Pack it Light.
Wear it Right.

Name:_____

CHIROPRACTIC CHIROPRATIQUE
Ontario

Introduction

This is a cross-curricular program designed to explore the design and use of backpacks and the implications on children's back health. This program was a product of a multi-disciplinary research project conducted by the Queen's Ergonomic Research Group and funded by the Ontario Chiropractic Association of Ontario.

Aim

The aim of the "Pack it Light. Wear it Right." educational program is to empower grade 5 Ontario students with an awareness of their back health in relation to the design and use of their backpacks.

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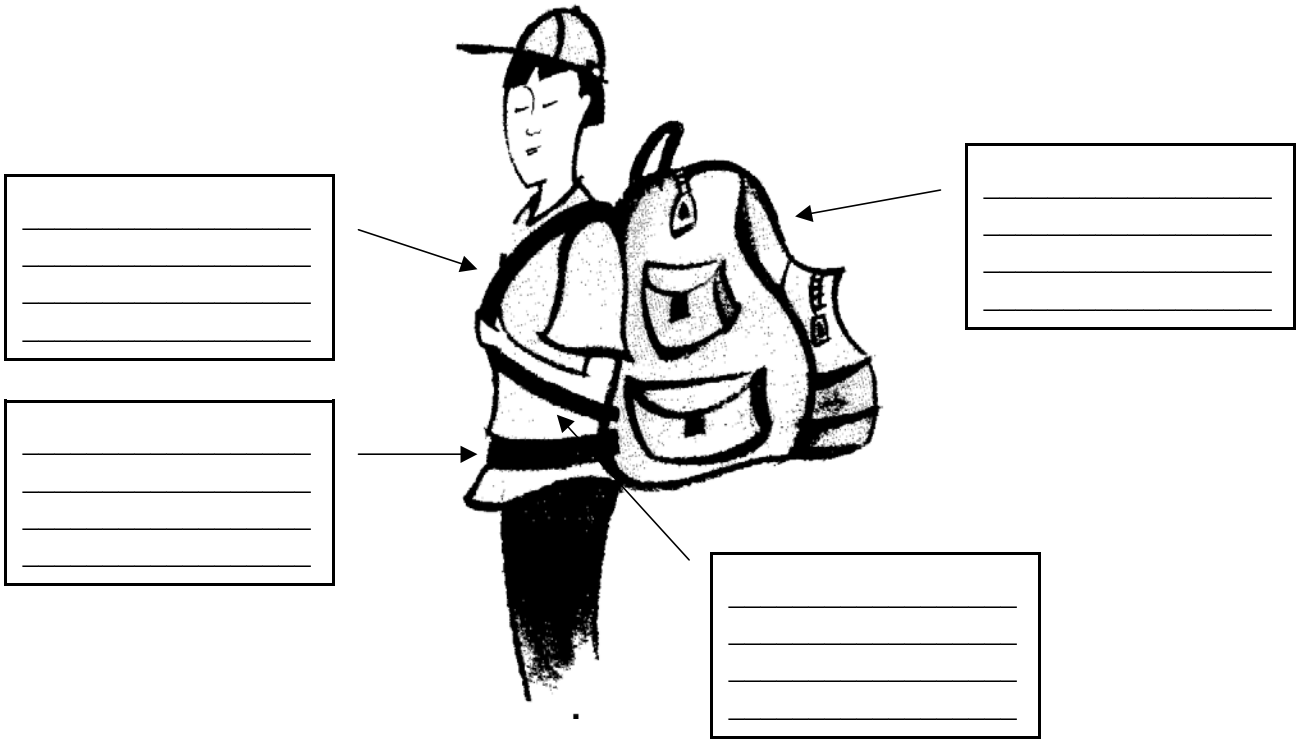
It all started . . .

Forty years ago, people did not use backpacks. Instead, they carried their books by hand. Carrying backpacks to school became more common in the 1970's when students discovered the "day pack," a small backpack that campers used for day long hikes. In the 1990's, backpacks became an everyday accessory in school life. Backpacks are a convenient way to transport belongings because it leaves both arms free to do other things (like open doors).

In North America, early Native Americans strapped their belongings to wooden boards and fastened the boards to their backs. In Europe, up until the 18th century, most women carried their belongings in pouches that were sewn into their under garments. When new fashion trends prevented access to these pouches, purses were developed. Men's clothing typically had pockets to carry around their belongings.

