The practical side of science and tech







junior

challen



TEACHER'S GUIDE

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



A program of



PRODUCTION TEAM

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Design of the challenge and the pedagogical tools

In collaboration with the pedagogical consultants of the regional networking group in Science and Technology, elementary of the Laval-Laurentides-Lanaudière region.

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THE JUNIOR TECH CHALLENGE: A UNIQUE LEARNING SITUATION!

Every year in Quebec, the Junior Tech Challenge allows all elementary school students to learn about science and technology in a creative and fun way. The Junior Tech Challenge is an original and hands-on classroom project that is also a learning and evaluation situation (LES). Six challenges are presented cyclically, one per year. Educational tools are offered to meet the challenge of the current year. The pedagogical content can be adapted according to the intended pedagogical objectives. With each new edition, the rules and educational tools are improved upon to ensure that they best meet teachers' needs. This document is intended to support professionals who teach the Intensive ESL Project or the Science and Technology Program (Elementary), or anyone who wishes to experience the Junior Tech Challenge with their students in English.

AN ADAPTABLE CHALLENGE!

This year, we proudly present the new version of the 2016-2017 Junior Tech Challenge. Originally named Sugar Power, the new version Mission: Launch, can be carried out with a team at school, or individually at home. The challenge has also been adapted to meet the needs of students in all cycles.

FOR INTENSIVE ESL TEACHERS

The students will have the opportunity to:

- 1. Develop Competency 1 (Interact orally in English) through challenging hands-on activities. The teacher will have various opportunities to observe the students' oral interactions during these activities.*
- 2. **Review and consolidate science knowledge** in an English-language context. The science, technology and mathematics concepts in this LES have already been taught in previous cycles. This LES gives students the opportunity to put these concepts into practical application and reach their end-of-cycle objectives (see Progression of Learning for Science and Technology and Mathematics on pages 7-10).
- 3. Participate in an authentic learning situation. The Junior Tech Challenge can be a class competition, a school-wide competition or a regional event where students from selected teams will have the opportunity to meet other selected teams at the Regional Finals.

* Evaluation tools and suggestions for activities can be found in Appendix 2.

NEUIS

INTRODUCTION (CONTINUED)

TEACHING TOOLS AVAILABLE

All documents that have been translated into English can be accessed on the <u>Réseau Technoscience website</u>.

- Rules
- Teacher's Guide
- Student Handbook
- Slideshow (Google Slides, PPT and PDF formats)
- Junior Tech Certificate of Participation
- Carton de notation (French only)
- Tableau de pointage Excel (*French only*)
- Fiche de vérification des prototypes (French only)

PREPARATORY ACTIVITIES

The preparatory activities aim to help students acquire scientific concepts related to the challenge. They also help develop strategies that support students in the development of science-specific competencies.

Although the activities can be carried out independently, they can lose their meaning if they are not developed in a meaningful context where students can reinvest their knowledge in an authentic production. The activities suggested in this LES allow students to become familiar with the design process and to allow the teacher to collect traces of the following competencies in Science and Technology:

- Competency 1: To propose explanations for or solutions to scientific or technological problems.
- Competency 2: To make the most of scientific and technological tools, objects and procedures.
- Competency 3: To communicate in the languages used in science and technology.

All activities allow students to establish concrete links with scientific concepts anchored in the <u>Progression of</u> <u>Learning Science and Technology</u> and the <u>Mathematics, Science and Technology program</u> of Quebec.

FROM A LES FOR THE CLASSROOM TO THE REGIONAL FINALS

The **Junior Teach challenge** is an authentic learning opportunity in which students experience a science and technology design in the classroom. They are invited to compete in one of the many levels of competition - with the ultimate experience of participating at the Regional Finals!

Here are the different levels of finals:

Class Finals	These finals are organized in class to determine the most efficient prototypes.
School Finals	School Finals are organized per cycle to determine the representatives who will go to the school service center or school board finals. If there are no finals in the school service center or school board, they will go directly to the Regional Finals.
School Service Center Finals or School Board Finals	These finals are organized per cycle by the school service center or school board, or in collaboration with Réseau Technoscience. If the school service center or school board is planning on holding finals, students will have to register to these finals first.
Regional Finals	Regional Finals are organized per cycle and bring students together from their region. Réseau Technoscience organizes 11 regional finals which will take place in May, as part of l'Odyssée des sciences. Science fair projects from Expo-sciences and activities from the Débrouillards will also be presented.
	Consult the <u>calendar</u> for the date of your Regional Finals. To register teams, contact the Regional Coordinator of the Junior Tech Challenge. The contact information is available on the <u>website</u> .

Note: During the Regional Finals, the challenge can be presented in a different format to that presented in the school service center, or school board finals. The students will be required to change their strategy to adapt to this new format. No advanced preparation is needed, but extra time will be given to students to make the necessary changes.

PROGRESSION OF LEARNING FOR SCIENCE AND TECHNOLOGY

PROGRESSION OF LEARNING

The intention of this learning and evaluation situation is to help develop students' skills, particularly those associated with the technological design process. Many skills used during this process are described in the activities proposed in the Teacher's Guide. The details of the concepts targeted in each of the activities and the links with the Progression of Learning are presented below.

KNOWLEDGE ACTIVATED IN THE LES

This learning situation activates the following knowledge from the <u>Progression of Learning Science and Technology</u> and from the <u>Progression of Learning Mathematics</u>:

SCIENCE AND TECHNOLOGY

MATERIAL WORLD

\rightarrow	Student constructs knowledge with teacher guidance.								
*	Student applies knowledge by the end of the school year.								
	Student reinvests knowledge.	Cycle 1 Cycle 2 Cycle 3							
A. I	MATTER	1 st	2 nd	3 rd	4 th	5 th	6 th		
1.	Properties and characteristics of matter								
	a. Classifies objects according to their properties (<i>e.g. colour, shape, size, texture, smell</i>)								
	f. Distinguishes between the mass (quantity of matter) of an object and its weight (gravitational force acting on the mass)			\rightarrow	*				
	 Describes various other physical properties of an object, a substance or a material (e.g. elasticity, hardness, solubility) 					\rightarrow	*		
	k. Recognizes the materials of which an object is made					\rightarrow	*		
B. E	NERGY	1 st	2 nd	3 rd	4 th	5 th	6 th		
3.	Transformation of energy								
	d. Describes the transformations of energy from one form to another			\rightarrow	*				
	e. Recognizes the transformations of energy from one form to another in various devices (<i>e.g. flashlight: chemical to light; electric kettle: electrical to heat</i>)					\rightarrow	*		

\rightarrow	Student constructs knowledge with teacher guidance.	Elementary					
*	Student applies knowledge by the end of the school year.		E	ieme	entai	ý	
	Student reinvests knowledge.	Сус	Cycle 1 Cycle 2 Cycle 3				le 3
C.	FORCES AND MOTION	1 st	2 nd	3 rd	4 th	5 th	6 th
3.	Gravitational attraction on an object						
	a. Describe the effect of gravitational attraction on an object (e.g. free fall)					\rightarrow	*
5.	Characteristics of motion						
	c. Describes the characteristics of motion (<i>e.g. direction, speed</i>)			\rightarrow	*		
6.	Effects of a force on the direction of an object						
	a. Identifies situations involving the force of friction (<i>pushing on an object, sliding an object, rolling an object</i>)	\rightarrow	*				
	 b. Identifies examples of a force (e.g. pulling, pushing, throwing, squeezing, stretching) 			\rightarrow	*		
	c. Describes the effects of a force on an object (<i>e.g. Sets it in motion, changes its motion, stops it</i>)			\rightarrow	*		
	d. Describes the effects of a force on a material or structure			\rightarrow	*		
7.	Combined effects of several forces on an object						
	a. Predicts the combined effect of several forces on an object at rest or an object moving in a straight line (e.g. reinforcement, opposition)					\rightarrow	*
D.	SYSTEMS AND INTERACTION	1 st	2 nd	3 rd	4 th	5 th	6 th
1.	Everyday technical objects						
	a. Describes the parts and mechanisms that make up an object	\rightarrow	*				
	b. Identifies the needs that an object was originally designed to meet	\rightarrow	*				
2.	Simple machines						
	a. Recognize simple machines (<i>lever, inclined plane, screw, pulley, winch, wheel</i>) used in an object (<i>e.g. lever in seesaw, inclined plane for an access ramp</i>)			\rightarrow	*		
	b. Describes the uses of certain simple machines (to adjust the force required)			\rightarrow	*		
3.	Other machines						
	a. Identifies the main function of some complex machines (<i>e.g. cart, waterwheel, wind turbine</i>)					\rightarrow	*
4.	How manufactured objects work						
	b. Describes a simple sequence of mechanical parts in motion			\rightarrow	\rightarrow	\rightarrow	*
	c. Describes a simple sequence of mechanical parts in motion			\rightarrow	\rightarrow	\rightarrow	*

