junior tech challenge

The practical side of science and tech

STUDENT HANDBOOK

Intended for:
Intensive ESL Project, Elementary Cycle 3
Science and Technology Program, Elementary Cycle 2 & 3

READY, SET, ROLL!

2024-2025 EDITION

Name :

Team Members:

Prototype Name:

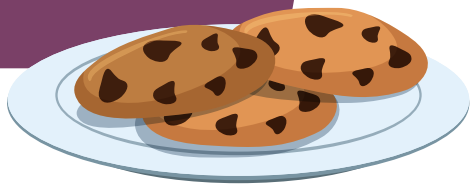
A program of

RÉSEAU TECHNOSCIENCE
Together for a new scientific generation

You and your friend just baked a batch of delicious cookies for your class and your teacher. But alas! You've missed the bus! How will you get these delicious creations to school?

Let's see…you'll need a vehicle to transport the cookies from your home, which is located at the top of a hill, to school. Here's an idea! Build a vehicle that will go down the hill and stop right in front of one of the school's three main entrances.

If you do this quickly enough, you might even arrive at school before the bus. One thing's for sure, whether you get there on time or not, everyone will enjoy your delicious cookies!



THE CHALLENGE

To design a prototype that will go down an inclined plane and stop as close to a target as possible.

YOUR MISSION

Cycle 2

Your prototype must reach a **different** target in each of the two rounds. It's up to you to choose which ones!

Cycle 3

Your prototype must reach Target A in the first round and Target C in the second round.

REQUIRED EQUIPMENT

The **chassis*** of the prototype must be built using…

Cycle 2

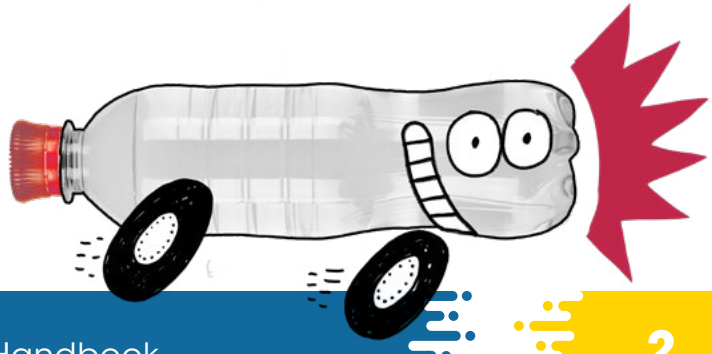
a cardboard container or a plastic bottle.

Cycle 3

a plastic bottle.

The **wheels and axles*** must be made only of common, everyday circular items *(e.g., discs, thread spools, lids, straws, wooden skewers, or dowels)*.

** Chassis : The supporting frame of a vehicle.*
** Axles: Rods to which the wheels are attached.*



GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY

(ACTIVE DISCOVERY PROCESS) IN PRIMARY SCHOOL

Context related to everyday life

Your challenge

The tests you will complete with your prototype.

