placing a piece of wood or large stone over an area they needed to get over - for example, a stream.

Today, wide spans are often handled with either an I-beam or truss. A truss is a support structure made up of a series of triangles that give it great strength with relatively little weight. By using triangles, amazingly large, strong structures can be made.

A variety of structures are made from triangles - bridges, roof trusses, tripods.

Materials usually thought of as being weak or flimsy (like drinking straws) if joined in connecting triangles can be used to form surprisingly large, stiff structures. The roofs in many modern, box-like stores are spanned by long steel trusses incorporating triangles.

Using what they have just learned in the video “Structures: ...” and from the previus lesson on pages , students will test the stability of a triangle and a square by standing them on a table and pressing on them. The one that changes shape less is more stable.



Materials: 7 drinking straws; 14 paper clips

Make a Prediction:

Predict which shape will be stronger. Why do you think so? _____

_____

_____

_____

_____

_____

_____

Procedure:

1. With your partner, build a triangle and a square from the straws and paper clips. To connect two straws, slip the wide end of a paper clip into the end of one straw. Hook a second paper clip to the first. Now insert the wide end of the second clip into a second straw.

2. Compare the stability of the shapes. Stand each shape up and press down on the top corner.

What happens? _____

_____

How much does each one bend and twist? _____

_____

How hard can you press down on each shape before it collapses? _____

_____

Observations: Compare the results of your tests on the triangle and square.

Which shape was more stable? _____

What do you think made it more stable? _____

_____

How might this shape be used in large structures? _____

_____

Extension Activity:
Can you reinforce the less stable shape by adding no more than 2 straws and 4 paper clips?
Now that you know more about shapes, build the most stable structure you can using no more than 20 straws and 40 paper clips. How much weight can your structure support?

_____

_____

_____

_____

Shape, Stability and Building Materials: Newspaper Tower Experiment

You can also add strength to a structure simply by folding, twisitng/braiding and layering materials. That's right - by changing the shape of a material, you can make it stronger.

Materials: Newspapers, rulers

Procedure: Have students work in partners. Each team is given 2 sheets of newspaper. Using only these 2 sheets, students are to build the tallest tower they can. They can't use tape, staples, glue, or other materials to make the tower. They can, however, bend, fold, or tear the newspaper. Use the ruler to measure the height of each tower. Remind students that each tower must stand for at least 30 seconds without falling over.

Teacher Text: The key to building a tower out of newspaper is to figure out how to make a weak and flimsy material strong. Newspaper is weak under compression (a pressing force that squeezes a material together). In other words, if you push the ends together, it collapses. Newspaper is somewhat stronger under tension (a stretching force that pulls on a material). That means you'll find it is harder to pull it apart. One way to increase the strength of newspaper is by changing its shape, like rolling it into a tube, crumpling it, or pleating it with folds.

To make sure your tower will stand up, you also need to consider the different forces acting on it. The tower's weight (caused by the pull of gravity from the Earth) is pulling the tower down. The surface on which the tower is resting is pushing back up. Small air movements are also adding forces from the side. Building a wide base at the bottom will distribute the weight over a wider area and make the tower more stable if it is pushed sideways by the air.

Changing the shape of the newspaper can increase its stiffness and strength. You can do this by pleating, crumpling, or rolling it.

The type of paper you use can affect the strength and stability of the tower. You'll find that stiff paper (like cardboard) makes a taller, more stable tower than flimsy paper (like tissue paper).

Tape can be used to stiffen the newspaper, particularly at the base, or to hold stable shapes, such as triangles or columns, together.

By building a wide base, either with paper or books, you can make the tower more stable.

Extension Activity: How can the kids use new materials to make their towers even taller? What happens if they add 20 cm of tape? What happens if they use books as a foundation to support the bottom of the structure? Or, what happens if they use a different type of paper, like tissue paper, copier paper, or cardboard? Make sure they change one variable at a time. Ask them to make a prediction of what they think will happen before they test it.

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Shape, Stability and Building Materials: Newspaper Tower - Student Worksheet

What different approaches did you and your partner use to solve the problem?

_____

_____

_____

_____

What is similar among the taller structures?

_____

_____

_____

_____

What limited the height of your tower?

_____

_____

_____

_____

If you could use one other material to make your tower taller, what would it be and why?

