



**centre de  
développement  
pédagogique**  
*pour la formation générale  
en science et technologie*

# The wheel of fortune



## GUIDE

CYCLES 2 or 3 of ELEMENTARY

Spring 2013

**Thanks to:**

For testing the task:

- The CDP team for a first experiment by adults.

For the illustrations

- Clipart
- Thumbnails (illustrations)

[http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/vignettes\\_science\\_technologie/](http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/vignettes_science_technologie/)

For linguistic review, in French:

- Lucie Brouillette

For English translation :

- Christine Tansey

Note:

- For the purposes of brevity, the masculine form has been used

## A quick glance at *The wheel of fortune*

This LES was designed to support cycle 1, 2 and 3 teachers in the appropriation of the general learning process in science and technology in elementary school. This appropriation will occur while the task is carried out with the students. The theme allows certain concepts from the *Progression of Learning* to be acquired. These concepts relate to designing a wheel of fortune within the framework of a complex task where the student will have to carry out a technological design. In addition, this task has been designed so that the students are in action as much as possible, rather than consigning traces.

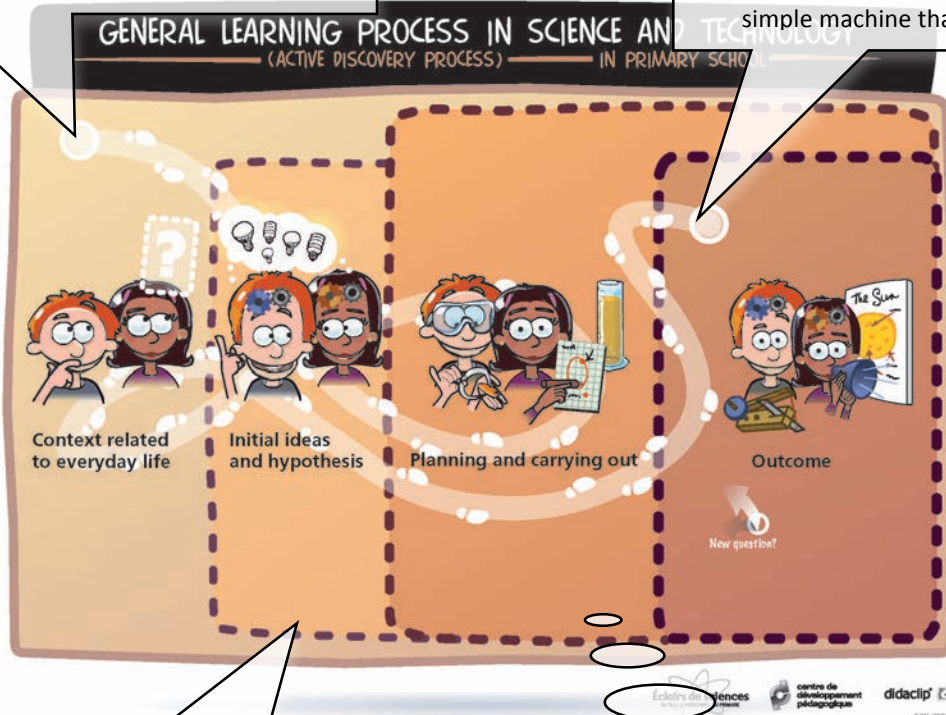
### Complex task suggested to the students



The students will have to design and build a working wheel of fortune. It will be used to randomly determine how many steps to take when it is his turn to play.

### Main targeted learning (pages 4 to 8)

- Become familiar with the process or carry out certain elements of the process relatively autonomously.
- Initiation to the adequate use of simple tools.
- Know various concepts related to technological design and to the simple machine that is the wheel.



### Misconceptions targeted (page 18)

- Concept of the wheel ("Just because it's round doesn't mean that it rolls" and "Just because it rolls doesn't mean it rolls well")

### As a learning activity:

- Trace and cut out a disk;
- Make a wheel.

## **The wheel of fortune**

### **Science and technology – Cycles 2 or 3**

#### **Overview**

#### **Pedagogical aims**

- This learning situation allows the student to implement the general learning process in science and technology in elementary school, using the design of a simple technical object.
- It allows the student in Cycle 3, if desired, to build the concept of the circle and all the satellite concepts to this geometric shape (center, radius, diameter, circumference, disk).

#### **Proposed context**

Using the game *Hypotetika*, it is suggested that the student build his own wheel of fortune while respecting a specific specifications booklet. Another context could be suggested to the students in order to establish a link to their everyday life.

#### **Broad area of learning**

Orientation and entrepreneurship

- Adoption of strategies related to a plan or project: This learning situation may be experienced in the context of the development of a product where the student will put into place strategies associated to various facets of the implementation of a project.

#### **Competencies**

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

#### **Statements from the *Progression of Learning* (Cycle 3 of elementary school)**

This learning situation was designed to be undertaken in Cycle 3 of elementary school because of its close relationship to the mathematics program which includes the study of the concept of the circle. It may, however, be adapted for Cycle 2 of elementary school if the task is a little more closely directed and if you omit the part where the student works on the concept of the circle by building a disk using a supplied range.

As a complement to the statements below, a lexicon and complementary references have been added on pages 8 and 9.