Initial ideas and hypothesis

- Your ideas to create an efficient prototype
- Your sketch

Planning and carrying out

- Your construction
- Your tests
- Your improvements
- The competition

Outcome

- Your successes
- Your suggestions for improvement

Éclairs de sciences

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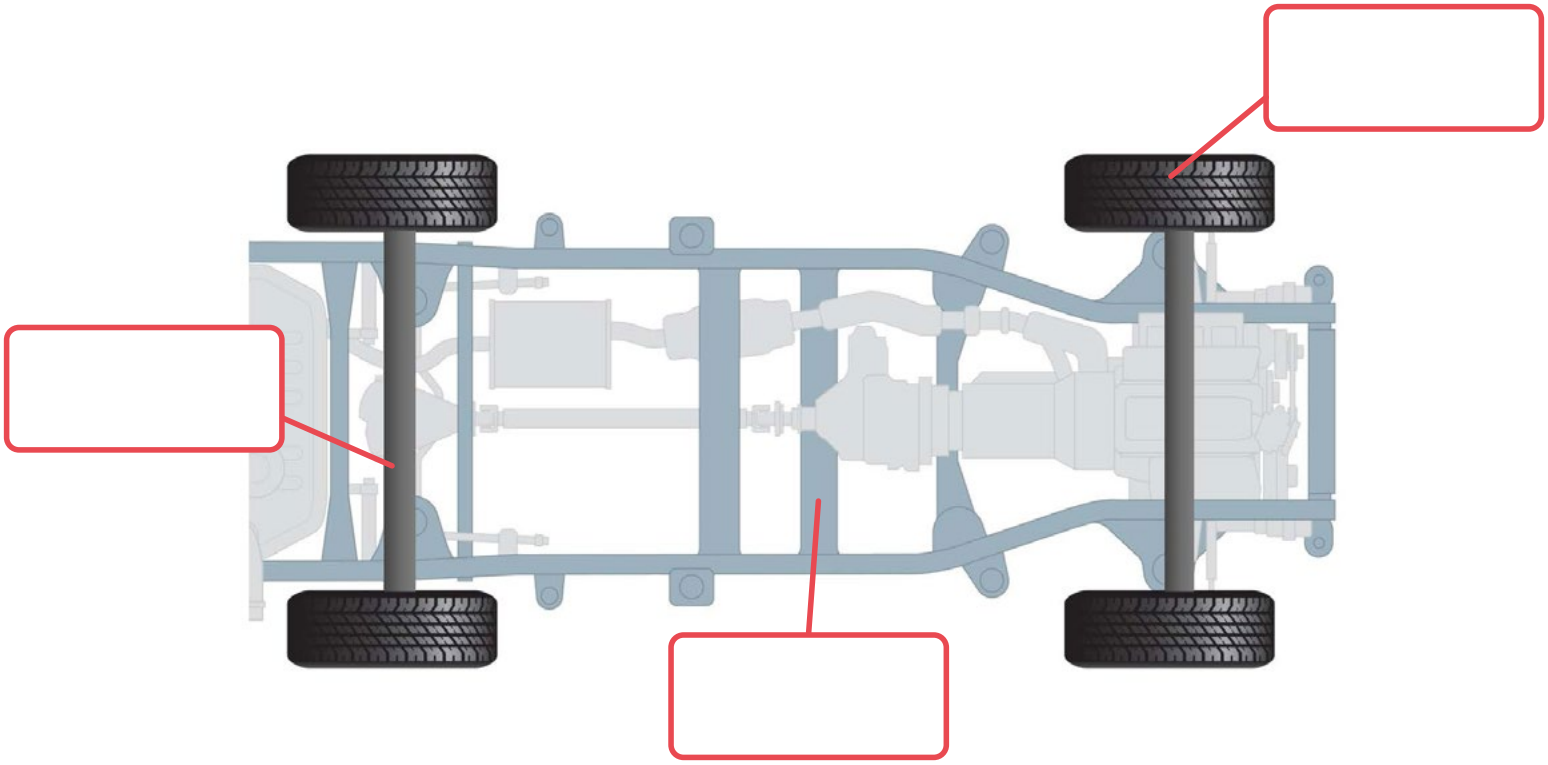
didaclip

ACTIVITY 1 - THE WHEEL HUNT

Write the following words in the correct location on the diagram below:

- Wheel
- Axle
- Chassis (or frame)



ACTIVITY 1 - THE WHEEL HUNT (CONT.)

After exploring various rolling objects, complete the table below.

- Name 3 objects.
- Choose 3 criteria.
- Write your observations.

Name of the system observed	Criteria 1 _____	Criteria 2 _____	Criteria 3 _____

ACTIVITY 2 - LET'S GET ROLLING!

You are now ready to build your own vehicle with a chassis, axles and wheels! When you are done, test it out and complete the table below by following these instructions:

- Write down two challenges you encountered while constructing your wheels.
- Explain what modifications you made to address these challenges.
- Observe how your vehicle performed after the modifications were made, and record everything!
- Circle whether your modifications were successful or not.