_____

_____

_____

_____

_____

Be sure to reduce, reuse and recycle. The newspaper used to design and build your tower can be recycled.

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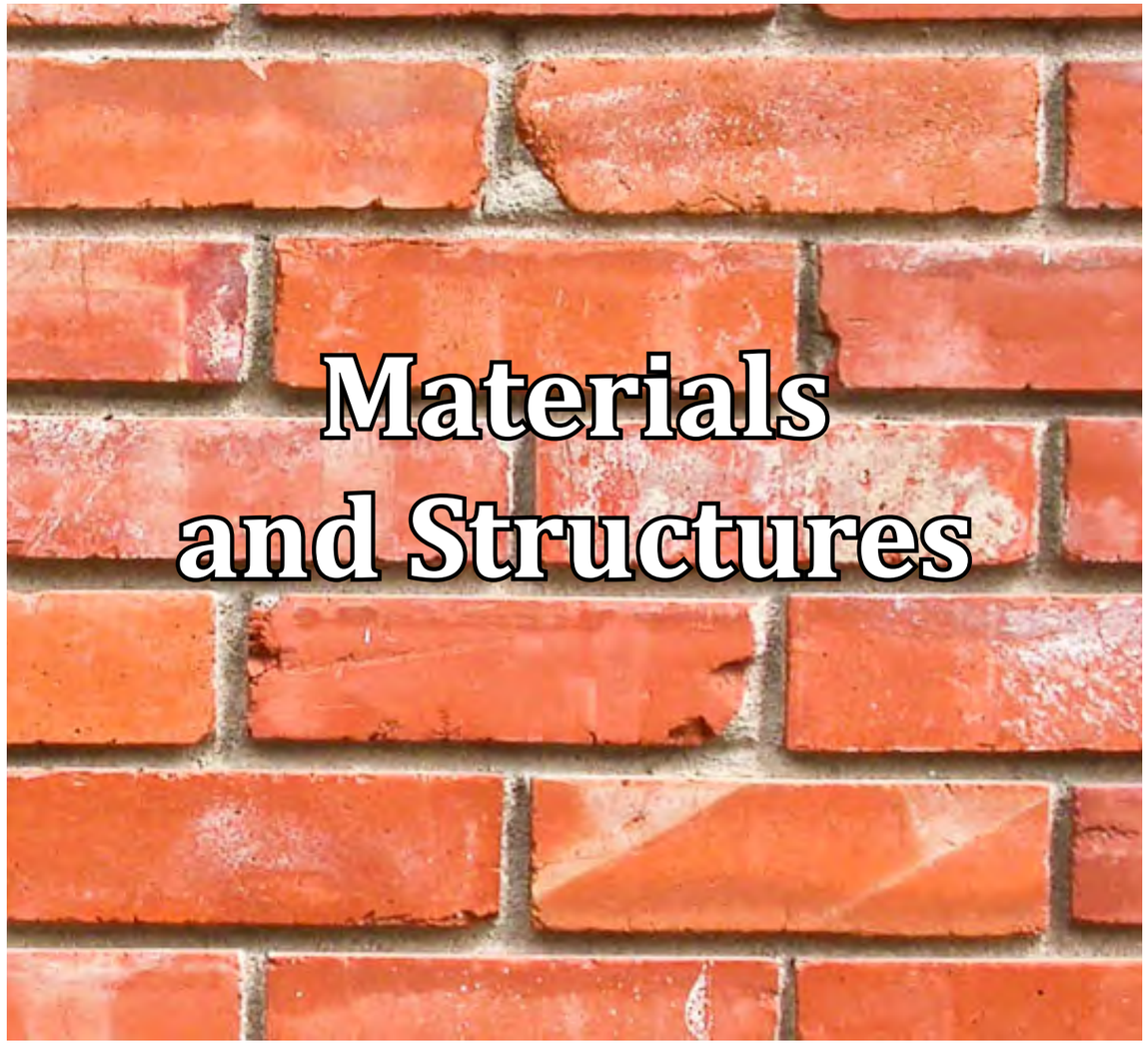

Activity #5: Materials & Structures

In groups of 4, take turns reading the information below.

There are many different materials in the world, and a lot of them can be used to build structures. However, not every material is appropriate for every job. Think of a building in your community. What is it made of? As with all buildings, before construction can start, the designer has to decide which are the best materials to use.