Legend:

★: Worked on during the LES

↺: Previous cycle(s)

+: Optional

## Material World

- ★ A.1.k. Recognizes the materials of which an object is made
- ↻ C.5.a. Describes the characteristics of motion (e.g. direction, speed)
- ↻ C.6.a. Identifies situations involving the force of friction (Cycle 1)
- ↻ C.6.b. Identifies examples of a force (2<sup>nd</sup> cycle)
- ↻ C.6.c. Describes the effects of a force on an object  
(e.g. Sets it in motion, changes its motion, stops it) (Cycle 2)
- ↻ D.2.a. Recognizes simple machines (wheel) used in an object
- ★ D.4.b. Recognizes two types of motion (rotation and translation)
- ★ E.1.a. Appropriately uses simple measuring instruments (rulers)
- ★ E.2.a. Appropriately uses simple machines (wheel)
- ★ E.3.a. Appropriately and safely uses tools
- ★ E.4.a. Knows the symbols associated with types of motion, ... and mechanical parts
- ★ E.4.d. Draws and cuts parts out of various materials using appropriate tools
- ★ E.4.e. Uses appropriate assembling methods (e.g. screws, glue, nails, tacks, nuts)
- ★ F.1.a. Appropriately uses terminology related to the material world
- ★ F.1.b. Distinguishes between the meaning of a term used in a scientific or technological context and its meaning in everyday language

## Strategies

- Exploration strategies
  - Remember previously resolved similar problems
  - Drawing a diagram for the problem or illustrating it
  - Anticipating the results of his or her approach
  - Taking into account the constraints involved in solving a problem or making an object
  - Using empirical approaches (e.g. trial and error, analysis)
- Instrumentation strategies
  - Resort to consignment tools (e.g. sketch, notebook )

## Interdisciplinary links

### In mathematics

In terms of competencies, this task may be considered under the *To solve a situational problem related to mathematics* competency. To do so, the task will need to be presented before having worked on the concept of the circle. If the circle is a notion that the students have already learned, the solicited competency would be *To reason using mathematical concepts and processes* instead.

Here are two extracts from the *Progression of Learning* relating to the construction of a mathematical concept in elementary school.

“Because mathematics is a science that involves abstract concepts and language, students develop their mathematical thinking gradually through personal experience and exchanges with peers. Their learning is based on situations that are often drawn from everyday life. Thus, by participating in learning activities that encourage them to reflect, manipulate, explore, construct, simulate, discuss, structure and practise, students assimilate concepts, processes and strategies. These activities allow students to use objects, manipulatives, references and various tools and instruments. They also enable students to rely on their intuition, sense of observation, manual skills and ability to express themselves, reflect and analyze—

actions that are essential to the development of competencies. By making connections, visualizing mathematical objects in different ways and organizing them in their minds, students gradually develop their understanding of abstract mathematical concepts.” (Page 3)

“Throughout elementary school, by participating in activities and manipulating objects, students acquire the vocabulary of geometry and learn to get their bearings in space, identify plane figures and solids, describe categories of figures and observe their properties.” (Page 14)

As far as the circle is concerned, here are the elements in the *Progression of Learning* in mathematics in elementary school which may be worked on with the students.

C. Plane figures	1	2	3	4	5	6
1. Compares and constructs figures made with closed curved lines or closed straight lines	→	★				
2. Identifies plane figures (square, rectangle, triangle, rhombus and circle)	→	★				
3. Describes plane figures (square, rectangle, triangle and rhombus)	→	★				
<b>Vocabulary</b> Straight line, closed straight line, curved line Plane figure, side Square, circle, rectangle, triangle, rhombus	→	★				
10. Describes circles					→	★
<b>Vocabulary</b> Equilateral triangles, isosceles triangle, right triangle, scalene triangle Circle, central angle, diameter, radius, circumference					→	★

D. Angles	1	2	3	4	5	6
1. Compares angles			→	★		
<b>Vocabulary</b> Angle, right angle, acute angle, obtuse angle			→	★		
2. Estimates and determines the degree measurement of angles					→	★
<b>Vocabulary</b> Degree, protractor <b>Symbols</b> $\angle$ , $^\circ$					→	★

The teacher may choose to explore these elements in one of two ways: by concept building or by building on previously acquired concepts. This choice is left up to the teacher and the “Animation guide” section of this document suggests avenues for building the concept of the circle.

In addition, the wheel of fortune may serve as a trigger or as re-investment for the concepts in the field of probabilities.

## Evaluation of learning

The evaluation criteria as well as elements promoting the understanding of the criteria related to the suggested activities are integrated into the student booklet. Since this is a task within a context, calling upon the production of a process, all the criteria may be used for feedback by the teacher.

**When an activity presented in the booklet is very structured by the teacher (methods imposed), the criteria are presented in grey in the student booklet. This indicates that it is not recommended to evaluate the student on this element.**

## **The wheel of fortune – The vocabulary**

Cycles 2 and 3 of elementary

### **The Vocabulary of the *Progression of Learning***

Brass fasteners	Part
Cut out	Roll
Force	Rotation
Friction	Screw
Measure, measurement	Speed
Movement	Stop
Nail	Trace
Nut	Wheel

### **The vocabulary associated to the General Learning Process in science and technology**

Sketch  
Drawing  
Raw material  
Equipment  
Plan  
Prototype  
Diagram

### **Complementary vocabulary**

While this vocabulary is not the subject of formal evaluation, it is recommended that the student have a look at it in order to begin using the words.