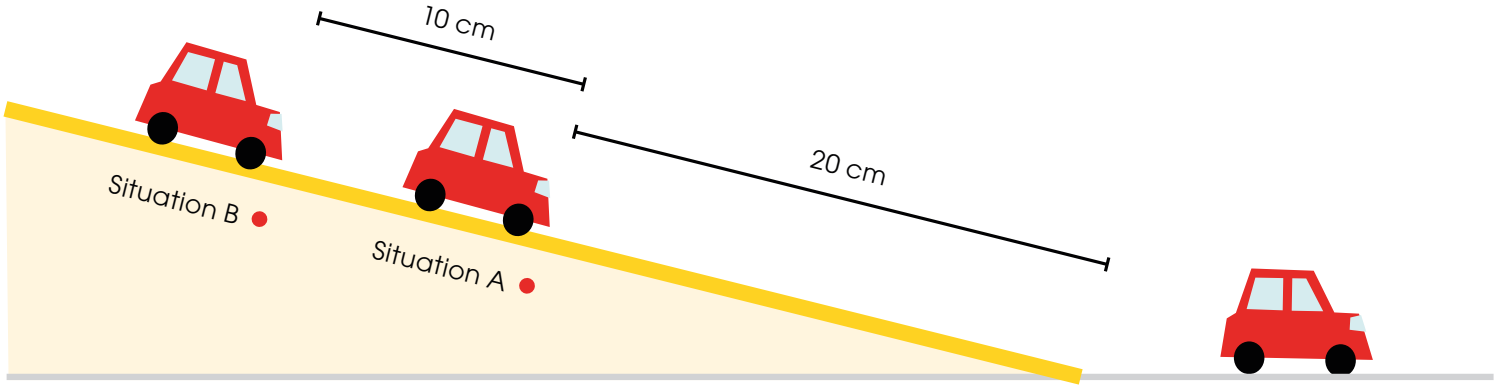
Challenges Encountered	Modifications Made	How did your vehicle perform after the modifications?	Were the modifications successful?
			YES / NO
			YES / NO

ACTIVITY 3 - IT'S ROLLING! DOWN WE GO!

PART A: HIGHER TAKES YOU FARTHER!

The higher your vehicle is released on an inclined plane, the farther it will roll. But how far will it roll before it stops? Can you predict the distance?

DIAGRAM OF EXPERIMENTAL SITUATION 1



What do you think will happen if you release the vehicle 10 cm higher than the original starting position? Check the hypothesis of your choice.

HYPOTHESIS

- ☐ The vehicle will travel an additional distance of more than 10 cm.
- ☐ The vehicle will travel an additional distance equal to 10 cm.
- ☐ The vehicle will travel an additional distance of less than 10 cm.

Justify your hypothesis using prior knowledge, experience, fact, or observation.

_____

_____

_____

PLANNING THE EXPERIMENT

Describe what will be measured in this experiment.

_____

ACTIVITY 3 - IT'S ROLLING! DOWN WE GO! (CONT.)

Compare the two starting conditions of the vehicle. Mark an X in the appropriate box to indicate whether each element is the same or different. If they are different, describe the differences.

Elements	Same	Different	Differences observed
Degree of the inclined plane			
Distance travelled on the inclined plane			
Mass of the vehicle			
Size of the wheels			
Vehicle used			

ACTIVITY 3 – IT'S ROLLING! DOWN WE GO! (CONT.)

For each starting point, conduct three trials, and write the results in the table below.

Starting point	Trial number	Distance travelled on the ground *(cm)*	Average *(cm)*
Situation A *20 cm*	1		
	2		
	3		
Situation B *30 cm (20 cm + 10 cm)*	1		
	2		
	3		

CONCLUSION

In light of the results, was your hypothesis correct? Check your answer.

☐ YES ☐ NO

Justify your answer by comparing the results with your hypothesis.