\rightarrow	Student constructs knowledge with teacher guidance.	Elementary						
*	Student applies knowledge by the end of the school year.	Liemeniory						
	Student reinvests knowledge.	Сус	le 1	Сус	Cycle 2 Cycl		le 3	
E. 1	ECHNIQUES AND INSTRUMENTATION	1 st	2 nd	3 rd	4 th	5 th	6 th	
2.	Use of simple machines							
	 Appropriately uses simple machines (lever, inclined plane, screw, pulley, winch, wheel) 			\rightarrow	\rightarrow	\rightarrow	*	
3.	Use of tools							
	a. Appropriately and safely uses tools (e.g. pliers, screwdriver, hammer, wrench, simple template)			\rightarrow	\rightarrow	\rightarrow	*	
5.	es (<i>e.g.</i>	water	filtratior	ו				
	 Knows the symbols associated with types of motion, electrical components and mechanical parts 			\rightarrow	\rightarrow	\rightarrow	*	
	b. Interprets a diagram or a plan containing symbols			\rightarrow	\rightarrow	\rightarrow	*	
	d. Draws and cuts parts out of various materials using appropriate tools			\rightarrow	\rightarrow	\rightarrow	*	
	e. Uses appropriate assembling methods (e.g. screws, glue, nails, tacks, nuts)			\rightarrow	\rightarrow	\rightarrow	*	
	f. Uses appropriate tools for proper finishing work			\rightarrow	\rightarrow	\rightarrow	*	
	 Uses simple machines, mechanisms or electrical components to design or make an object 			\rightarrow	\rightarrow	\rightarrow	*	
F. 4	PPROPRIATE LANGUAGE	1 st	2 nd	3 rd	4 th	5 th	6 th	
1.	Terminology related to an understanding of the material world							
	a. Appropriately uses terminology related to the material world	\rightarrow	\rightarrow	\rightarrow	\rightarrow	\rightarrow	*	
	 Distinguishes between the meaning of a term used in a scientific or technological context and its meaning in everyday language (e.g. source, matter, body, energy, machine) 	\rightarrow	\rightarrow	\rightarrow	\rightarrow	\rightarrow	*	
2.	Conventions and types of representations specific to the concepts studied							
	a. Communicates using appropriate types of representations that reflect the rules and conventions of science and technology (<i>e.g. symbols, graphs, tables, drawings, sketches, norms and standardization</i>)			\rightarrow	\rightarrow	\rightarrow	*	

PROGRESSION OF LEARNING FOR SCIENCE AND TECHNOLOGY (CONTINUED)

MATHEMATICS

GEOMETRY

\rightarrow	Student constructs knowledge with teacher guidance.	Elomontary					
*	Student applies knowledge by the end of the school year.	Elementary					
	Student reinvests knowledge.	Cycle 1 Cycle 2 Cycle 3					
В. 3	SOLIDS	1 st	2 nd	3 rd	4 th	5 th	6 th
1. C	Compares objects or parts of objects in the environment with solids e.g. spheres, cones, cubes, cylinders, prisms, pyramids)	\rightarrow	*				
2. C	Compares and constructs solids (e.g. spheres, cones, cubes, cylinders, prisms, pyramids)	\rightarrow	*				
3. lo	dentifies the main solids (e.g. spheres, cones, cubes, cylinders, prisms, pyramids)	\rightarrow	*				
Voco	abulary						
Solid prisn	l, base of a solid, face, flat surface, curved surface Sphere, cone, cube, cylinder, n, pyramid	\rightarrow	*				
4. lo	dentifies and represents the different faces of a prism or pyramid	\rightarrow	*				
5. C	escribes prisms and pyramids in terms of faces, vertices and edges			\rightarrow	*		
6. C	Classifies prisms and pyramids			\rightarrow	*		
7. C	Constructs a net of a prism or pyramid			\rightarrow	*		
Voco	abulary				*		
Verte	ex, edge, net of a solid			\rightarrow	T		

OVERVIEW

DESCRIPTION	TIME	PEDAGOGICAL RESOURCES
PREPARATION		
Setting the Stage The teacher presents the challenge to the students, but does not give them all the details. The rules will be presented at a later time.	15 minutes	 Student Handbook p. 2-3 Slideshow Intensive ESL-Appendix 4: What Could We Do?
Activity 1: Machines that Launch! In this task, students will explore machines that launch, and compare the different characteristics of the models presented (<i>e.g. flexibility of</i> <i>the materials</i>).	45 minutes	 Student Handbook p. 4-6 Intensive ESL-Appendix 4: The Catapult
 Activity 2: Launching from all Angles Full Speed Ahead! Part A - Varying the Launch Angle Using an online simulator, students will experience how varying the launch angle can affect the trajectory of a projectile. Part B - Varying the Speed of the Projectile Using the same online simulator, the student can vary the launch speed of the projectile and observe how it affects the trajectory. 	50 minutes	 Electronic device (Chromebook, computer or tablet) Student Handbook p. 7-10
Activity 3: Angle and Speed: A Perfect Team!* Students will apply what was learned in the previous activity by varying the angle of the inclined plane and the speed of the projectile. Ultimately, they will find that for any given speed, the optimal angle to reach the greatest distance is 45°.	90 minutes	Student Handbook p. 11-12
Activity 4 : Solid Structures Students will build and then compare solids in order to determine the characteristics that make them strong.	75 minutes	Student Handbook p. 13-14
Activity 5: The Effect of a Force on a Structure Part A - Building a Springboard Students will build a springboard and explore different applied forces on different structures. Part B: A Flexible Structure Students will explore how the flexibility of different structures require different applied forces. Part C: The Launch Students will test their hypotheses.	1+ period	• Student Handbook p. 15-20

* Activities 2 and 3 address similar concepts. If time and resources (computer, tablet, or Chromebook) are available, activities 2 and 3 are best done in class. If not, Activity 2 could be done online (asynchronous) and Activity 3 in class.

EXEMPLE DE DÉROULEMENT (SUITE)

DESCRIPTION	TIME	PEDAGOGICAL RESOURCES
IMPLEMENTATION		
Preparing to Meet the Challenge & The Trials The teacher will present the rules of the competition to students. Students will experiment with different prototypes.	1+ periode	Student Handbook p. 12-15Rules
The competition Students will execute the challenge.	2-3 periods	 Student Handbook p. 25 Materials permitted for the construction of the prototype (<i>see Rules</i>).
REVIEW AND REFLECT		
The teacher and the students will review the design and the construction of the prototype, and the strategies that will be used to carry out the task.	20+ minutes	Student Handbook p. 26

SETTING THE STAGE

Pedagogical Intentions

- Present the learning and evaluation situation and the challenge. •
- Generate student interest.

Materials

- Slideshow •
- Student Handbook p. 2-3

Procedure

Use the slideshow and the Student Handbook to present an overview of the challenge to the students.

- Show slides 1-3. Ask students to think of the problem presented to them and 1. brainstorm some possible solutions. After they present their suggestions, explain that a solution will be presented to them in the next slide.*
- Present the rest of the slides. 2.
- Distribute the Student Handbook to generate interest. 3.

*Intensive ESL see Appendix 2, Grammar Flash: What Could We Do?

YOUR MISSION

The water level near your home is rising and you are warried about your friends who live on the islands nearby. How will you get them help if the roads between the city and the islands will

To prevent the water from reaching your friends' homes, you will need to build a prototype that will allow you to propel sandbags onto the Islands. Your friends will be able to receive them and install them to block the rising water from reaching their homes.

You will need to collect all the materials necessary to build your prototype. need to be able to launch projectiles as far as the farthest island,

THE CHALLENGE

To build a prototype that launches sugar packets at multiple targets.

AN ADDITIONAL CHALLENGE FOR CYCLE 3!

For Cycle 3 students, the sugar packets must be launched by a mechanical trigger. This mechanical trigger must be something other than the participant's hand: a button, a pin, the cutting of a string, etc. The prototype must be able to remain armed before being triggered.

Although it is not necessary, you can decide to use a mechanical trigger even if you are in Cycle 1 or Cycle 2!



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ACTIVITY 1 – MACHINES THAT LAUNCH!