Angle	Protractor
Axle	Radius
Center, centered, to center	Roll
Circle	Thick
Compass	Thickness
Core	Disk
Diameter	Thin
Perimeter	Turn
Pivot	



## Complementary references

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General learning process in science and technology in elementary school  
[http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources\\_engl.html](http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources_engl.html)

Vignettes (illustrations)  
[http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/clipart\\_science\\_technology/](http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/clipart_science_technology/)

### Éclairs de sciences — <http://www.eclairsdesciences.qc.ca/>

Material World – Cycle 2 - *Activity 5 – Rolling objects*: experimental factors (page 3) and scientific conceptual content, page 4  
[http://www.eclairsdesciences.qc.ca/files/pdf/Activities\\_EN/2M-5e.pdf](http://www.eclairsdesciences.qc.ca/files/pdf/Activities_EN/2M-5e.pdf)

## Description of the learning situation

<b>Preparation phase</b>	<b>Pages in the student booklet</b>
<ul style="list-style-type: none"> <li>Context related to everyday life <ul style="list-style-type: none"> <li>Reformulation of the problem</li> </ul> </li> <li>Initial ideas and hypotheses<sup>1</sup></li> </ul>	Page 1
<b>Performance phase</b>	
<ul style="list-style-type: none"> <li>Planning</li> <li>Carrying out (Results)</li> <li>Outcome (Readjustments)</li> </ul>	Page 2 Page 3 Pages 2 and 4
<b>Integration phase</b>	
<ul style="list-style-type: none"> <li>Outcome (Review of initial ideas and the hypothesis)</li> <li>Outcome (Unforeseen events or problems encountered)</li> <li>Outcome (Acquired knowledge)</li> </ul>	Page 4
<b>Learning activities* (to be carried out when deemed appropriate)</b>	<b>Optional</b>
<ul style="list-style-type: none"> <li>Tracing and cutting</li> <li>Making a wheel roll</li> <li>The circle (mathematics)</li> </ul>	

\* Learning activities are available in the booklets or pedagogical materials may be used. There are also learning activities or complementary resources available in the "Documentation" section on the CDP website.

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<sup>1</sup> Please note that within the proposed context and method, the reformulation of the problem, the initial ideas and the hypotheses should be formulated orally. The aim of the task is for the student to mainly be in a materials manipulation situation.

## Animation guide Important!

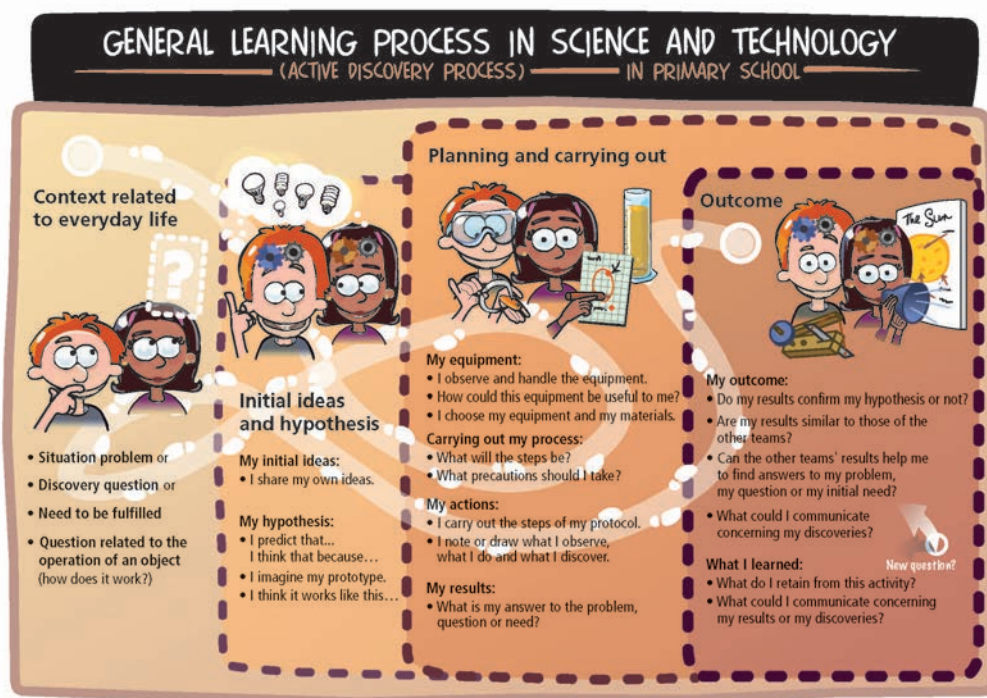
The next pages in this guide relate to the student booklet. There are suggestions for the animation of the learning situation.

For this task, we provide a single student booklet. This booklet allows the student to use a full range of strategies in order to find a solution to the problem. It is therefore an “open” booklet and the teacher should feel free to add what he deems appropriate for his students.

To respond to the adapted pedagogical aim, the booklet may be adapted depending on the targeted class, the timing in the cycle and on the experience (or autonomy) of the students. The use of the open booklet is the ideal to be reached, but the teacher must organise their teaching plan so as to allow the student to achieve at least a certain degree of autonomy.


We have produced a single pedagogical guide to avoid duplicating documents. So that the students may experience a learning situation in science and technology, in the next pages we propose suggestions for animation that the teacher can adapt.