Today, there are a wide variety of backpacks on the market, in different colours and styles. As a class, let's identify, label and describe the different parts of the backpack in the diagram below:



In the box below, draw what your backpack looks like:

Does your backpack have a Chest Strap?
9 Yes 9 No
Do you wear it?
9 Yes 9 No

Does your backpack have a Waist Strap?
9 Yes 9 No
Do you wear it?
9 Yes 9 No

What do you like about your backpack?	What would you like to change about your backpack?
_____ _____ _____ _____	_____ _____ _____ _____

As a class, let's create a graph displaying the various backpack colours found in our classroom. Use the graph paper below:

Title:_____

What is the most common backpack colour in the classroom?

_____

Using information about the backpacks in our classroom, what else can we graph?

_____

_____

_____

Choose one of the graphing ideas above, or another idea and create a graph using the graph paper below:

Title: _____

It Can All Add Up

For homework tonight:
At home, weigh yourself in kilograms and record your weight on the post-it note provided. Please note that this number is personal and you do not need to share it with anyone else.

The next day:
1) Place the post-it note with the weight of the back pack in box A.
2) Place the post-it note with your weight in box B.

A
(weight of back pack)

B
(your weight)

3) Complete the operation of A÷B

_____ ÷ _____ = _____

What kind of number is your result?

_____

4) A percentage is a number that represents the number of parts in every 100, where by 100 represents something complete. So, 14% would be 14 parts of 100. To find a percentage we take the decimal we found in question 3 and multiply it by 100.

_____ × 100 = _____ %

This is your backpack percentage.

Scientific literature recommends that your backpack weigh no more than 10% of your body weight.

How much would 10% of your body weight be?	
Answer the question that describes your situation:	
If you were over 10%, how much weight do you need to take out of your backpack?	If you were under 10%, how much more weight are you allowed to carry?

As a class, let's write down our calculated backpack percentages (this number is ok to share because it does not reflect how much we weigh). We are now going to calculate the mean, median and mode of our class. First, let's define these three mathematical terms:

Term	Definition	How do we calculate it?
Mean		
Median		
Mode		

As a class, let's calculate the mean, median and mode of the classes' backpack percentage and record the results in the chart below:

Mean	Median	Mode

Is the mean larger or small than the recommended 10%?_____

How many students are above 10%? _____

How many students are above the mean? _____

How many students are above the median?_____

How many students are above the mode?_____

In what ways do these numbers describe our classroom backpack habits?

_____

The Anatomy of It

Your back consists of bones and muscles. Together, this group of bones is called the vertebral column (you may have heard it called a spine). Each individual bone is called a vertebra. The vertebral column is divided into five sections; the cervical section has seven vertebrae; the thoracic section has 12 vertebrae; the lumbar section has 5 vertebrae; the sacral section is one bone that plays an important role as the weight bearing arch of the hips; and finally the vertebrae of the coccygeal section are fused and can vary from 1 to 5 vertebra.

Between each vertebra is an intervertebral disc (inter means between). These discs are made of a substance called collagen. Collagen is a type of very dense and fibrous cartilage. The intervertebral discs make it possible for our vertebrae to move.

Let's define cartilage:

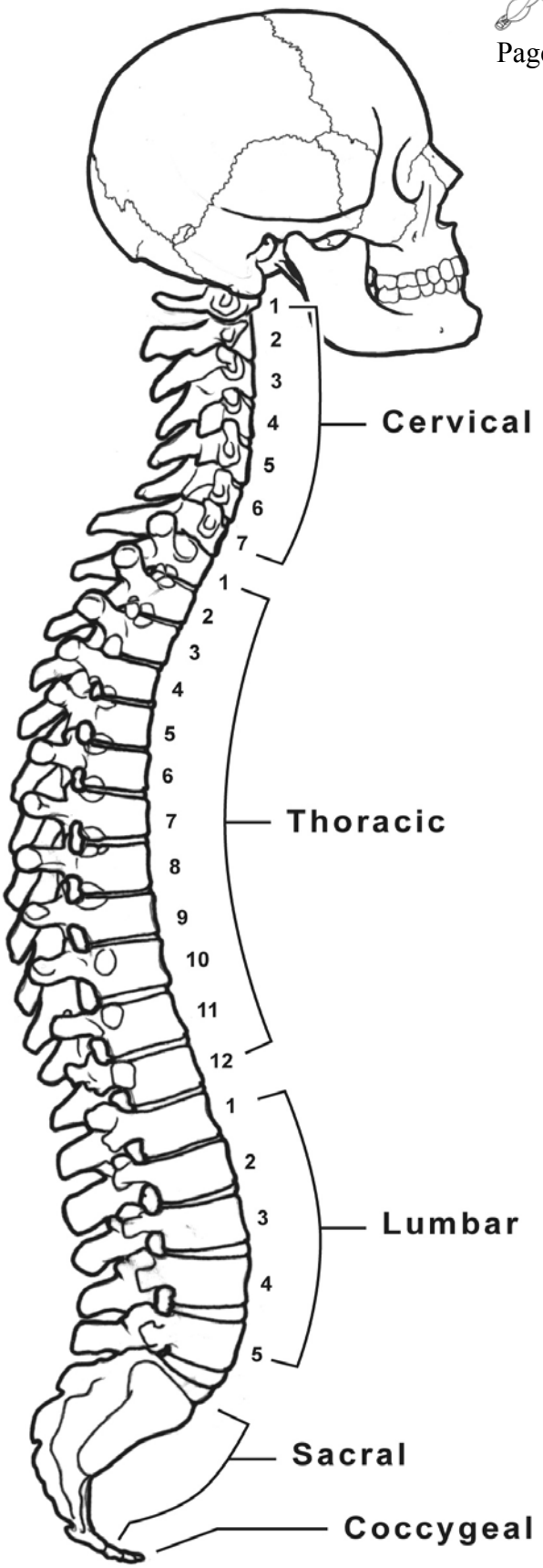
_____

_____

_____

The vertebral column protects our spinal cord. The spinal cord is a thick bundle of nerve cells that connects the brain with the rest of the body.

Colour in the vertebral column to the right, using different colours for each section.



Glen Oomen, 2004

Cartilage

In small groups, let's take a closer look at cartilage. Let's remember that the intervertebral cartilage is much tougher and fibrous than the cartilage we will be looking at today which is called articular cartilage or joint cartilage.

Materials:
1) a chicken wing or a chicken leg
2) newspaper
3) scissors
4) tweezers
5) magnifying glass
6) gloves

Method:
1) Use chicken cooked at 350°F for 45 minutes.
2) Lay the chicken wing or leg on the newspaper.
3) With your fingers, find the spot where two bones join to make a joint.
4) Use the scissors and tweezers to expose the joint and find the cartilage between the two bones.
6) Look closer at the cartilage with the magnifying glass.
7) When you're finished, be sure to wash all your instruments with soap and warm water. Be sure to also wash your desk with a cleaning solution or diluted bleach.

Describe the texture and colour of the cartilage:

_____

_____

Let's make a model vertebral column

Materials
1) thin licorice laces
2) fruit loops
3) miniature marshmallows
4) double pointed toothpick

Method:
1) Tie a knot at one end of your licorice. The knot will be the sacrum and the end will be the coccygeal section.
2) Stick a double pointed toothpick into the other end of your licorice.
3) Alternating between fruit loops and marshmallows, string them onto the licorice lace.
4) Remember how many vertebrae are in each section.

What does the licorice represent?

_____

What do the fruit loops represent?

_____

What do the marshmallows represent?

_____

What happens when you push two fruit loops together?

_____

_____

What health problems might be associated with the vertebrae being compressed (pushed together)?

_____

_____

_____

May the Force be with You

As a class, let's define the term centre of gravity.