In all buildings many different materials are used. Different properties make materials suitable for different uses. A beautiful cottage can be made out of logs, but a sports stadium made from logs would not be as successful. High jump crash mats are made from foam and plastic. The high-jumper would not be as willing to compete if it were made from cement and steel.

Materials are chosen for each individual job based on their properties. When choosing a material, one must consider:

- Do I need something that is heavy or light?
- Should it be flexible or stiff?
- Does it need to last a long time, or will it have a short life?
- How will it fit in its environment?
- Should it be waterproof?

Take a look at building materials. Ask students what makes the following materials good for building or constructing structures.

Concrete, clay, steel, wood, glass, plastic, metals.

Concrete is very hard and resists squashing extremely well. but it is brittle and tends to crack when bent. Sometimes it is reinforced by steel bars or meshes. These strengthen the concrete and help to stop it bending and breaking.

Bricks are made of **clay,** shale or various other materials. Clay is cheap and plentiful and can be formed in to a variety of shapes and sizes. Bricks are strong, hard and resistant to fire and weather damage.

Steel is one of the world's cheapest and most useful metals. It is hard and durable. Steel is a strong metal yet it is fairly light in weight.

Wood comes from trees and is a natural materials. It is divided into two main classes: softwood and hardwood. Most hardwoods come from deciduous trees - loses its leaves. Most softwoods come from evergreen trees - doesn't lose its leaves. Wood has many useful properties. It can be shaped easily, is strong but pliable.
Wood can be changed to make it more useful. Different kinds of wood are used for home building with strong and durable timber used for construction.

Plastics are man-made materials that can be shaped in to almost any form. Plastic is light weight. Plastic can be coloured, opaque or transparent. It is strong, is a good insulator and is waterproof

Glass is made from heating sand. It has many useful properties. Glass is transparent. Glass is strong but is can shatter. Glass can be moulded or blown or coloured.

Metals are strong and tough. They are easy to shape and are shiny.

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Materials and Structures: Worksheet #1

Explain why the object listed is made out of the material indicated. What properties make it a suitable material for the object or structure?

Object	Material	Reason
Car Tire	Rubber	
Desk	Steel or Wood	
Window	Glass	
House	Bricks	
Sweater	Wool	
Support Beams	Metal	
Hockey Stick	Wood or carbon fibre	

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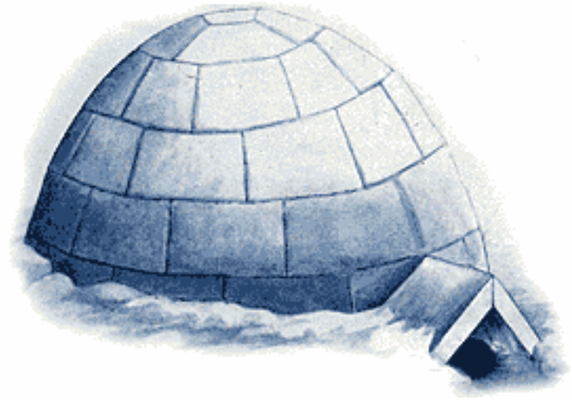
Materials and Structures: Worksheet #2

In Canada, we have a unique climate. We enjoy four distinct seasons - spring, summer, fall and winter. We have warm summers and cold, snowy winters. We have rain, snow, sleet, heat, winds, stomtimes tornadoes and flooding. When the temperature does drop, Canadians stay warm thanks to an infrastructure of heated houses, cars and public transportation systems. Some cities have also installed walkways to and from buildings in schools.

People living in northern Canada sometimes build temporary structures with snow. These are known as igloos. They use these when they are hunting. In the cold north, snow is abundant and actually acts as an insualtor against the cold and wind. Although snow blocks are a fragile building material, the dome shape gives the structure its strength.

Have students think of other types of structures used as shelter by people around the world. What types of materials are they made from?

- Sod/Grass or Thatch houses
- Tipis/teepees
- Adobe houses
- Bamboo houses
- Brush structures



Assign one of the above structures to each of five groups.

The type of structure we researched is a _____.

It is a structure used for shelter by people who live in _____.

It is made using _____.

The advantage of using this material is _____

_____.

Make a drawing or model of this type of shelter structure.