Pedagogical Intentions

- To analyse the mechanism behind machines that launch.
- To compare the characteristics of the different models (*e.g. flexibility of the different materials*).

Material

- <u>Video</u>
- Student Handbook p. 4-6

Procedure

Part A

1. Ask students to look at the images of the ballista and the catapult and identify their shared function.

Part B*

- 2. Show students the video and ask them to answer the questions explaining how the object works.
- 3. Ask students to describe the difference between a rigid object and a flexible one, circle their hypotheses and answer the questions.

Part C

4. Ask students to look at the additional images, circle their hypotheses and answer the question.

Part D

5. As the students complete Part D, point out that they will have the choice of using rigid or flexible materials in their design.

*Intensive ESL see Appendix 4, The Catapult before completing Part B.

Pour aller plus loin... (In French only)

Ce document est une ressource intéressante pour faire de l'analyse technologique avec les élèves: <u>https://cdpsciencetechno.org/cdp/UserFiles/File/telechargement/analyse_primaire.pdf</u>

	MACHINES	THAT LAUNC	H!			ACTIVIT	y 1
A. L	ook at the two m	nachines below and	answer the fol	lowing question	ons.		
				\ •			
v	What is the function	on of these machine	s? What are th	ey used for?			
1	To throw a bo	all or other obje	cts.				
B. V I So hi Co	Watch the video What is holding ample answ igh enough atapult. Etc.	and answer the follo 9 the ball in the cata ers: The ball is p to keep it in plo	wing question bult? blaced in a ace. / A rea	s. a receptad ceptacle is	cle wh holdir	ere the side ng the ball ir	s are n the
2	2. Explain how the	e catapult works.					
So fo b	ample answe oot moves aw and can brir	ers: The white roc ray, the white roc ng the arm up. I	l must be p d will rise ar Etc.	ushed upw nd propel (vards. V throw)	Vhen the per the ball. A ru	son's bber

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ACTIVITY 1 - MACHINES THAT LAUNCH! (CONTINUED)



ACTIVITY 2 – LAUNCHING FROM ALL ANGLES... FULL SPEED AHEAD!

PART A - VARYING THE LAUNCH ANGLE

Pedagogical Intentions

The student will recognize that:

- As the angle varies, the distance an object is projected varies.
- For any given speed and height, the optimal angle is 45°.

Materials

- Interactive Simulation PHET: Projectile Motion
- Chromebook, computer or tablet
- Student Handbook p. 7-8

Procedure

In teams of two:

- 1. Invite students to watch this <u>tutorial video</u> (in French only) or follow the procedure on page 7 of their Student Handbook.
- 2. Ask students to connect to the Interactive Simulation <u>PHET: Projectile Motion</u> (using a Chromebook, a computer or a tablet).
- 3. Ask students to complete the table in their Student Handbook by drawing the different trajectories of the projectiles when they are launched at these angles: 0°, 30°, 60° and 90°.
- 4. Challenge teams to find the angle at which the projectile will go the farthest.

With the whole class:

- 5. Compare the answers arrived at.
- 6. Lead students to conclude that the launch angle that will cover the greatest distance will always be 45°.



ACTIVITY 2 - LAUNCHING FROM ALL ANGLES ... FULL SPEED AHEAD! (CONT.)





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ACTIVITY 2 – LAUNCHING FROM ALL ANGLES... FULL SPEED AHEAD! (CONT.)

PART B – VARYING THE SPEED OF THE PROJECTILE

Pedagogical Intentions

• Students will discover that varying the initial speed (launch speed) influences the distance traveled by the projectile.

Materials

- Interactive simulation PHET: Projectile Motion
- Chromebook, computer or tablet
- Student Handbook p. 9-10

Procedure

In teams of two:

- 1. While using the simulator, students complete the table in their Student Handbook (p. 9).
- 2. Ask students whether or not they have reached the target.
- 3. Ask students to provide a hypothesis to predict whether to increase the initial speed or decrease it in order for the projectile to reach the target. Provide a tentative explanation.

With the whole class:

- 4. Compare the answers arrived at.
- 5. Ask students what think is the ideal speed.
- 6. Lead the students to conclude that the initial velocity is directly proportional to the distance traveled by the projectile.

LAU	NCHING FULL	FROM A SPEED A	ALL ANGLE AHEAD!	Ś	ACTIVITY Z
PART B - How do yo	VARYING T	HE SPEED O	F THE PROJEC	TILE he projectil	»?
Complete HEIGHT	the followin	g table with	what you obser	rved. DRAWII	NO OF TRAJECTORY
1 m	15 m/s	45°	4	0	
Diduction		Comp	Olete the following INITIAL SPEED	ng table by	indicating the speed used to reach the target. DRAWING OF TRAJECTORY
Do you thin	ach the targ	98 	n	45°	
JUNIOR TECH	CHALLENGE -	20 What	do you think is t	the ideal sp	eed?
		JUNIOR	TECH CHALLENGE	- 2022-2023	Student Handbook 10

ACTIVITY 2 – LAUNCHING FROM ALL ANGLES... FULL SPEED AHEAD! (CONT.)





Complete the following table by indicating the speed used to reach the target.

What do you think is the ideal speed? _____

The ideal speed is 12 because at 11 m/s the object does not reach the target, and at 13 m/s the object passes the target.



ACTIVITY 3 – ANGLE AND SPEED: A PERFECT TEAM!

Pedagogical Intentions

• Allow students to build on what they learned in the previous activity by varying the angle of the inclined plane and the speed at which the projectile is launched. Ultimately, they will find that for any given speed, the optimal angle to reach the greatest distance is 45°.

Materials

- 1 binder
- 1 large rubber band (this type)
- 1 sugar packet
- 1 sheet of white paper

- 2 Bulldog clips
- Lego[©] bricks
- 1 sturdy cardboard box
- Appendix 1 Activity 3: Construction of the Launch Pad Note: Appendix 1 only appears in the Teacher's Guide. You may choose to project the document on the board or print it for your teams.
- Student Handbook p. 11-12

Procedure

In teams:

- 1. Attach the binder to the cardboard box at the first height.
- 2. Make sure the binder is firmly secured for the launch.
- 3. Place the sugar packet in the receptacle of the launch pad.
- 4. Pull the rubber band to the desired stretch length.
- 5. Release the rubber band to launch the sugar packet.
- 6. Measure the distance travelled between the starting position and the landing point of the sugar packet.
- 7. Repeat steps 1-6 using different ramp heights and stretch lengths.

With the whole class:

- 8. Compare the answers arrived at.
- **9.** Ask students what the relationship is between the stretch of the rubber band, the height of the ramp, and the distance traveled.

ANGLE	AND SPEED: A	PERFECT TEAM!	Αστινι	тт 3
Now that you distance that In this activity the speed of t	know more about ti a projectile travels, , you will explore a c the projectile.	he effect that the angle and it's time to put your knowled design that will allow you to o	the initial speed have on ge into practice! change the launch angle	and
Materials:				
1 binder 2 buildog cl 1 large rubb Lego ^o brick: 1 sugar pac 1 sturdy car 1 sheet of w Appendix 1	lips ber band s sket dibaard box hilfe paper - Activity 3: Constructii	on of the Launch Pad		
Procedure: 1. Build the lat 2. Attach the lat 3. Make sure fi 4. Place the sub 5. Pull the rubil 6. Release the 7. Measure the 8. Repeat step	unch pad (refer to App binder to the cardboar he binder is placed se ugar packet in the reco ber band to the desire rubber band so that i e distance from the sto ss 1-6 for each height o	cendix 1- Activity 3 in Teacher's (of box at the first height, sourely on the table to prepare for phace. I stretch length, I propels the sugar packet, arting point to the landing point and stretch length tested.	Suide). ar the launch. of the sugar packet.	
Complete the follo must be the same	ning Jables and ann	un the analises for this part of	f the policity the baiaht of t	
TRIAL	ANGLE	AND SPEED: A PER	FECT TEAM!	
1				(55111)
2	2. What do	you notice as the stretch len	gth increases?	
1. Why do yo	For this part of	the activity the stretch lengt	h must remain the same in	n all three trials
	TRIAL	STRETCH LENGTH OF RUBBER BAND	HEIGHT OF THE RAMP	DISTANCE TRAVELLED BY THE PROJECTILE
	1			
JUNIOR TECH CHALLE	2	Fixed Length		
	3			
	3. Why do y	you think these trials have to I	be performed with the san	he stretch length?
	4. In which	trial was the projectile thrown	n the farthest? Why?	
	5. Based or projectile	n your abservations, which po e to reach the greatest distan	arameters (stretch length c ce?	allowed the
	6. After exp in relatio	loring Activity 2 (PHET simulati n to the angle and speed of	on) and Activity 3 (the laun a projectile?	
	JUNIOR TECH CHAI	LLENGE - 2022-2023 Student Han	dbook	12

ACTIVITY 3 – ANGLE AND SPEED: A PERFECT TEAM! (CONT.)