_____

_____

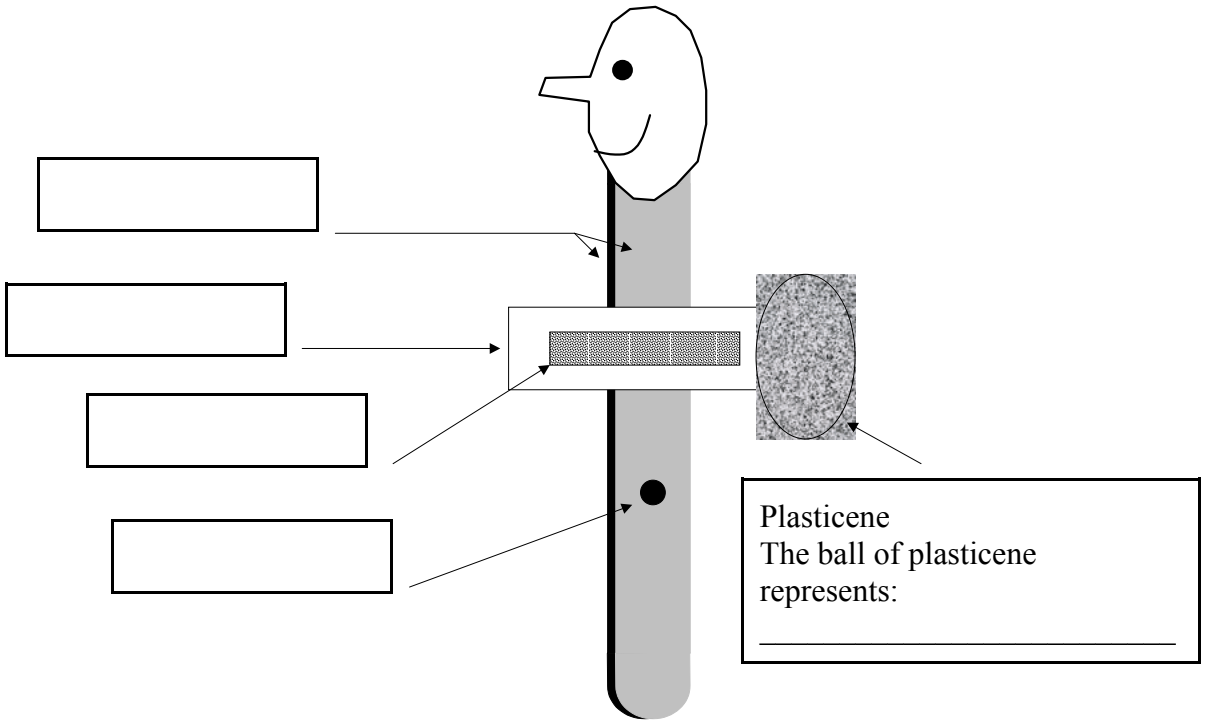
_____

Centre of Gravity

Working co-operatively in a small group, you will make a model representing what happens to your centre of gravity when you put on a backpack.

Materials:
1) three tongue depressors
2) a heavy duty hole punch
3) a paper fastener
4) magnet
5) glue
6) a small level
7) scissors
8) a small graphic showing the profile of a head
9) a ball of plasticene
10) magnetic blackboard

Method:
1) Using the heavy duty hole punch, punch holes in the middle of two tongue depressors.
2) Fasten these two tongue depressors with the paper fastener.
3) Stick the magnet on the back of thefastened tongue depressors.
4) Glue the small level to the third tongue depressor (no hole). Make sure the level is in the middle. Cut off the ends.
4) Wait for it to dry.
5) Glue the tongue depressor (with level on it) to the other two tongue depressors (fastened by a paper fastener) to make a cross.
6) Wait for it to dry.
7) Glue the head graphic just above the level.
8) Stick your model on the magnetic blackboard so that it is balanced.
9) Label the diagram on the next page depicting the model you just made.



NOW, add the ball of plasticene as shown in the diagram above.

Draw what happens:	Where is your centre of gravity? _____ _____ _____ How might your body adjust to this load and the change in your centre of gravity? _____ _____ _____ _____ _____

Our bodies adapt to forces when they are applied to our bodies. As a class, let's look at the unloaded posture of one of our classmates and draw a picture in the chart below:

Draw a picture of your classmate's unloaded posture:

Now, let's place an overloaded backpack on our classmate and see how their posture has changed. Draw their posture in the chart below:

Draw a picture of your classmate's posture with a load . . .	Describe how it has changed?
	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____

As a class, let's define the following three terms:

Mass

_____
_____
_____

Force

_____
_____
_____

Weight

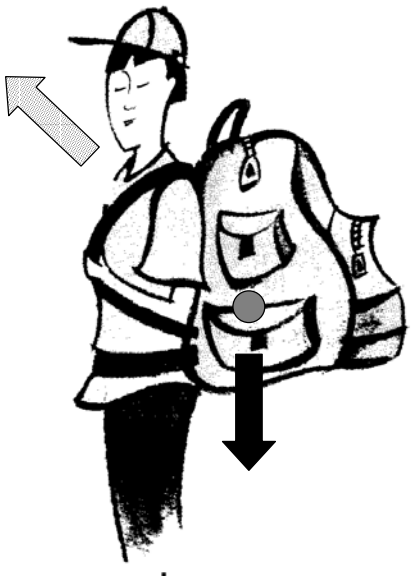
_____
_____
_____

Even though your backpack is carrying a certain weight (similar to when you weighed your backpack on a scale) your body feels like it is carrying more.

The grey dot in the middle of the backpack is the backpack's centre of gravity. The black vertical arrow, directly under the backpack's centre of gravity, represents the *external* force.

The grey arrow is called a *reaction* force. Reaction forces are the forces produced by your body, in reaction to the external force of the backpack.

Label both the external force and the reaction force in the diagram below:



Packing it Light and Wearing it Right

As a class, let's watch the video "Pack it Light. Wear it Right." (© Ontario Chiropractic Association, 2002). After watching the video, answer the following questions:

1) How should you pack your backpack?

_____
_____
_____

2) What are some strategies you could do to decrease your backpack load?