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Reducing, Reusing, Recycling:

Teacher's Notes:

Planet Earth is an amazing place that is home to billions of people, animals and plants. Natural resources like water, sun, trees, oil and minerals come from nature and are used or made into the things we want and need to survive. While some natural resources like the sun and the wind can be used with little effect or damage to the environment, extracting other natural resources, like trees and oil can have negative impacts on the earth. Animal habitats can be destroyed or severely changed when we clear forest areas for oil drilling or logging. Rivers, streams and watersheds can become polluted, and our air becomes dirty from using certain natural resources like oil. While it is impossible not to use natural resources for life on Earth as we know it, it is possible to be smart about the resources we do use in order to make less of a negative impact on the environment.

Waste, and how we choose to handle it, affects our world's environment -- that's YOUR environment, everything that surrounds you including the air, water, land, plants, and man-made things. And since by now you probably know that you need a healthy environment for your own health and happiness, you can understand why effective waste management is so important to YOU and everyone else. The waste we create has to be carefully controlled to be sure that it does not harm your environment and your health.

What exactly is "waste"?
Simply speaking, waste is anything discarded, rejected, surplused, abandoned, or otherwise released into the environment in a manner (or quantity) that could have an impact on that environment.

How can you help?
You can help by learning about and PRACTICING the three R's of waste management: reduce, reuse, and recycle! Practicing all three of these activities every day is not only important for a healthy environment, but it can also be fun too.

Show the students a "mobius loop". (The recycling symbol with three arrows in a triangle) Ask students what they know about the symbol. (It represents a closed loop for the recycling system. As materials, such as paper, are manufactured, they enter the loop. People use the paper and then, for the loop to continue, the paper must be recycled into a new product and people must choose to buy and use that product.)

1) Ask students to name the 3Rs (Reduce, Reuse and Recycle). How can they help?:

- Buy only what you need and use all of what you buy.
- Avoid buying things that use excessive packaging and buy in bulk.
- Buy durable things that will last a long time
- When things break, see if they can be fixed before throwing them away.
- Wash and reuse plastic cups, utensils and bags.
- Precycle by buying products whose packaging can be recycled
- And always bring your own bag! If you are just buying a few things just carry them in your hands.
- Complete the cycle and buy products made from recycled materials. When you buy products made from post-consumer recycled materials you are helping to reduce carbon emissions and saving resources.

3) Ask students to explain what recycling means. The idea is that in order for something to be truly recycled it must go through a change in state. For example, an aluminum can is melted down before it is formed into a new can.

4) Ask students why recycling is important. There are a variety of reasons.

- It keeps materials out of the landfill. Many materials put in the landfill break down slowly over time and chemicals leach from them into the earth and water. These chemicals can be dangerous to both animals and humans.
- It allows materials to be used again, instead of needing to harvest new materials each time.
- Recycling materials takes less energy and resources than making the items from “virgin” material.
- Everyone knows about recycling, but reducing and reusing are of equal value. These options mean even fewer resources need to be harvested.

5) Have students brainstorm ways that they can reduce and reuse. One way to reduce is to refuse. A person can refuse a plastic shopping bag by bringing their own, thus reducing the number of plastic bags being used. Have students think of other ways to reduce.

Student Project:

Students work in groups of 4. Each group is given a structure to research - eg. a house, a steel shed, a wooden garden shed. They are to research the materials the structure is made of and where these materials have been obtained (eg., wood from cutting down trees). Students will then discuss in their groups where the materials come from, how this affects the environment (forests, water, air) and how these materials are returned to the environment after use (eg. lumber being sent to a landfill). Are there better ways to protect the environment when building a structure?

Some answers to look for are:

- Grass land/farm land is destroyed as structures are built on top of them.
- Trucks are used to transport materials to the building site. These create pollution form exhaust fumes and also cause noise pollution.
- The raw materials (iron, steel, sotne, etc) used to build structures have to be taken from quarries and mines and this can damage the land.
- Factories process raw materials. This process uses a lot of energy and causes air pollution.
- The local environment is changed meaning that native plants and animal habitats may be destroyed.

Students can also look at thepositive effects of structures. For example, the construction of some bridges have a positve impact on the environment. Before some bridges are constructed, trucks and cars have to make longer trips to get from place to place. Building a bridge can make this a much shorter trip, thus saving gas, noise and air pollution.

To answer these questions, students are to present their answers on a bristol board and then present their findings to the class.

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