_____

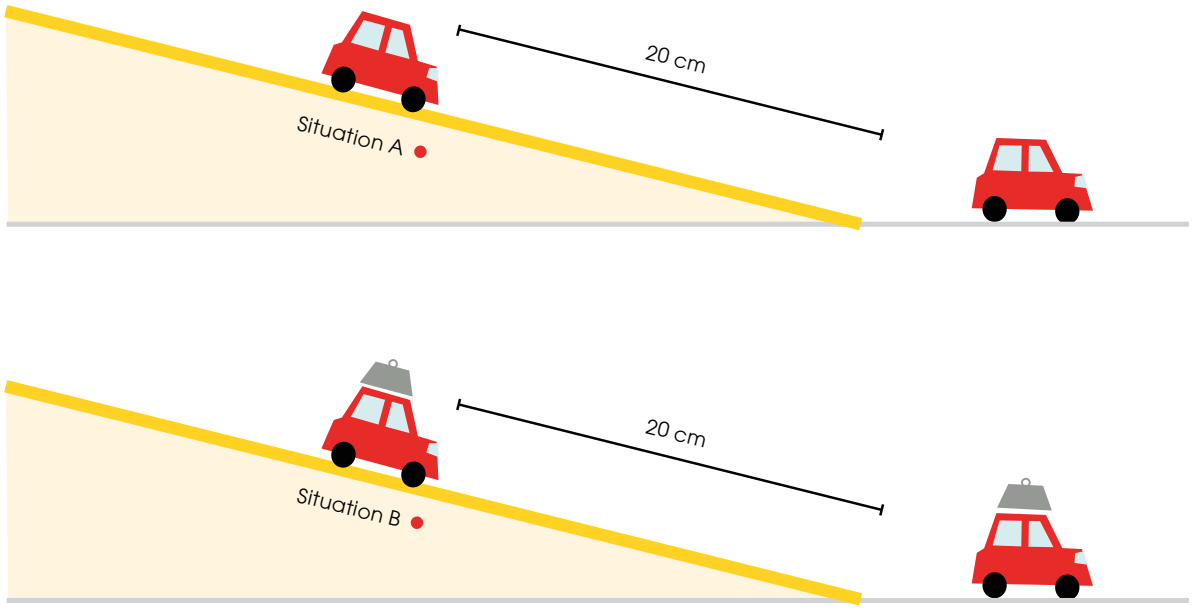
_____

_____

PART B: DOES HEAVIER MEAN FARTHER?

In the following experiment, you will observe what happens when you increase the mass of your vehicle.

DIAGRAM OF EXPERIMENTAL SITUATION 2



What do you think will happen if you increase the mass of the vehicle? Check the hypothesis of your choice.

HYPOTHESIS

- ☐ The vehicle will travel farther.
- ☐ The vehicle will not travel as far.
- ☐ The vehicle will travel the same distance.

Justify your hypothesis using prior knowledge, experience, fact, or observation.

_____

_____

_____

PLANNING THE EXPERIMENT

What will I measure in my experiment?

_____

ACTIVITY 3 - IT'S ROLLING! DOWN WE GO! (CONT.)

Compare the two starting conditions of the vehicle. Mark an X in the appropriate box to indicate whether each element is the same or different. If they are different, describe the differences.

Elements	Same	Different	Differences measured or observed
Degree of the inclined plane			
Distance travelled on the inclined plane			
Mass of vehicle			
Size of the wheels			
Vehicle used			

ACTIVITY 3 – IT'S ROLLING! DOWN WE GO! (CONT.)

IMPLEMENTATION

For each situation, conduct three trials, and write the results in the table below.

Starting point	Trial number	Distance travelled on the ground *(cm)*	Average *(cm)*
Situation A *Vehicule*	1		
	2		
	3		
Situation B *Vehicule + additional mass*	1		
	2		
	3		

CONCLUSION

In light of the results, was your hypothesis correct? Check off your answer.

☐ YES ☐ NO

Justify your answer by comparing the results with your hypothesis.

_____

_____

_____

ENRICHMENT

Repeat the experiment using different masses. Can you predict how far the vehicle will travel using a different mass? Write your hypothesis before every trial.

_____

_____

ACTIVITY 4 - LET'S CREATE FRICTION!