_____
_____
_____

3) What is the proper way to pick up and put on your backpack?

_____
_____
_____

4) What is the proper way to wear a backpack?

_____
_____
_____

5) What should you look for when you purchase a backpack?

_____
_____
_____

6) What should you do in the store to make sure the backpack is right for you?

_____
_____
_____

Sharing our Knowledge

In a small group, you will write a short commercial about some of the back health principles we have learned in this unit. You will be presenting this commercial to the primary division (grades 1, 2 and 3).

Before you begin your presentation planning process, as a class, let's talk about our audience and what we know about them.

Some things I KNOW about my audience:	What I NEED to KNOW about my audience:
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Presentation Plan:

TOPIC:		
Audience background information: _____ _____ _____ _____ _____ _____		
Describe the beginning . . .	Describe the middle . . .	Describe the end . . .
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____
Group Members: 1) _____ 2) _____ 3) _____ 4) _____ 5) _____	What materials will you need for your presentation? _____ _____ _____ _____ _____	

Once you have finished your presentation plan, you can use the following pages to prepare your presentation in more detail.

The Beginning . . .	
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Picture:

The Middle . . .	
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Picture:

The End . . .	
_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____	Picture:

Your presentation will be marked using the following rubric:

Date:	Level ONE	Level TWO	Level THREE	Level FOUR
Understanding of concepts	- students failed to communicate key concepts - the concepts communicated were incorrect or lacking in detail	- students communicated the knowledge in a factual manner - some of the concepts communicated were lacking in detail	- students connected content to daily life - the concepts communicated were accurate and detailed	- students communicated the knowledge using a creative story that reflected daily life - the concepts communicated were accurate and students provided additional information from independent research or extensions
Communication of concepts	- the students did not consider the audience of the presentation - voices were unclear and inaudible	- students utilized some presentation strategies that were not well suited for the audience - voices were at times unclear or inaudible	- students directed the presentation content to the audience using appropriate vocabulary and situations - voices were clear and audible	- students engaged the audience by using audience appropriate props, situations and vocabulary - voices were clear and audible
Group Members:				

Have We Changed

Today:
1) Place the post-it note with the weight of your backpack in box A.
2) Place the post-it note with your weight in box B from the activity "It Can All Add Up."

A
(weight of back pack)

B
(your weight)

3) Complete the operation of A ÷ B

_____ ÷ _____ = _____

4) Now, to find the percentage, multiply the above answer by 100

_____ × 100 = _____%

Let's write down our backpack percentages. As a class, let's calculate the mean, median and mode of the class.

Mean	Median	Mode

How did the Mean change? _____

What does this tell us?

_____
_____
_____

How did the Median change? _____

What does this tell us?

_____
_____
_____

How did the Mode change? _____

What does this tell us?

_____
_____
_____

Summarize what you have learned during this unit:

_____
_____
_____
_____
_____
_____
_____
_____
_____

Homework

Share your "Pack it Light. Wear it Right." booklet with at least one family member at home. Tell them all you have learned about backpack use and safety. Have the person, that you shared your booklet with, fill out the form below, detach it and bring it back to school.

C.....

_____shared their "Pack it Light. Wear it Right." booklet with the following family members:

_____
_____
_____
_____
_____

_____
Parent's Signature

Glossary

Cartilage
Flexible tissue that connects bones in humans and animals. Cartilage is the material that supports your ears and nose. A shark's skeleton is all cartilage.

Centre of Gravity
Is the point in a solid on which the object can be balanced. You must hold a tray of dishes under its centre of gravity or the dishes will crash to the floor.

Chest Strap
Holds the shoulder straps together across the chest.

Force
Energy that changes the motion or shape of an object. You use force when you hit a baseball or squeeze some clay.

Mass
The amount of matter in an object. Mass is also defined as the resistance of an object to make a change in its motion. An object's mass always stays the same, while weight, which is the pull of gravity, can change.

Mean
A number that represents the average of a group of different amounts.

Median
The middle number in a group of sequentially ordered numbers.

Mode
In a group of numbers it is the number that occurs the most.

Shoulder Strap
Are the main straps used to carry the backpack.

Spinal Cord
The thick bundle of nerve cells in the spine that connects the brain to nerve cells in the arms, leg, and trunk of the body.

Vertebra
One of the bones of the spine, or backbone. Its plural is vertebrae.

Waist Strap
Pulls the backpack closer to the body.

Weight
The pull of gravity on an object. Weight is different from the mass, or amount of matter, in the object. Mass stays the same, but weight changes, depending on where the object is being weighted. It is commonly associated with the unit of pounds.