The proposed animation may seem linear. Much as scientists and technologists do, however, it is possible and even recommended to allow the students to go back over certain elements in order to readjust them. The only elements we ask the students not to modify are their initial ideas and hypotheses.






**Preparation phase**  
**Context related to everyday life**  
**Estimated time: 15 minutes (to be validated)**



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**Student booklet**

Name: \_\_\_\_\_



**The wheel of fortune**


*Hear ye! Hear ye!*

We are calling upon your talent to design of a wheel of fortune. It will need to replace a die in a new game: *Hypotetiko*. This wheel enables the player to randomly determine the number of steps to take when it is his turn to play.

**Specifications booklet**

The wheel of fortune must:

- be in the shape of a disk. This disk must be drawn and cut out from a letter-size piece of cardboard;
- allow the player to move from one to seven squares, randomly, depending on where the wheel stops;
- not promote one result over another;
- be used horizontally or vertically (as desired);
- be made solely from the materials and tools put at your disposal.



Cr1 Appropriate description of the problem	Reformulation of the problem Formulation of a tentative solution or explanation
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Page 1

1. **Read or have the students read the task presented on page 1. Ensure that the mission is correctly understood.**


In order to ensure that manipulation is emphasised, we suggest that the first part be done orally. Here are examples that can be discussed with the group:

- Ask the students to give examples of wheels of fortune (televised games, board games like *Twister*, casino wheels as seen in *Lucky Luke*, etc.). That way, the students will have a better idea of what is required.
- Discuss the list of constraints. Given that this list is long, it is important that the students understand them and find strategies to ensure that none is forgotten.
- Exploit the strategies used in English for reading, as well as the tools used (underlining, highlighting, circling, annotating, etc.).

2. **Ask the students to reformulate the problem.**

The use of several strategies is possible for reformulating the problem:

- In some cases, highlighting and annotating the text will be enough;
- In a group discussion, ensure that everyone in the class understands the problem the same way;
- Ask the student to reformulate what he understands of the problem in his own words and to write it at the top of page 2. Sketches and diagrams may also be accepted.



**Preparation phase and beginning the performance phase**


**Initial ideas and hypothesis**

**Estimated time: variable, depending on the students' familiarity with the general learning process in science and technology**


Normally, you must ensure that each student notes his initial ideas: his hypothesis. For the wheel of fortune task, however, we suggest a path which will allow the student to quickly move to a materials manipulation situation. There is no planned space in the booklet to leave traces of this part of the process.

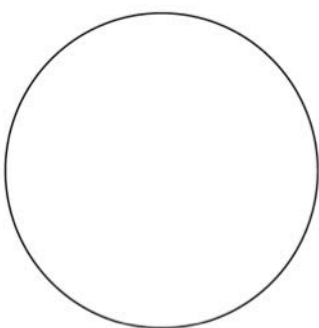
It is possible to ask the students to offer their ideas or hypotheses orally. These ideas may be written on the board. You may also ask the students to make a sketch on a piece of paper that will be posted in class.

Even though this part of the task may be guided in the framework of a group discussion, each student must note his own initial ideas or hypothesis.



**Use this page to describe your prototype.**  
If you must modify elements, use a different colour pencil.

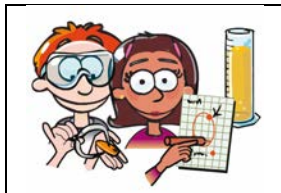




Cr2 Application of an appropriate procedure	Planning of work	
	Implementation of procedure	
	Readjusting the process, as required	
Cr3 Appropriate use of instruments, tools or techniques	Handling of objects, tools or instruments	
	Observance of safety rules	

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Page 2



## Performance phase

### Planning and carrying out: the disk

Estimated time: 30 minutes (to be validated)

Before allowing the students to become involved in the technological design of the wheel of fortune, we recommend that you isolate the part concerning the fabrication of the disk. This part of the task is essentially mathematics, given the fact that the students are asked to build a circle. The traces may be left in a document separate from this task.

#### 1. Build a mathematical concept - the circle - from materials (Cycle 3 only)

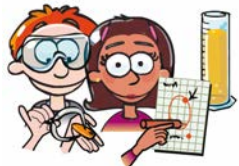
Here is an animation suggestion for this mathematical activity:

- Give each student the materials<sup>2</sup>.
  - This activity may also be done in teams of two (2) or three (3) students, but it is germane to carry it out singly;
  - You will notice that there is no compass or protractor in these materials;
  - The students can perform trials on paper before tracing and cutting out the disk in cardboard.
- Ask the students to trace a circle and divide it to conform to the three (3) first constraints from the specifications booklet:
  - Be made from a letter-sized piece of cardboard;
  - Allow the player to move one to seven boxes;
  - Not to have any result more likely than the other.
- Allow the students to work for some time (5, 10 or 15 minutes).
- In class, ask the students to share the strategies they have adopted, their successes and the obstacles they encountered.
  - If the students don't address the difficulty of **finding the center of a circle**, you will need to ask this question. Without finding the center, it will be difficult to divide the circle properly. Without the center, the wheel may not turn properly.
- For the students who do not adequately manage this task, you may want to adopt the path outlined for Cycle 2 students, suggested below.