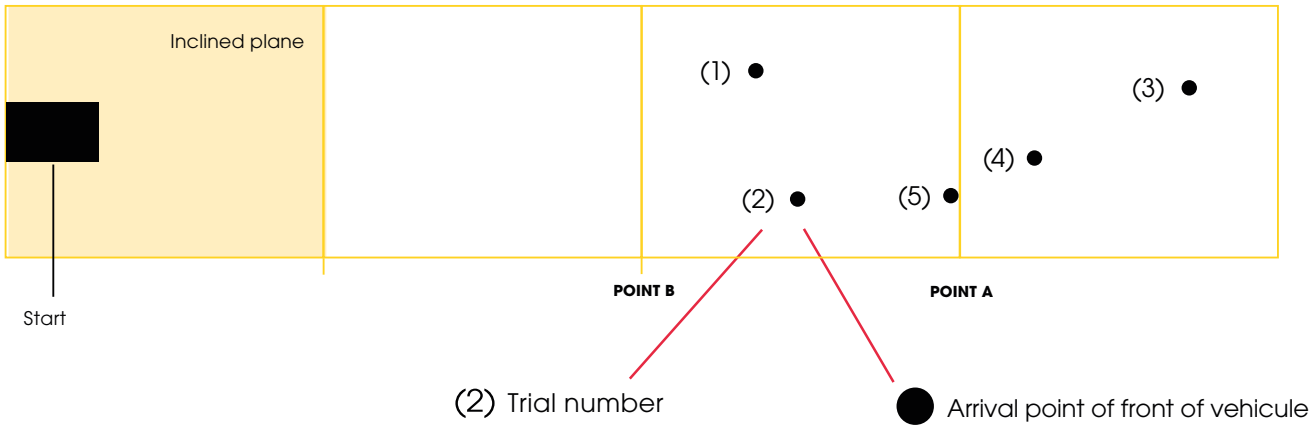
How many trials do you predict it will take for your vehicle to stop at Point A once friction is added to the wheels?

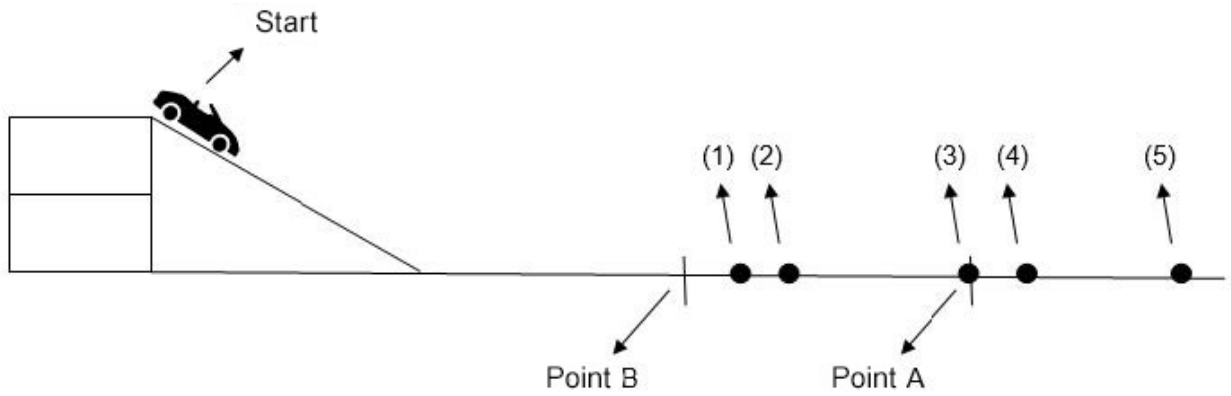
YOUR GOAL

Design your vehicle to use friction in a way that allows it to stop at the desired points.