ANGLE AND SPEED: A PERFECT TEAM!

ACTIVITY $\boldsymbol{3}$

11

Now that you know more about the effect that the angle and the initial speed have on the distance that a projectile travels, it's time to put your knowledge into practice!

In this activity, you will explore a design that will allow you to change the launch angle and the speed of the projectile.

Materials:

- 1 binder
- 2 bulldog clips
- 1 large rubber band
- Lego[©] bricks
- 1 sugar packet
 1 sturdy cardboard box
- I sheet of white paper
- Appendix 1 Activity 3: Construction of the Launch Pad

Procedure:

- 1. Build the launch pad (refer to Appendix 1- Activity 3 in Teacher's Guide).
- 2. Attach the binder to the cardboard box at the first height.
- 3. Make sure the binder is placed securely on the table to prepare for the launch.
- Place the sugar packet in the receptacle.
- 5. Pull the rubber band to the desired stretch length.
- 6. Release the rubber band so that it propels the sugar packet.
- 7. Measure the distance from the starting point to the landing point of the sugar packet.
- 8. Repeat steps 1-6 for each height and stretch length tested.

Complete the following tables and answer the questions. For this part of the activity, the height of the ramp must be the same in all three trials.

TRIAL	STRETCH LENGTH OF RUBBER BAND	HEIGHT OF THE RAMP	DISTANCE TRAVELLED BY THE PROJECTILE
1	Answors		Answors
2	Allsweis	Fixed Position	Answers
3	may vary.		may vary.

1. Why do you think these trials have to be performed with the ramp in a fixed position?

If the ramp height is constant, we can see a pattern on the effect of

the velocity on the projectile.

JUNIOR TECH CHALLENGE - 2022-2023 | Student Handbook

ANGLE AND SPEED: A PERFECT TEAM!

ACTIVITY 3

2. What do you notice as the stretch length increases?

The longer the stretch, the greater the speed and the further the

projectile will go.

For this part of the activity, the stretch length must remain the same in all three trials.

TRIAL	STRETCH LENGTH OF RUBBER BAND	HEIGHT OF THE RAMP	DISTANCE TRAVELLED BY THE PROJECTILE
1		Answers	Answers
2	Fixed Length	may vary.	may vary.
3			

3. Why do you think these trials have to be performed with the same stretch length? With the same stretch length (constant velocity), it is possible to see the effect that the height of the ramp will have on the distance covered by the projectile.

4. In which trial was the projectile thrown the farthest? Why?

Answers may vary.

5. Based on your observations, which parameters (*stretch length and ramp height*) allowed the projectile to reach the greatest distance?

For the projectile to reach the greatest distance, the stretch of the rubber band must be at its maximum and the angle must be close to 45 degrees (This is an average of the speed and the angle).

6. After exploring Activity 2 (*PHET simulation*) and Activity 3 (*the launch pad*), what do you observe in relation to the angle and speed of a projectile?

Sample answer: In both activities, it can be concluded that the greater the velocity of the projectile and the closer the angle is to 450, the greater the distance the projectile will travel.

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<u>ACTIVITY 4 – SOLID STRUCTURES</u>

Pedagogical Intention

• Students will build and then compare the structures of solids to determine which characteristics make them strong.

Material

 20 sticks of equal length per team (brochette sticks, toothpicks) to build the edges of the structure

Note: We suggest that you prepare the sticks in advance by cutting the pointed ends off with a pair of scissors or shears.

- Modeling clay or adhesive putty to build the vertices of the solid •
- Student Handbook p. 13-14

Procedure

With the whole class:

Introduce the activity to the students by referring to page 13 of the Student Handbook.

- 1. In teams of two, students will build 2 of the 4 solids:
 - Half the class will build a triangular prism, and a triangular pyramid. 0
 - The other half will build a cube and a square pyramid. 0
 - Explain the procedure for using the sticks and the play dough to build these 0 solids by using the following diagram.



SOLID STRUCTURES

In this activity, we will build 4 solids:



In your opinion, are these structures equally solid?

In your opinion, which one do you think is the most scample answer: I think it's the cube,

Materials

because there are more sticks in the

ACTIVITY 4

A prism with a

triangular base

- construction. • 20 sticks of equal length per team (brochette sticks, toothpicks)
- · Modeling clay or adhesive putty

Procedure:

- 1. Build 2 of the 4 solids.
- 2. Decide which tests you will use to determine the strength of the solids.
- 3. Note your observations in the following table.



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ACTIVITY 4 - SOLID STRUCTURES (CONT.)

In teams of two:

2. Build 2 solids.

With the whole class:

3. Discuss the kinds of tests students can perform to test the strength of the solids. These may vary from team to team, but it is important to ensure that each team uses the same tests for both solids.

Suggestions:

- Press on the edges.
- o Press on the vertices.
- o Place an object on the solid.
- 4. Ask students to choose one or two of these suggestions to test the strength of the solids, and to complete the table in their Student Handbook (*p. 14*).

In teams of two :

- 5. Perform the strength tests.
- 6. Ask students to record their observations in the table on page 14 of their Student Handbook.

With the whole class:

- 7. Review the tests performed and reach a conclusion.
- 8. An additional challenge:
 - Review the structures analyzed in Activity 1, and identify if triangleshaped structures were used.
 - Attempt to strengthen the solids with rectangular sides by adding sticks to it. Note that additional sticks of varying lengths will be needed.

Solid Structures

DESCRIPTION OF TESTS	Sample answer: I placed my solid on my desk and pushed on the vertices.		
SOLIDS TESTED	Prism with a triangular base	Pyramid with a triangular base	
MY OBSERVATIONS	When I pressed the vertices at the top of my solid, my solid collapsed.	When I pressing on the vertices at the top of my solid, my solid kept its shape.	
DRAW AN X ON THE STRONGEST SOLID.		X	

Which solid is the strongest?

The pyramids, especially the ones with a triangular base.

-	
	The trianale
Which accompany shape is found in the strongest solids?	me mungle
	•

Could you suggest a way to strengthen certain solids?

Where there are rectangular shapes in the structure, a stick could be added diagonally to create triangles. It could be attached to the inside of the solid, to one side or to the outside.

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ACTIVITY 4

ACTIVITY 5 – THE EFFECT OF A FORCE ON A STRUCTURE

Pedagogical Intention

• Explore the conditions necessary for a springboard to build up enough energy to launch a ball of clay.

Materials for all three parts of this activity:

- 3 tongue depressors
 Tongue depressors are used instead of stir sticks because they are thin and flexible. The rigidity of stir sticks does not lead to the desired effects with respect to the concepts studied in these activities.
- 1 stir stick (from which a 2 cm section has been cut off) It can be cut ahead of time (see plan in the Student Handbook). A tongue depressor or plastic stir stick can also be used.
- 1 small ball of adhesive putty Modeling clay can also be used, but adhesive putty supports the stir stick better.
- A 15 or 30 cm ruler
- Red marker
- Blue marker
- Black marker
- A desk
- 2.5 cm diameter (approximately 15 g) ball of modeling clay
- Student Handbook p. 15-20









ACTIVITY 5 – THE EFFECT OF A FORCE ON A STRUCTURE (CONT.)

PART A - BUILDING A SPRINGBOARD

Pedagogical Intention:

• To build a springboard that will enable students to analyze the effects that different applied forces have on it.

Procedure

With the whole class:

- 1. Discuss the concept of a force applied on an object. Allow students to express their opinions. Sample questions:
 - What happens when I apply force to a ball of clay with my hand?
 - What happens when I apply force with my feet on the end of a diving board?
 - What happens when I apply force by pulling on the ends of a rubber band? When I release it?
 - What happens when I apply force to a pole while pole vaulting?
- 2. Explain task to students: To build a device (in this case, a springboard) that will allow students to observe the effects of a force applied to a structure.
- 3. Present Diagrams 1 and 2 on page 15 of the Student Handbook to guide students into building the simple catapult.
 - a. Diagram 1: Preparing a Springboard
 - b. Diagram 2: Springboard installation plan provides instructions on how to install the springboard to the edge of the desk.
 - c. Students must follow the instructions illustrated in both diagrams.
- 4. Present and distribute the material that will be used by each team to build a springboard: 1 tongue depressor, 1 stir stick (or tongue depressor) and adhesive putty.