#### For Cycle 2 students:

- It is possible to supply the students with a sheet (see Annex A, at the end of this document) which will be used as a template for the disk.
- This approach may also be used for Cycle 3 students who already master the concept of the circle, its characteristics and the associated vocabulary.
- This approach may be favoured in cases where time is lacking and when you want to concentrate on the "technological design" dimension.

<sup>2</sup> For detailed complementary information about all these items, please refer to the *Suggestions for materials* section at the end of the guide.

	<p><b>Performance phase</b></p> <p><b>Planning and carrying out: designing, making and testing the prototype</b></p> <p><b>Estimated time: 60 minutes (to be validated)</b></p>
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### 1. Before beginning, decide if the wheel is to be used horizontally or vertically.

The teacher may allow the students to choose, or impose how the wheel will work.

When using a single layer of cardboard with a certain amount of flexibility, you need to know that it is easier to design a wheel that works vertically, rather than horizontally. Thus, for some students, this type of operation may be imposed.

### 2. Explore the materials and the equipment

For many students, it will prove necessary to manipulate the materials a bit before venturing into design. Touching the materials will enable some to come up with ideas. It is therefore recommended to let the students handle the materials before continuing the planning and performance phase of the prototype.

#### **If necessary, plan for learning activities around the tools used.**

It is important to ensure that the students use the tools and instruments at their disposal correctly and safely. Technical and safety capsules offered by the CDP offer teachers an important resource.

In French : <http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources.html#techniques>  
 In English : [http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources\\_engl.html](http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources_engl.html)

### 3. Plan the process

Depending on the level of autonomy of the students faced with a design task, the requirements in regards to planning may need to be adjusted. For students who have experienced few design tasks, it may be difficult to imagine a prototype without attempting to make it immediately. Various strategies may then be adopted to allow the students to learn how to plan their work. Here are a few examples:

- Ask the students to identify the first thing they will need to do and to note that information in the space provided for traces of the steps of the process on page 3 of the student booklet.
- Orally, with the whole class, carry out a general plan together which the student can adjust when the appropriate time comes.
- Let the students make their prototype without planning, but ask them to note, after the fact, what steps they had to carry out to make their wheel of fortune.

### 4. Leave traces of the fabrication and testing of the wheel


During the experiment, the students are invited to leave traces of what they observe and what goes on when they test their design. Page 2 of the booklet provides a space to note these traces. This part is relatively difficult to carry out, even for an adult, since what is done to make the wheel stems in large part from the imagination.

To promote noting the traces, you may:


- Plan a few minutes for the whole class to pause, in order to write or draw what was done in the last while;
- Come back later for writing or drawing the traces. Avoid letting too much time pass between the implementation time and the time for noting the traces.
- It is possible, when the work is carried out as a team, to name a secretary for this part. Then, a single consignment per team would be required. The evaluation of this part would be used in the context of helping to learn.
- The intention of the task is to allow the student to make and design a wheel of fortune. Thus, the accent must be placed mostly on the design, rather than imposing consignment tasks. Other tasks lend themselves better to focusing on this dimension of learning the proper way to work in science and technology.

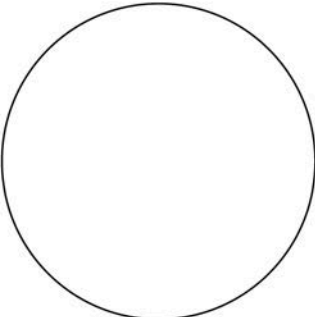
## 5. Represent the object schematically in its final version.

On page 2 of the booklet, the student corrects the presentation of his wheel diagram. It is recommended that each student complete this part. Notes or symbols (e.g. arrows to show the movement) may be added around the diagram.



**Use this page to describe your prototype.**  
If you must modify elements, use a different colour pencil.





Cr2 Application of an appropriate procedure	Planning of work Implementation of procedure
Cr3 Appropriate use of instruments, tools or techniques	Readjusting the process, as required Handling of objects, tools or instruments Observance of safety rules

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Page 2

**The results**



**What do you observe about wheels that work well?**  
I notice that... because...

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**And about those that don't work as well?**  
I notice that... because...

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Cr4 Appropriate use of scientific and technological knowledge	Production of explanations or solutions
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Page 3

## 6. Share the results

In class, some wheels will work better than others. This is normal and the student shouldn't be penalised if he does not manage to make a perfectly functional prototype. Page 3 of the booklet will allow the student to understand what is happening. It also allows the student to explain the operation of a functional wheel of fortune.

This part may also be completed with all the students. The main ideas should then be noted on the board. For classes with a smart board, these traces may be saved and be used as references for a later activity.





## Performance phase (end) and integration phase

### Outcome


Estimated time: 30 minutes or more if you want all the students to have the opportunity to express themselves

#### 1. Review the initial ideas and the hypothesis.

Outcome	
Here is one (or some) difficulty or unforeseen event that occurred:	
Here is (are) the constraint(s) that was (were) harder to respect (if you know why, add your explanation):	
Here is how I could improve the prototype:	

Cr2 Application of an appropriate procedure	Planning of work	
	Implementation of procedure	
Cr4 Appropriate use of scientific and technological knowledge	Production of explanations or solutions	
	Use of terminology, rules and conventions specific to Science and Technology	

What did you learn?



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Page 4

Ask the students to remember their initial ideas. As needed, use the traces saved on the board or posted.

Ask the students to explain, orally or in writing, the reason behind the differences. These explanations may be of many types.