1. Use coffee stirrers and mounting putty to control the friction on the wheels so that the vehicle stops at Point A.

Example

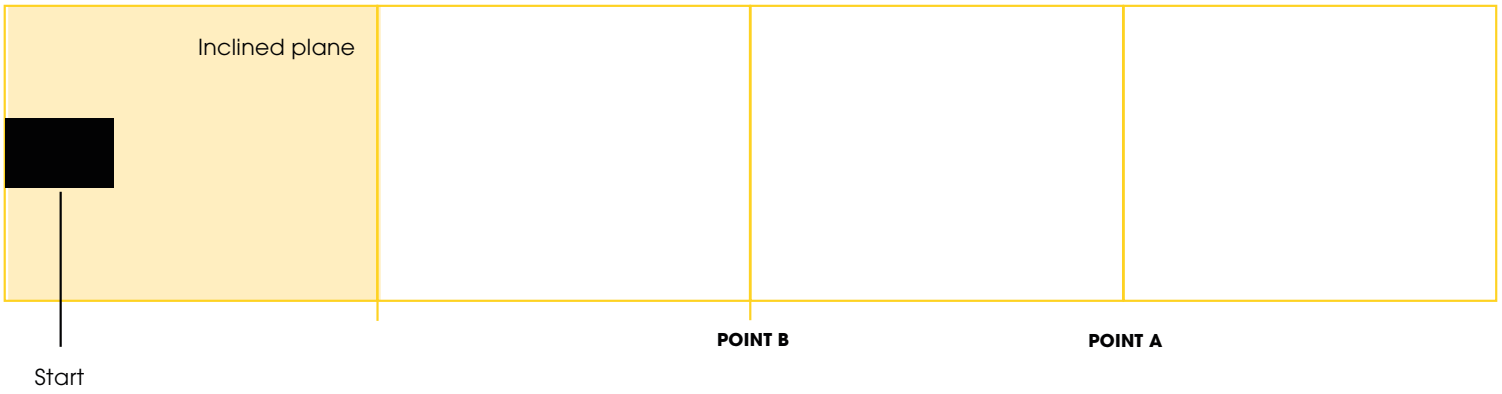




ACTIVITY 4 - LET'S CREATE FRICTION! (CONT.)

RESULTS

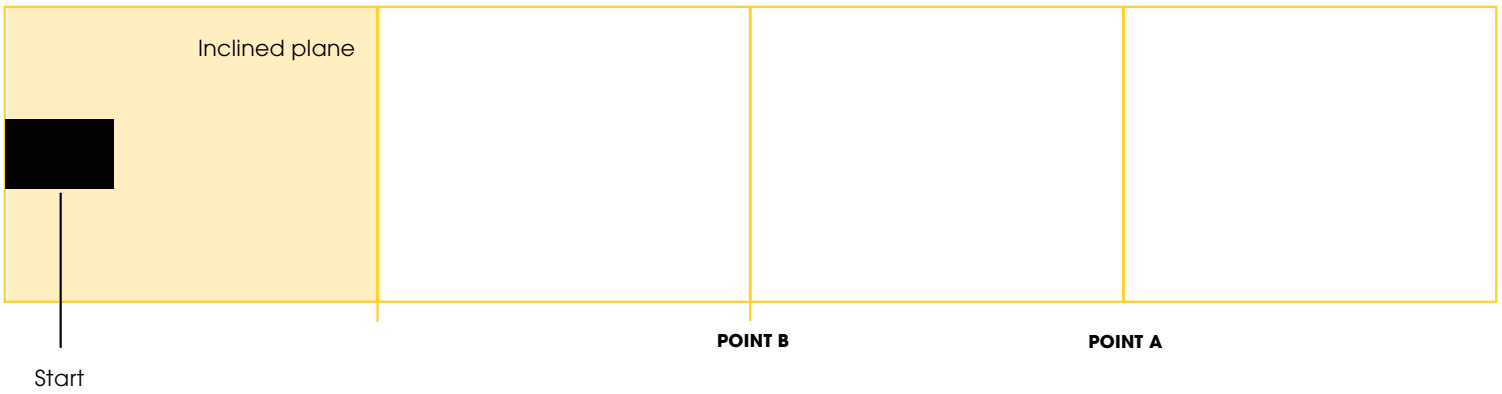
2. Number and record your results using the example on page 13 as a model.

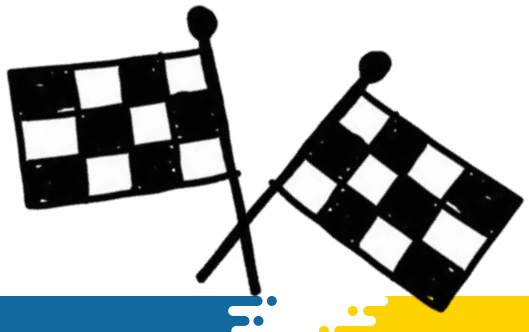


3. How many trials do you predict it will take for your vehicle to stop at Point B once friction is added to the wheels?

_____

4. Using coffee stirrers and mounting putty, control the friction on the wheels so that the vehicle stops at Point B.
5. Record your results, numbering them as above.