In teams of two:

- 5. Ask students to draw and colour the springboard zones on the tongue depressor while respecting the instructions in Diagram 1.
- 6. Ask the students to install the springboard on the edge of their desk as shown in Diagram 2. Adjustments may be necessary since the size of the desks may vary from one team to another or from one class to another.
 - o It is important to respect the 2 cm space between the springboard and the reference stick (as much as possible).
 - The springboard must not be fixed to the desk. It must be manually held in place.

With the whole class:

- 7. Discuss the difficulties that were encountered, and the solutions found to solve the problems.
- 8. Inform students that the springboard they just built will be used in the next activities.

ACTIVITY 5 - THE EFFECT OF A FORCE ON A STRUCTURE (CONT.)

PART B - A FLEXIBLE STRUCTURE

Pedagogical Intention

• To determine the different amounts of force needed for different structures.

This task supports the development of the following strategies:

- Exploration strategies
 - o Becoming aware of his or her previous representations.
 - o Formulating questions.
 - Anticipating the results of his or her approach.
 - Using empirical approaches (*e.g. trial and error, analysis, exploration using one's senses*).
- Strategies for recording, using and interpreting information
 - Using a variety of observational techniques and tools.
 - Using different tools for recording information (*e.g. diagrams, notes, graphs, procedures, logbook*).
- Communication strategies
 - o Exchanging information.

Research Question:

• Which structure will require the most amount of force on the Tension Zone in order for the springboard to reach the reference stick?

Procedure

With the whole class:

- 1. Present the activity to students and explain that they will make observations about the rigidness of the springboard.
- 2. Using multiple tongue depressors, present the side view of the three structures of springboards. Refer to the diagrams of the structures on page 16 of the Student Handbook. These tongue depressors show a side view of the thickness of the springboard. It may be necessary to present these views to the students by manipulating the tongue depressors in front of them.



ACTIVITY 5 – THE EFFECT OF A FORCE ON A STRUCTURE (CONT.)

- 3. Read the Research Question with the students while presenting each of the three springboards and the three hypotheses in the Student Handbook. Question students to ensure that they understand the Research Question.
- 4. Ask students to circle the image that represents their choice and to explain why they made this choice.
- 5. Ask a few students to share their hypothesis. Do not hesitate to question them to help them clarify their ideas and link them to observations, past experiences, etc.
- 6. Discuss the steps they will have to take to complete this experiment. Advise the students that when the springboard is made of many layers, the coloured tongue depressor must be on top.
 - One or two fingers should be used to push on the Tension Zone.
 - The student must bend each springboard until it reaches the reference stick (2 cm).

In teams of two:

- 7. Hand out 2 tongue depressors to each team.
- 8. Ask students to set up their springboard and reference stick if this was not already done (see Part A).
- 9. Ask students to carry out the experiment and to note down their results. They can use the legend on page 17 of their Student Handbook to identify the amount of force needed for each springboard to reach the reference stick.
- **10.** Students may repeat the experiments many times to validate their observations.
- 11. Ask students to put their material away (unless Part C is to be done immediately after Part B).

With the whole class:

12. Reflect on the experiment using the questions in the Student Handbook. Remind students of their original hypothesis. Review the results of the experiment with them. Discuss what they learned. Lead them into creating a new question about their experience.

ACTIVITY 5 – THE EFFECT OF A FORCE ON A STRUCTURE (CON

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PART C – THE LAUNCH

Pedagogical Intention

• Determine which structure will project a ball of clay the highest when a force is applied it.

Research Question:

• When you place a ball of clay on the Launch Zone, and bend the springboard to reach the reference stick, which springboard will launch the ball the highest?

Procedure

With the whole class:

- Present the activity to the students and explain that they will observe how a 1. springboard propels an object.
- Read the Research Question with the students while presenting each of 2. the three springboards and the three hypotheses in the Student Handbook. Question students to ensure that they understand the Research Question.
- Ask students to circle the image that represents their choice and to explain 3. why they made that choice.
- Ask a few students to share their hypothesis. Do not hesitate to auestion 4. them so they can clarify their ideas and relate them to observations, past experiences, etc.
- Tell students that when the springboard is made of multiple layers, the coloured 5. tongue depressor must be on top.
 - One or two fingers should be used to push on the Tension Zone. 0
 - The student must bend each springboard until it reaches the reference stick (0

	инт.)
THE EFFECT OF A FORCE ON A STRUCTURE	ACTIVITY 5
PART C - THE LAUNCH	-
QUESTION	
Place a ball of modeling clay on the Launch Z	one of the springboard, apply force to it until it reaches
the reference stick, then let go.	
	Space = 2 cm
desk	1
	Reference slick*
Adhesi edge o Diagram 2: Springboard Installatio	THE EFFECT OF A FORCE ON A STRUCTURE
Here is a side view of the 3 springboards:	
	MY HYPOTHESIS Circle your choice.
A. A spin goose where of a single B. A s tongue depressor. ton	I chose this springboard because Answers may vary.
JUNIORTECH CHALLENGE - 2022-2023 Student Har	
	MY OBSERVATIONS Did the three spring to do send the same way? Did they all propel the ball to the same height? Yes No Which one propellement ball the highest? Explain.
	The greater the force applied to the springboard,
k (2 cm)	the further the projectile will go.
K (2 CIII).	L PREPARE MY CONCLUSION FOR A CLASS DISCUSSION At first, I thought This experiment showed me that During this experiment, I also learned that I wonder
	JUNIOR TECH CHALLENGE - 2022-2023 Student Handbook

ACTIVITY 5 – THE EFFECT OF A FORCE ON A STRUCTURE (CONT.)

In teams of two:

- 6. Hand out one ball of clay per team.
- 7. Ask students to set up their springboard and reference stick if not already done (see Part A).
- 8. Ask students to carry out the experiment and to note their results in their Student Handbook.
- 9. Allow time to put the material away.

With the whole class:

10. Reflect on the experiment using the questions in the Student Handbook. Remind students of their original hypothesis. Review the results of the experiment with them. Discuss what they learned. Lead them into creating a new question about their experience.



JUNIOR TECH CHALLENGE - 2022-2023 | Teacher's Guide

PREPARING TO MEET THE CHALLENGE

Pedagogical Intention

• To consolidate the learning acquired during the process of designing a prototype.

Materials

- Rules
- Slideshow
- Materials necessary to build the prototype
- 3 small aluminium trays (about 19 cm x 14 cm x 5 cm)
- 6 large aluminium trays (about 22 cm x 16 cm x 6 cm)
- Inclined Plane (See Rules p. 10)
- Student Handbook p. 21, 22

Setting the Scene

For the Finals of the Junior Tech Challenge, students will be asked to build a prototype that launches sugar packets at multiple targets.

Procedure

- 1. Use presentation slides to review the rules of the challenge.
- 2. Use Student Handbook to review the hypotheses discussed during the activities.
- 3. Ask the following questions to review and discuss what was learned from completing the activities:
 - How do you vary the launch angle?
 - Will you use materials that are flexible, rigid, or both? For which part(s) of your prototype?
 - How will you ensure that your prototype is strong enough to launch sugar packets?
- **4.** Arrange students into teams of 1-3.
- 5. Before building their prototype, each team must:
 - Select the materials they will use.
 - o Draw a sketch of their prototype on page 22 in their Student Handbook.



TESTING MY PROTOTYPE

Material

• Student Handbook p. 23, 24

Setting the Scene

For the finals of the Junior Tech Challenge, students will be asked to build a prototype that launches sugar packets at multiple targets.

Procedure

- 1. Each team designs their prototype to prepare for testing.
- 2. Before the trials, students must be reminded to verify that...
 - o the prototype must be able to hold a sugar packet.
 - the prototype must be able to fit into a cardboard box designed to hold 5,000 letter-size sheets of paper, with the lid closed.
 - the prototype must be able to stand on the ground or on the inclined plane on its own.
 - o in Cycle 3, the prototype must have a mechanical trigger.
 - o there are several ways to vary the launch angle.
 - o there are several ways to vary the launch speed.
- 3. Students note the performance of their prototype, the problems they encounter, and the modifications they make, in the table of their Student Handbook pages 23-24.
- 4. During the testing of the prototype, the teacher accompanies the students by questioning, encouraging and guiding them in their adjustments. The teacher also collects information on how students use the assembly techniques, and how they observe and solve problems.



During the trials, make sure that.