#### 2. Identify the constraint(s) that was (were) the hardest to respect

The students must name the constraint that was the most difficult for them to respect. This part of the report reviews the specifications booklet and identifies elements which may have been omitted.

#### 3. Unforeseen events and difficulties encountered.

During fabrication, each team will have encountered an unforeseen event or a difficulty other than those concerning the constraints. The students can identify them here and share them with the class. It is interesting and pertinent to allow the students to share the strategies used to surmount them. This knowledge may be used in a future design task.

#### 4. Suggest improvements

It is possible and even normal to run out of time for making a perfectly functional prototype. Thus, on page 4, the students can show traces for improving their prototype. This part of the task is an important element in implementing an appropriate process.

#### 5. Learning

To conclude, it is important to recognise what has been learned. The knowledge acquired may be of any order. Some are techniques (tracing and cutting out a part). Other learning may be vocabulary enrichment (e.g. recognise new words or various meanings for a word). There is also what has been learned about how to work in science and technology. A student may learn, for example, that it is not "bad" if his hypothesis is not the "right answer".

We suggest that you leave some time so the students can verbalise what they have learned.

Each student is invited to note what he learned in the speech balloon in the booklet at the bottom of page 4.

## 6. About the “right answer”

For this task, it is not expected that the student make a perfectly functional prototype which resembles in all points a known object or a specific model. Rather, the student must manage to make his wheel “roll”. If the students’ wheels don’t roll well, then it would be appropriate to look together to attempt to identify the problem. If you feel it may prove useful, you could explore objects which use a similar operating principle such as:

- A weathervane;
- A compass;
- Wheels: from a cart, a car, toys or a bicycle;
- A pizza wheel;
- A clock with hands;
- A wind spinner;
- A windmill.

## 7. About wheels that roll

Making a wheel turn may, at first glance, seem simple. This task, however, is not always easy to accomplish. Some student productions will not allow the wheel to roll. Here are some examples:

- The student makes a circle, but forgets to make an axis of rotation;
- The student may not foresee that there may be friction and the wheel turns with great difficulty;
- The student doesn’t place his axis of rotation at the center of the disk.

So, it is important for the teacher and the student to know that a properly functioning wheel needs a central axis, guided in rotation. The guide must provide minimal friction. To illustrate this principle, you may use a thin rod, which will represent the axis (or axle) and a straw, which will represent the guide (hub).

## Suggestions for materials

Before starting, we suggest that you install a piece of cardboard or another material in which it is possible to plant a thumbtack or a nail, over the work area, in order to make the students' manipulations easier. A piece from a cardboard box (e.g. from photocopy paper) would work well.

### Making the disk

For the disk, choose a **light-coloured, thick cardboard**. The cardboard should be stiff enough that it holds adequately when it is transformed into a disk placed vertically or horizontally, but thin enough for the students to be able to cut using scissors.

Materials that could be used for this construction are presented in table 1. The quantities are left to the teacher's discretion. Ideally, each student should attempt to build a disk and thus become familiar with concepts pertaining to the circle.

**Table 1: Materials for building the disk**


Items	Notes
Scissors	<ul style="list-style-type: none"><li>• The scissors should allow the students to cut the cardboard themselves.</li></ul>
Nails	<ul style="list-style-type: none"><li>• Any size of nail may be used.</li><li>• Roofing nails with their flat head and relatively large size is a good choice.</li></ul>
String	<ul style="list-style-type: none"><li>• Whether it is kite string, butcher's string or fishing line, the strings should not be apt to stretch.</li><li>• Wool, which stretches easily, should be avoided.</li></ul>
Plastic lids	<ul style="list-style-type: none"><li>• Lids of various sizes, but mostly bigger than 10 cm in diameter may come from coffee cans or mayonnaise or jam jars.</li><li>• Avoid using peanut butter jar lids to avoid severe allergic reactions.</li></ul>
Pencils	<ul style="list-style-type: none"><li>• For tracing, a lead pencil is best.</li></ul>
Rulers	<ul style="list-style-type: none"><li>• The student's 30 cm ruler is an excellent choice.</li></ul>
Thumbtacks	<ul style="list-style-type: none"><li>• Thumbtacks could replace the nails. Do avoid using flat head thumbtacks because the students will have a hard time manipulating them.</li></ul>
Sheets of paper, tracing paper or transparencies (acetates)	<ul style="list-style-type: none"><li>• These items will allow the students to practise and to use various strategies.</li></ul>

### Designing and making the wheel

First, you need to plan materials to cut, cut out, punch holes and measure. Table 2 suggests certain items. They are not all indispensable and others may be added.

Quantities are left to the teacher's discretion. You may plan for teams of two (2) or three (3) for this part of the task.

**Table 2: Materials to design and make the wheel of fortune**

Items	Notes
Scissors	The scissors will be used to cut soft materials (cardboard, straws, etc.)
Wire cutters	<p>The pliers may be used to cut pencil tubes, dowels, skewers or small wooden rods.</p> <p>The use of pliers is not suggested for students in Cycle 2, since they seldom have the strength to use them. The use of a saw and miter box is then recommended, since they are much safer and easier to use.</p> 
Safety glasses	<p>Glasses protect against projections when cutting using the wire cutters.</p> <p>Wearing glasses initiates the students to the use of this piece of safety equipment.</p>
Rulers	The ruler is useful for measuring length.
Flexible measuring tape	A flexible measuring tape makes it easier to measure objects that are not straight.
Hammer	<p>The hammer is used to nail or punch holes using a nail.</p> <p>*To protect classroom furnishings, use a martyr.</p> <p>One or two work stations equipped with this tool should be enough for the whole class.</p>
Screwdriver	The screwdriver is used to screw in the screws. The head must be compatible with the screws used by the students.