PREPARING TO MEET THE CHALLENGE!

THE CHALLENGE

Now that you've experimented with different elements of your vehicle, it's time to build it! Before you begin, take the time to reread the rules of the competition.

YOUR IDEAS

Imagine how you will build your prototype, taking into account the results from the previous activities.

YOUR PLAN

Make a list of the materials and tools you will need to build your prototype.

REFLECT ON...

What can I do to avoid friction?
Which objects will I use for the wheels?
How will I assemble the wheels with the axles?

MATERIALS

List the materials you will need to make your prototype.

Chassis : _____

Wheels : _____

Axles : _____

Connectors : _____

Before you begin building, draw a few diagrams of the side view and/or top view of your prototype. Don't forget to label the main parts, their dimensions and the materials used to build them.

Side View

Top View

Criteria 1 – Appropriate description of the problem	A	B	C	D
Formulation of complete and relevant solutions				

PREPARING TO MEET THE CHALLENGE! (CONT.)

Before you start working on your prototype, let's make sure that everything is in order by reviewing the design rules. This will ensure that the cookies will arrive safely at their destination!

- ☐ Your prototype measures 50 cm x 50 cm maximum at the starting point.
- ☐ The chassis is designed using…
  - » Cycle 2 : a cardboard container or a plastic bottle.
  - » Cycle 3 : a plastic bottle.
- ☐ The wheels and the axles are made of common, everyday circular items.
- ☐ Your prototype has no added accessories.
- ☐ Only the wheels of your prototype are allowed to touch the ground or the inclined plane.

THE TRIALS

After each trial, record your observations and the modifications you will make to improve your prototype.

Trial	Target	Distance between the target and the prototype	Problems encountered	Modifications
1				
2				
3				
4				

THE TRIALS (CONT.)

Trial	Target	Distance between the target and the prototype	Problems encountered	Modifications
5				
6				
7				
8				
9				
10				

Criteria 2 – Application of an appropriate procedure	A	B	C	D
Readjustment of procedure, as required				
Criteria 3 - Appropriate use of instruments, tools or techniques	A	B	C	D
Appropriate handling of tools and instruments				

THE TRIALS (CONT.)

Indicate which of the following challenges you encountered while testing your prototype.

WHEELS AND AXLES:

- ☐ Building wheels that were identical.
- ☐ Stabilizing the wheels to the axles *(ex.: the wheels fell off when the vehicle wasis moving, some wheels got stuck, some wheels did not touch the ground, etc.)*.
- ☐ Finding the center of the wheel.
- ☐ Too much friction prevented the vehicle from rolling.
- ☐ Building parallel axles.

MATERIAL:

- ☐ The material was too fragile.
- ☐ The material was the wrong size. *(ex.: axles too long)*
- ☐ It was difficult gluing the material together.
- ☐ It was difficult piercing or cutting the material.
- ☐ The vVehicle was unstable.

OTHER CHALLENGES:

3, 2, 1, LET'S GO!

The moment to showcase your skills has arrived!

Scoring for each round is calculated as follows: ***100 - d***

d: distance measured in centimeters between the center of the target and ***the ground contact point of the wheel closest to the target.***

Record your results below.

RESULTS ROUND 1 **100 -** [ ] **=** [ ]

Distance

RESULTS ROUND 2 **100 -** [ ] **=** [ ]

Distance

[ ] **+** [ ] **=** [ ]

Results - Round 1 | Results - Round 2 | Final Results

REFLECTION

1. What was your best idea while planning or building your prototype?

_____

_____

Explain why.

_____

_____

_____

2. What changes or adjustments would you add to improve your prototype?

_____

_____

Explain why.

_____

_____

_____

Criteria 4 - Appropriate use of scientific and technological knowledge	A	B	C	D
Produces explanations and uses terminology specific to Science and Technology				