- · The prototype can hold a sugar packet.
- The prototype can propel the sugar packet.The prototype can launch the sugar packet to reach the target
- The prototype can launch the sugar packet to reach the
 The prototype is able to repeat the launch.
- The proper adjustments can be made when the targets are changed.
- Cycle 3: The mechanical trigger works.

For each trial, note or draw your observations and the changes you will make to improve your prototype.

TRIAL	TARGET	PROBLEMS ENCOUNTERED	MODIFICATIONS MADE
1			
2			



Application of an appropriate procedure	A	В	с	D
Readjustment of the design made during the testing phase				
Appropriate use of tools, instruments and techniques	A	В	с	D
Appropriate handling of tools and instruments				

JUNIOR TECH CHALLENGE - 2022-2023 | Student Handbook

24

THE COMPETITION

Material

• Student Handbook p. 25

Procedure

You will find all the information on how to run the class competition on pages 4-8 in the Presentation and Rules. Here are some details to remember for the organization of the finals:

- 1. Ensure that all students of the same cycle complete the challenge under the same conditions.
- 2. Once the competition is over, ask students to record their scores on page 25 of their Student Handbook.

THE COMPETITION

Are you satisfied with your prototype? You are excited to show it to your friends who believed that your creativity could save them. You are now ready for the launch!

It's time to carry out the final test of your prototype.

The points will be calculated in this way:



During the competition, you must...

- Install your prototype on the ground or on the inclined plane at the start line.
- Wait for the signal to start.
- Activate the mechanism of your prototype.
- Launch 10 packets of sugar within a maximum of 2 minutes.
- Remember that your turn ends when you either run out of sugar packets, or time runs out.

1	NUMBER OF SUGAR PACKETS IN	POINTS Cycle 1	POINTS Cycles 2 and 3	TOTAL POINTS
	Zone	x 30 points	x 10 points	
А	Left/right target	x 240 points	x 40 points	
	Center target	x 350 points	x 150 points	
	Zone	x 20 points	x 20 points	
В	Left/right target	x 140 points	x 140 points	
	Center target	x 250 points	x 250 points	
	Zone	x 10 points	x 30 points	
С	Left/right target	x 40 points	x 240 points	
	Center target	x 150 points	x 350 points	
		TO	TAL	

JUNIOR TECH CHALLENGE - 2022-2023 | Student Handbook

REVIEW AND REFLECT

Pedagogical Intentions

- To consolidate learning.
- To review the design and construction of the prototype, as well as the strategies used to complete the challenge.

Material

• Student Handbook p. 26

Procedure

Review and discuss the following questions as a group, then invite students to complete page 26 of their Student Handbook on their own.

- 1. Compare the different properties of the prototypes:
 - o What made some prototypes more accurate and reliable?
 - Was the choice of materials appropriate?
- 2. Ask students about the strategies they used. Were some more effective than others?
- 3. Have students analyze their performance using the questions on page 26 of their Student Handbook.
- 4. Ask students to discuss what they learned from this project.

Frequently Asked Questions

The frequently asked questions are updated every week. Consult <u>Foire aux questions</u> regularly, and do not hesitate to send us your questions.

REVIEW AND REFLECT					
. What was the best idea you had when planning or	building yo	ur protot	ype?		
My best idea was:					
Explain why.					
. How will you modify or adjust your prototype to imp will:	rove it?				
2. How will you modify or adjust your prototype to imp will:	rove it?				
2. How will you modify or adjust your prototype to imp will: Explain why	rove it?				
How will you modify or adjust your prototype to imp I will: Explain why	rove it?				
How will you modify or adjust your prototype to imp I will:	rove it?	В	6	D	
How will you modify or adjust your prototype to imp I will: Explain why Appropriate use of scientific and technological knowledge Produces explanations and uses terminology specific to Science and Technology	rove it?	В	с	D	

EVALUATION GRID-SCIENCE AND TECHNOLOGY

EVALUATION CRITERIA	А	B - C - D
Appropriate description of the problem	 Formulation of complete and relevant solutions (Student Handbook and observations made in class) The student proposes relevant solutions of the design, orally or through the sketch drawn in the Student Handbook: The prototype has a receptacle to hold the sugar packet; The prototype has a place to launch the sugar packet; The prototype has a base that allows it to be placed on the ground or the inclined plane. Note: We are not assessing the efficacy of the design. We want to check whether the student can identify the important elements of the design, and to propose possible solutions before its construction. 	 B : The student proposes a relevant solution, either orally or in writing, that addresses two of the three constraints mentioned in A. C : The student proposes a relevant solution, either orally or in writing, that addresses only one of the constraints listed in A. D : The student does not propose any relevant solutions either orally or in the Student Handbook.
Application of an appropriate procedure	Readjustment of the design made during the testing phase (Student Handbook and observations made in class) During the testing phase, the student identifies three problems encountered, and offers a number of relevant solutions for each, either orally or written. Note: The solutions proposed do not necessarily have to be successful. Some trials may be successful. Either way, evaluate trials where a problem and a modification have been described.	 B : During the testing phase, the student identifies two problems encountered, and offers a number of relevant solutions for each, either orally or in writing. C : During the testing phase, the student identifies one problem encountered, and offers a relevant solution, either orally or in writing. D : During the testing phase, the student does not identify any problems.
Appropriate use of instruments, tools or techniques	Appropriate handling of tools and instruments (Observations made in class and on the prototype.) The student appropriately uses the techniques taught in class.	B-C : The student appropriately uses the techniques taught in class. Some difficulties are observed.D : The student does not appropriately use the techniques taught in class.
Appropriate use of scientific and technological knowledge	 Produces explanations and uses terminology specific to Science and Technology (Student Handbook) The student summarizes: by describing their best idea AND a modification; by using the terminology specific to Science and Technology. 	 B : The student summarizes by describing their best idea AND a modification. Some awkwardness is observed. C : The student summarizes by describing their best idea OR its modification, and by using the terminology specific to Science and Technology. D : The student simply presents their ideas without any explanation, or the explanation provided is not based on Science and Technology.

PEDAGOGICAL RESOURCES (FRENCH ONLY)

AUDIOVISUAL MATERIAL (free)

Bricolage - la catapulte - Coopération - les bons côtés de la Suisse. *YouTube*, 1 min 34 s. https://www.youtube.com/watch?v=xyGHi8PfQhQ

La catapulte à l'attaque! - Débrouillards. YouTube, 6 min 55 s.

https://www.youtube.com/watch?v=QQuIsFp5fFw

Tuto fabriquer une catapulte - Myah and co. YouTube, 3 min 08 sec.

https://www.youtube.com/watch?v=esAWSCp7ASU&t=4s

C'est pas sorcier, Le Châteaux Forts, segments de 10:14 à 12:00 et de 14:12 à 15:00

https://youtu.be/dybWx0kAYJE

Déclencheurs pour s'inspirer - Comment fonctionnent-ils?

https://sites.google.com/cslaval.qc.ca/declencheurs/accueil

2 catapults out of popsicle sticks (English)

https://www.youtube.com/watch?v=WpLFC_SOpXs

DATA BASE (paid subscription)

« Catapulte » - In Universalis Junior [en ligne]. Encyclopædia Universalis.

http://junior.universalis-edu.com/encyclopedie/catapulte/

« Principe du levier » - In eduMedia [en ligne]. EduMedia.

https://junior.edumedia-sciences.com/fr/media/675-principe-du-levier

Chemin : Primaire / Technologies / Des machines simples pour nous aider / Principe du levier

« Leviers » - In BrainPop [en ligne]. BrainPop.

https://fr.brainpop.com/technoingenierie/machinessimples/leviers/

MAGAZINES

À l'attaque! Catapulte-toi au Moyen Âge, Les Débrouillards, nº 380, avril 2018, p. 16 et 17

Note : Si la bibliothèque de votre école n'a pas cette revue et si vous êtes membre de <u>Bibliothèque et Archives nationales du Québec</u>, vous pouvez obtenir un PDF de ces deux pages. Quand vous serez sur leur site : cliquez sur « BAnQ Numérique » et cherchez la base de données « Repère », l'article se cherche à cet endroit. Bonne chance!

BOOKS

PUBLIC CIBLE	NOM ET RÉFÉRENCE DU LIVRE
3º cycle	La démarche scientifique, coll. « Les neurones atomiques explorent », Martin et Stéphane Brouillard, Éditions MultiMondes 2019, 23 p.
	ISBN : 978-2-8977-3118-2 Note : On peut aussi se procurer ce livre en version numérique pour un versement dans la plateforme BIBLIUS.