The students should be allowed to use all the materials they choose. Ideally, these materials can be found at home or in the recycle bin. It is also possible to supply the materials and equipment to the students. Table 3, on the next page, lists some examples.

Recommendations for the minimum of materials:

- The students will need at least the materials that will enable them to have an axis of rotation and a guide for rotation.

**Table 3: Materials to design and make the wheel of fortune**

Items	Notes
Straws	The straws and the marker tubes may be used to guide the axis of rotation.
<i>Crayola</i> marker tubes	
Used pencils	The used pencil stubs, dowels, small nails and skewers may be used to make the axis of rotation for the wheel.
Dowels	
Small nails	
Skewer sticks	
Corrugated cardboard	These three materials are suggested because they are relatively thick. The cardboard and the foam-core are easy to cut. The Coroplast is a material that is useful, inexpensive, and easy to find after elections.
Coroplast	
Foam-core	
Cork boards	Classroom cork boards, if they are accessible and unused, may be used.
Popsicle sticks and tongue-depressors	These sticks are useful to make the support for the wheel.
Chicago screws (binding screws)	These screws have a male part and a female part placed on either side of the part you want to bind. They are sold in stores selling scrapbooking materials.
Screws	Screws may be used to affix certain parts.
Thumbtacks	Thumbtacks may be used as rotation axes.  The point should be dulled by the students once they are installed so that no one is poked.
Glue	The glue may be used to affix some parts.
Adhesive tape	The adhesive tape is useful to affix certain parts.

**Suggestion for organising the materials**

- Use transparent boxes for the materials. These same boxes may be used for other activities. (e.g. *Housing in the 1500s*)

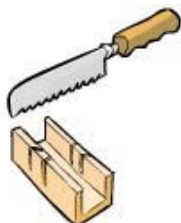





### Some interesting tools

In addition to the previously cited materials, it is possible to offer the students the possibility of working with tools that they seldom use. Table 4 suggests a few of these.

For capsules regarding their use, please consult the “Safety and Techniques” section on the CDP website, at: [http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources\\_engl.html](http://www2.cslaval.qc.ca/cdp/pages/primaire-outils-ressources_engl.html)

**Table 4: Complementary tools**

Tool	Illustration or vignette	Comments and advice
Finishing saw and mitre box		<p>This set allows wooden or plastic parts to be cut safely and precisely.</p> <p>One or two work stations equipped with this tool should be sufficient for the class.</p> <p>*This tool should always be available to the students to cut small wooden parts.</p> <p>** To protect the class furnishings, plan for a cutting mat.</p>
Hot glue gun		<p>This tool allows certain parts to be glued properly. Its use should be supervised.</p> <p>*To protect the class furnishings, use a plastic or metal tray.</p> <p>Simple safety rules and a supervised work station will prevent burns.</p> <p>One or two work stations equipped with this tool should be sufficient for the class.</p>
Retractable blade knife and shaped ruler		<p>Some cuts are easier with a retractable blade knife. A shaped ruler, however, must always be used in conjunction with this tool. It is also very important for the students to be supervised when working with this tool, in order for them to learn to use it safely.</p> <p>The knife should always point away from the body and hands while the cut is carried out.</p> <p>A single work station is sufficient for the class. Full time supervision is required when students use this work station.</p> 

### The stand for the wheels



It is possible to supply a stand on which to test the students' wheels. The model shown at left is one suggestion. It is made from a 1" X 9.5" wooden moulding, in which we drilled two holes with a diameter of 5/8". The moulding is screwed into a base, which may be round or square.

The holes are large enough so the rotation axes of the wheels of fortune made by the students require the additional space to be filled. Thus, the students may affix their wheel using sticky tack.

A single stand may be used for the whole class. The students can come up one at a time to test their prototype.

In the case where such a stand is not available, the students will have to plan a stand to support their wheel of fortune.

## Evaluation

The table below allows you to retrace the evaluation elements that can be found in the student booklet. Note that this task has been designed to allow the students to learn mathematics and to implement a process within the framework of technological design. Certain modifications to the student booklet are therefore required to collect more traces for evaluation.