PUBLIC CIBLE	NOM ET RÉFÉRENCE DU LIVRE
3º cycle	Les machines simples, coll. « Les neurones atomiques explorent », Martin et Stéphane Brouillard, Éditions MultiMondes 2018, 23 p. ISBN : 978-2-8977-3102-1
	Note : On peut aussi se procurer ce livre en version numérique pour un versement dans la plateforme BIBLIUS.
Dès le 1 ^{er} cycle	Moyen Âge, coll. « Docu DYS », Coppin, Brigitte, Éditions Fleurus, 2019, 47 p. ISBN : 978-2-2151-3782-5
	Note : Suggestion pour le contexte de l'époque. La police de caractère facilité la lecture aux entants dyslexiques.
	Les machines de Léonard de Vinci : la catapulte et l'arbalète, coll. « Sassi science », Covolan, Chiara et Girolamo, Éditions Sassi Junior, 2018, 1 livre de 16 pages + 2 maquettes ISBN : 978-8-8686-0568-1
	Note : Obtenir ce livre jouet pourrait prendre plusieurs semaines à votre libraire.
Dès le préscolaire	Petit Poilu, t. 13. Au château de Crotte de Maille, coll. « Puceron », Fraipont, Céline, Éditions Dupuis, 2013, 32 p. ISBN : 978-2-8001-5728-3
	Note : L'enseignant doit être prêt à assumer une aventure scatologique.
Dès le préscolaire	Super-héroïnes, Hargreaves, Roger, Éditions Hachette jeunesse, 2020, 32 p. ISBN : 978-2-0121-0232-3
	Note : Fiction humoristique. Calamity Canaille dévaste la ville avec une catapulte de tartes à la crème.
Dès le préscolaire	Je fais des sciences, Jugla, Cécile, Nathan, 2018, 93 p. ISBN : 978-2-0925-7941-1
	Note : Contient la question « Comment soulever des choses lourdes ? »
Dès le préscolaire	Les châteaux forts, coll. « Le p'tit doc en format géant », Ledu, Stéphanie, Éditions Milan, 2021, 29 p. ISBN : 978-2-4080-3220-3
	Note : On y trouve le trébuchet plutôt que la catapulte.
Dès le 2º cycle	Le Moyen Âge , coll. « L'histoire c'est pas sorcier ! », Mathivet, Éric, Éditions Deux coqs d'or, 2022, 31 p. ISBN : 978-2-0171-5671-0
	Note : Suggestion pour le contexte de l'époque. Contient les sujets des grandes invasions, une attaque au château fort et les guerres.
Dès le 1 ^{er} cycle	Mon premier livre sur la science, Oldham, Matthew, Usborne, 2020, 30 p. ISBN : 978-1-4749-8710-3
	Note : Il y a une double page titrée : déplacer des objets
3° cycle	Copain des sciences : le guide des scientifiques en herbe, Pince, Robert, Milan, 2019, 254 p. ISBN : 978-2-4080-1449-0
	Note : Contient un chapitre titré : Énergies, forces et mouvements
3º cycle	Science, Sparrow, Giles, Broquet, 2020, 127 p. ISBN : 978-2-8965-4646-6
	Note : Contient un chapitre titré : Forces et énergie.
3º cycle	Le guide des Castors juniors : aventures et découvertes, Walt Disney Company, Éditions Glénat, 2018, 208 p. ISBN : 978-2-3440-2948-0
	Note : Six aventures où chaque récit est complété par trois pages documentaires. L'une de ces sections explique comment faire une catapulte.

APPENDIX 1 - ACTIVITY 3: CONSTRUCTION OF THE LAUNCH PAD

STEP	PROCEDURE	ILLUSTRATED PROCEDURE
1	 Place a sheet of paper on the binder as illustrated. Attach the bulldog clips to both sides of the binder. 	
2	Build a receptacle for the sugar packet made out of Lego® (or cardboard).	
3	Place the rubber band through the receptacle.	
4	Cover the top of the receptacle.	

APPENDIX 1 - ACTIVITY 3: CONSTRUCTION OF THE LAUNCH PAD

STEP	PROCEDURE	ILLUSTRATED PROCEDURE
5	Attach the rubber band to the 2 bulldog clips using the bottom metal hook on each side to ensure a secure fit. Students can use the paper to trace the position of the receptacle.	
6	 With a pencil, mark the cardboard box with the different heights that you will use in your experiments. Note that there will be 3 different heights used during the test: Cycle 1 can estimate and measure height using non-conventional units (books, tissue boxes, etc.). Cycle 2 can compare the angles using conventional units (a ruler). Cycle 3 can estimate and measure the angles in degrees using the top of the binder and a protractor. 	
7	At each tested height, drill holes in the box so that the clamp will hold securely in place.	
8	You should now have a finished launch pad!	

APPENDIX 2 - INTENSIVE ESL EXTRAS

You will find:

- 1. Suggestions
- 2. Functional Language
- 3. Grammar Flash: What Could We Do?
- 4. The Catapult
- 5. C1 General Evaluation Tool
- 6. C3 I Write Texts Checklist
- 7. C3 Generic Evaluation Tool

1. SUGGESTIONS

Competency 1: To interact orally in English

Use the evaluation tool to observe students as they are planning their design and performing the various tasks.

Functional Language Posters: Ask students to brainstorm other possible phrases they will need while planning their prototype.

Competency 3: To Write Texts

Students can write a procedure (a step-by-step preparation) for the competition that will help them to succeed at the challenge. They can choose to present it as a poster, infographic, checklist, etc.

Suggested Tools:

- Graphic Organizers
- I Write Texts Checklist

Reflection Questions

It is important that students reflect on their experience at every step of the LES -before, during and after the challenge. The following are examples of a few reflection questions. Feel free to add more!

Before: Warm-Up Brainstorming Session

Before introducing the mission to students, present them with the situation and ask them if they had any ideas about how to solve it. See Grammar Flash: What Could We Do?

During

Consider these questions in a group discussion, just **after a new concept** has been presented and explored by the students:

- Give examples of where in your life you have seen the concept(s) presented in this activity.
- How does this concept connect to your life? to the world?
- What did you learn from this activity?

APPENDIX 2 - INTENSIVE ESL EXTRAS (CONT.)

After

Consider these questions in a group discussion, at the end of the challenge:

- What was your favourite part of the challenge?
- What was the most difficult part of the challenge for you?
- How did you "fail forward" during the design and construction of the challenge?
- Name something you learned about teamwork while completing this challenge.

Journaling Ideas

- Ask students to record their daily experiences, in any form they choose (*collaborative platform, personal journal, video, audio...*) to reflect on their practices, and/or share with their classmates.
- Describe how knowledge of science concepts can be useful in everyday life.
- Give students the choice of answering ANY of the BEFORE, DURING or AFTER questions in their journal.

2. FUNCTIONAL LANGUAGE

 BRAINSTORMING » We could » Do you have any other ideas? What do you think? » I think because » I don't think because 	SUGGESTIONS
 PRESENTING A HYPOTHESIS » I think that » I predict that » What do you think will happen? » What is your hypothesis? Do you agree or do you disagree? » I agree because » I disagree because 	SUGGESTIONS
 PLANNING YOUR PROTOTYPE Let's check if we have all the materials we need. Do we have a? Where is the? Can you pass the please? I think we need 	SUGGESTIONS

APPENDIX 2 - INTENSIVE ESL EXTRAS (CONT.)

3. GRAMMAR FLASH: WHAT COULD WE DO?

To be presented BEFORE the mission is introduced, after slide 1.

WHAT COULD WE DO?		
We use could to express possibility.		
Examples:		
We could play baseball at recess.		
We could build a snowman in our backyard in winter.		
With your team, write 5 ideas that could help stop the flooding in your friends' homes.		
1.		
2.		
3.		
4.		
5.		

WHAT COULD WE DO?

We use could to express possibility.

Examples:

We could play baseball at recess.

We could build a snowman in our backyard in winter.

With your team, write 5 ideas that could help stop the flooding in your friends' homes.

1.	
2.	
3.	
4.	
5.	

APPENDIX 2 - INTENSIVE ESL EXTRAS (CONT.)

4.THE CATAPULT

BEFORE completing page 5 of the Student Handbook.

Part 1: Watch the video, display the words for the students to view and ask them to add the vocabulary to page 5 in their Student Handbook.

WORDS

- PVC pipes
- 2 by 4
- Bungee cords
- Drain to hold the ball (receptacle)



Part 2: Review the video by asking the questions below. Then answer the questions on page 5 of the Student Handbook.