### Synthesis of traces for evaluation

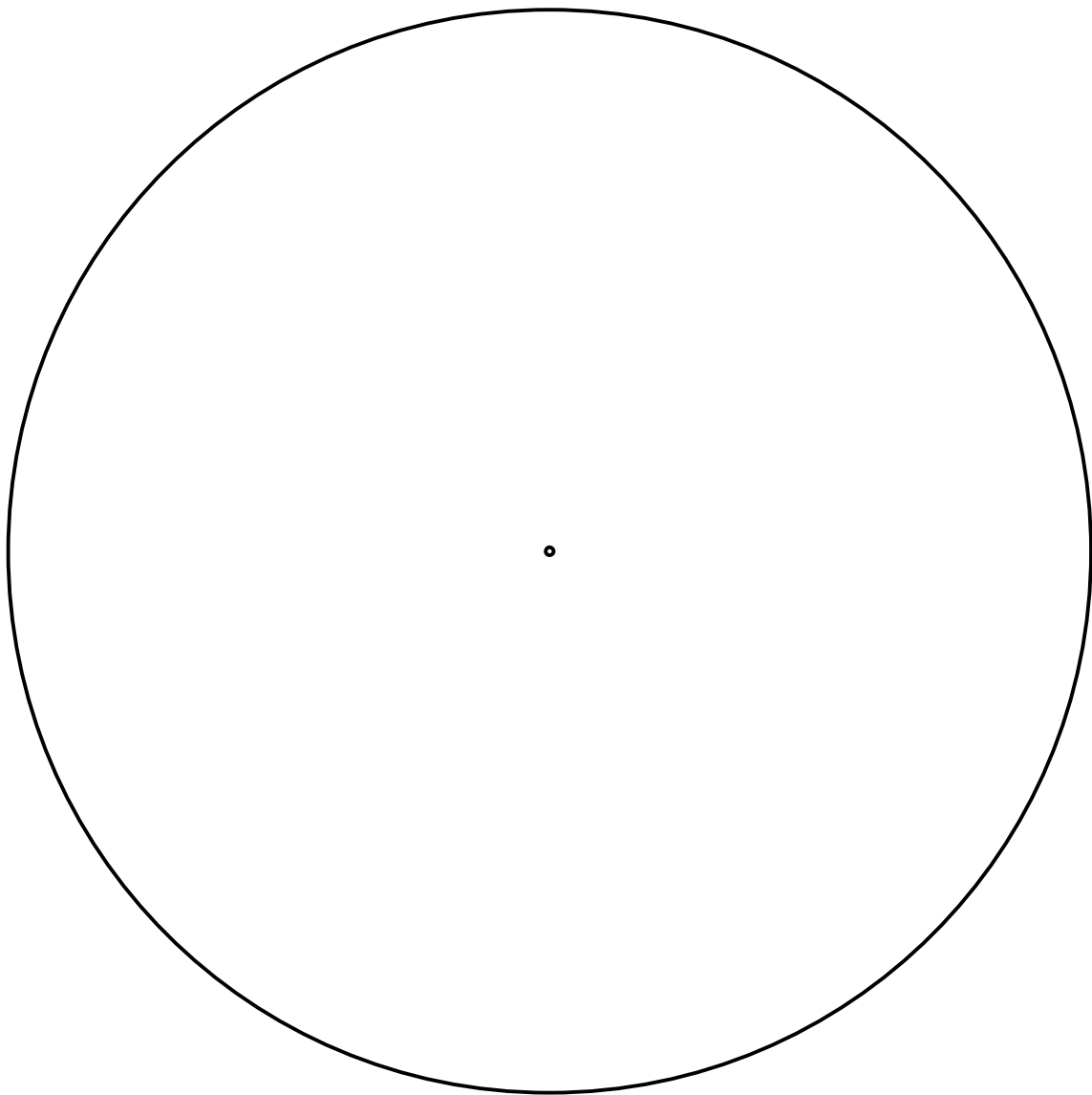
Evaluation criteria	Elements promoting the understanding of the criteria	Page	Result
Cr1 Appropriate description of the problem	Reformulation of the problem	Orally	
	Formulation of a tentative explanation or solution	Page 2	
Cr2 Application of an appropriate procedure	Planning of work	(page 2)	
	Implementation of procedure	(page 2) Page 3	
	Readjusting the process, as required	Page 4	
Cr3 Appropriate use of instruments, tools or techniques	Handling of objects, tools or instruments	In action	
	Observance of safety rules	In action	
Cr4 Appropriate use of scientific and technological knowledge	Production of explanations or solutions	Page 3 Page 4	
	Use of terminology, rules and conventions specific to Science and Technology	Pages 3 to 4	
Proficiency of subject-specific knowledge targeted in the <i>Progression of Learning</i> <sup>3</sup>	Material World	Orally All the pages	
	Strategies <sup>4</sup>	Page 3 to 4	
<b>Evaluation criteria</b>			

<sup>3</sup> It is important to remember to include learning related to techniques and instrumentation (section E) and appropriate language (section F) for each world.

<sup>4</sup> While feedback regarding this element must be provided to the student, it is not considered in the results communicated on the report card.



**Annex 1 – A template for the disk (15 cm diameter)**



**For a disk divided into 8 equal parts, the simplest technique is to fold:**

1. Fold the disk in 2 to obtain a half-moon.
2. Fold this half-moon in 2 to obtain a quarter disk.
3. Fold this quarter in 2, then open the disk and the folds allow 8 equal parts to be defined.

**For a disk divided into an uneven number of equal sections, there are several techniques:**

1. The most common requires the use of a protractor.
2. A manipulation technique may be carried out using string. It is not very precise, but allows the concept of the diameter of a circle to be introduced.
  - a. Place the string around the outline of the circle and cut the exact length of this outline.
  - b. Use a ruler to measure the total length of the string.
  - c. Divide this length into the required number of sections.
  - d. Make a line on the string for the length of each section.
  - e. Place the string back around the circle and make lines in the appropriate places on the outline of the circle.
  - f. Connect these marks to the center of the circle.

In all cases, it is always important to let the students suggest their own strategies. Some avenues used by the students may surprise you and prove to be treasures of ingenuity.