Discussion Questions

- 1. What distance does the ball travel?
- 2. Why does the girl say to be careful?
- 3. What does she say at the end of the video?

5. C1 - GENERAL EVALUATION TOOL

C1 Rubric to be used while students are working in groups, designing and planning their prototype.

ELEMENTARY CYCLE THREE ESL GENERIC EVALUATION TOOL

Competency 1, To interact orally in English

Clas	Class :		Student names	
valuation criteria : Participation in exchanges and Use of functional language	Participation in exchanges	20	Speaks throughout, contributing substantial content, AND uses techniques to create true interaction (e.g. asks partner questions, reacts to and builds on partner's ideas)	
		16	Speaks throughout, contributing substantial content.	
		12	Speaks throughout, contributing limited content.	
		8	Speaks sporadically.	
		4	Speaks rarely.	
	Use of vocabulary and useful expressions	15	Quickly accesses a variety of vocabulary and expressions.	
		12	Uses a variety of vocabulary and expressions.	
		9	Uses basic vocabulary and expressions.	
		5	Lacks vocabulary.	
	by an anglophone	15	Messages are easily understood despite errors, if any.	
		12	Messages are understood with some interpretation.	
		9	Messages are understood with considerable interpretation.	
		6	Some messages are not understood despite interpretation.	
	Comp	3	Messages are understood; however, they are brief, very simple and/or very few.	
ш			Total : /50	
			Challenges (see list below)	

Special cases :

- ✤ If a student does not participate or does not speak in English, allot 0/50.
- If most or all messages cannot be understood, allot 0/50.

Challenges	 Using English words Pronouncing keywords clearly Using a variety of words Expressing more ideas Elaborating on ideas (giving examples, details, etc.) Expressing a personalized messages Asking questions to maintain interaction, ask for details, ask for clarification, etc. 	 8. Building on what partner says 9. Reacting to what partner says 10. Initiating an exchange 11. Using vocabulary from available resources 12. Using a specific language convention : 13. Using the strategy :
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7 - C3 - GENERIC EVALUATION TOOL

Elementary Cycle Three Generic¹ Evaluation Tool for Competency 3, *To write texts*

Name of student: Class:					Class:	
	For marks and feedback purposes		For feedback purposes + = good job – = to work on			
Evaluation criteria: Characteristics of the written text and Application of targeted language conventions	 Comprehension of the text by an anglophone The text is easily understood despite errors, if any. The text is understood with some interpretation. The text is understood with considerable interpretation. One or two sentences may not be understood. Parts of the text are not understood despite interpretation. 	Conter + - cla + - de + - fic + - pa + - pe + - ot	nt arity stail w aragraphing ertinence her:	Form + - articles + - capitaliz + - preposi + - pronour posses + - sentence + - singular + - verbs (e + - vocabul + - other: _	Form + - articles + - capitalization and/or punctuation + - prepositions + - pronouns / possessive adjectives / possessive forms + - sentence structure (e.g. word order) + - singular/plural + - spelling + - verbs (e.g. tense, agreement) + - vocabulary + - other:	
	 > Introduction or introductory sentence 1 Effective 0 Ineffective 0 Missing > Body of the text 3 Effective 2 Mostly effective 1 Mostly ineffective 0 Ineffective 	 + appr + catcl + origin + usefit + othen + accut + accut + component + accut + component + accut + component + accut + accut + othen 	opriate hy nal ul r: urate plete (all ne mation) / to follow nent developed organized r:	cessary c	 does not make sense inappropriate or not pertinent to the task or context incomplete unclear other: essential information missing inaccuracies insufficient detail or development lack of logic lack of organization poor paragraphing repetition some content that does not make sense, is confusing or is not understood some content that is inappropriate or not pertinent to the task task requirements missing 	
	 > Conclusion or closing 1 Effective 0 Ineffective 0 Missing > Adaptation of the text to purpose and audience (task) 5 Entirely 3 Mostly 1 Somewhat 0 Not at all 	+ appr + origin + usefn + othe + well- + well- + well- + well- + othe	opriate nal ul r: -selected cc -adapted cc -selected la r:	 other: does not riappropri task or con - incomplete repetitive unclear other: ontent some inap nguage other: 	 other:	
Total mark for Competency 3 /20 Special cases Main challenges If you are unable to fairly evaluate the text using the tool, select one of the following descriptors and allot 6/20. Main challenges • Most or all of the text cannot be understood, despite interpretation. • The text is incomplete or too short. • The text is off task. • The text is off task.						

¹ If this evaluation tool is used along with a Competency 2 tool, do not evaluate "Body of the text" or "Adaptation of the text to purpose and audience," in order to avoid an overlap in evaluation, as these two elements will be addressed in the Competency 2 tool.

Using the Evaluation Tool

This generic evaluation tool is suitable for most writing tasks. It may be used with Elementary 5 or 6 students. You may adjust the level of difficulty through task choice, design, requirements and expectations.

This tool was designed for two purposes:

- 1) to allow teachers to collect marks on students' writing skills for the report card
- 2) to help teachers support student learning by providing specific feedback

The left-hand column is used to assess the texts and provide marks. In the right-hand column, you may provide specific feedback that will allow students to have a better idea of what they are doing well (+ sign) and what they still need to work on (– sign), and enable you to base your assessment on observable elements.

For each section of the evaluation tool, first determine which descriptor best represents the student's text, and circle the corresponding mark. Next, in the right-hand column, circle the elements that were particularly strong and those that were the most problematic. The goal is to identify which elements stood out and which should be tended to, not to catch each mistake or weakness. Finally, add up the marks in the left-hand column to obtain the final result for the task.

Notes on the Descriptors

> Comprehension of the text by an anglophone

You must read the text in its entirety as if you were an anglophone with little or no knowledge of French or the task.

Easily understood - You do not have to infer to understand the text.

Despite errors, if any – Errors, if any, do not affect the comprehension of the text.

Some interpretation – You must infer to understand parts of the text but most of the text requires no interpretation.

Considerable interpretation – You must make a substantial effort to understand several parts, or a significant portion of, the text.

Parts of the text are not understood despite interpretation – Even though you try to infer meaning, part of the text remains unclear.

> Introduction or introductory sentence

Depending on the form of text that students are required to write, the introduction may simply consist of an introductory sentence (e.g. *I'm writing to propose a new activity for the school* or *Once upon a time there lived a little girl*).

Do not use this section (and adjust the total marks) if:

- the text does not call for any introduction or introductory sentence (e.g. poster)
- students merely reproduce an introduction from a model provided to them

> Body of the text

No matter what form of text students are required to write, the body of the text must meet certain requirements: the content must be relevant to the task and sufficiently developed; ideas must be clear and grouped in a logical manner so the reader can easily follow them; information must be accurate, etc. To determine the degree of effectiveness, refer to the task and the set requirements. Refer to the sidebar if the task involves Competency 2.

Note about integrated tasks

If the task that students carry out involves Competency 2, *To reinvest understanding of written and oral texts*, two sections of the tool will not be used in order to avoid an overlap in evaluation: "Body of the text" and "Purpose and audience." These sections will be addressed in the Competency 2 tool.

> Conclusion or closing

Depending on the form of text that students are required to write, the conclusion may simply consist of a brief sentence that appropriately brings the text to a close (e.g. *I hope this information will be useful* or *They lived happily ever after*).

Do not use this section (and adjust the total marks) if:

- the text does not call for any conclusion or closing (e.g. poster)
- · students merely reproduce a conclusion or a closing from a model provided to them

> Adaptation of the text to purpose and audience

All texts are written for a purpose and a target audience. The purpose can be basic (e.g. to remind someone of an upcoming event) or more complex (e.g. to convince someone to do something). The target audience can be a single person, a group or the public at large.

You can determine whether or not a text was written in light of the purpose and audience by asking yourself a few questions. For example:

- Does the text accomplish what it was supposed to accomplish? For example, if the student was meant to explain a concept, was the concept explained well so that the reader will easily understand?
- Is the language used appropriate to the purpose and audience? For example, are words too technical for the target audience? Is slang used in a formal text?
- Is necessary background provided (if applicable)? For example, does the audience need to know certain facts about the topic to understand the text?
- · Is there too much irrelevant or extraneous information, thus confusing the reader?
- Is information detailed enough for the audience to understand? For example, if a decision is presented in the text, is it explained? Are opinions supported?
- Is the information too specialized or technical for the reader, hindering his or her comprehension?
- · Is the information organized in a way that the reader can easily follow and understand?

