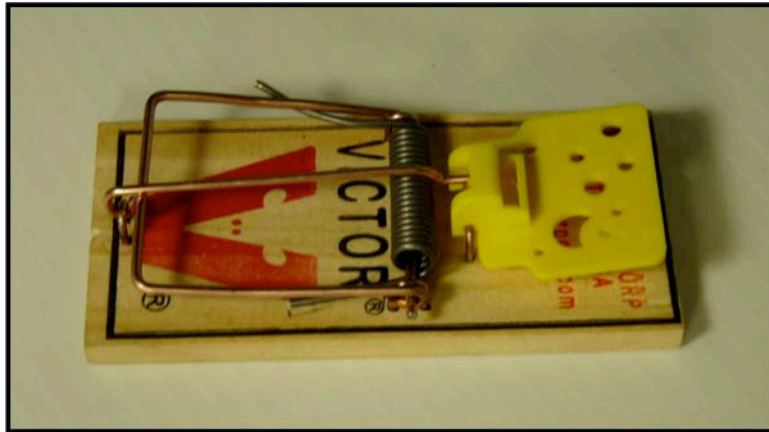




centre de  
développement  
pédagogique  
*pour la formation générale  
en science et technologie*



## Mouse Traps

*Technological analysis*

### GUIDE



Winter 2015

WORKING DOCUMENT

### CAREFUL!



This task asks the students to work with mouse traps. To avoid injury, only non-powerful mouse traps should be proposed to the students. **Under no circumstances should rat traps or other types of traps be used for this task.**

It is the teacher's responsibility to make the adjustments judged necessary, depending on the targeted audience. It may be appropriate to remove the retaining rod to prevent the trap being armed.

**Note:**

- In this document, the masculine is used to make the text more readable.
- Once the LES has been experimented in its entirety, adjustments will complete this guide.

## Mouse trap at a glance (Technological analysis)

This learning and evaluation situation (LES) was designed to illustrate a problem resolution process calling upon a technological analysis process. The proposed task allows teachers to explore teaching strategies to put into place with 1st cycle high school students.

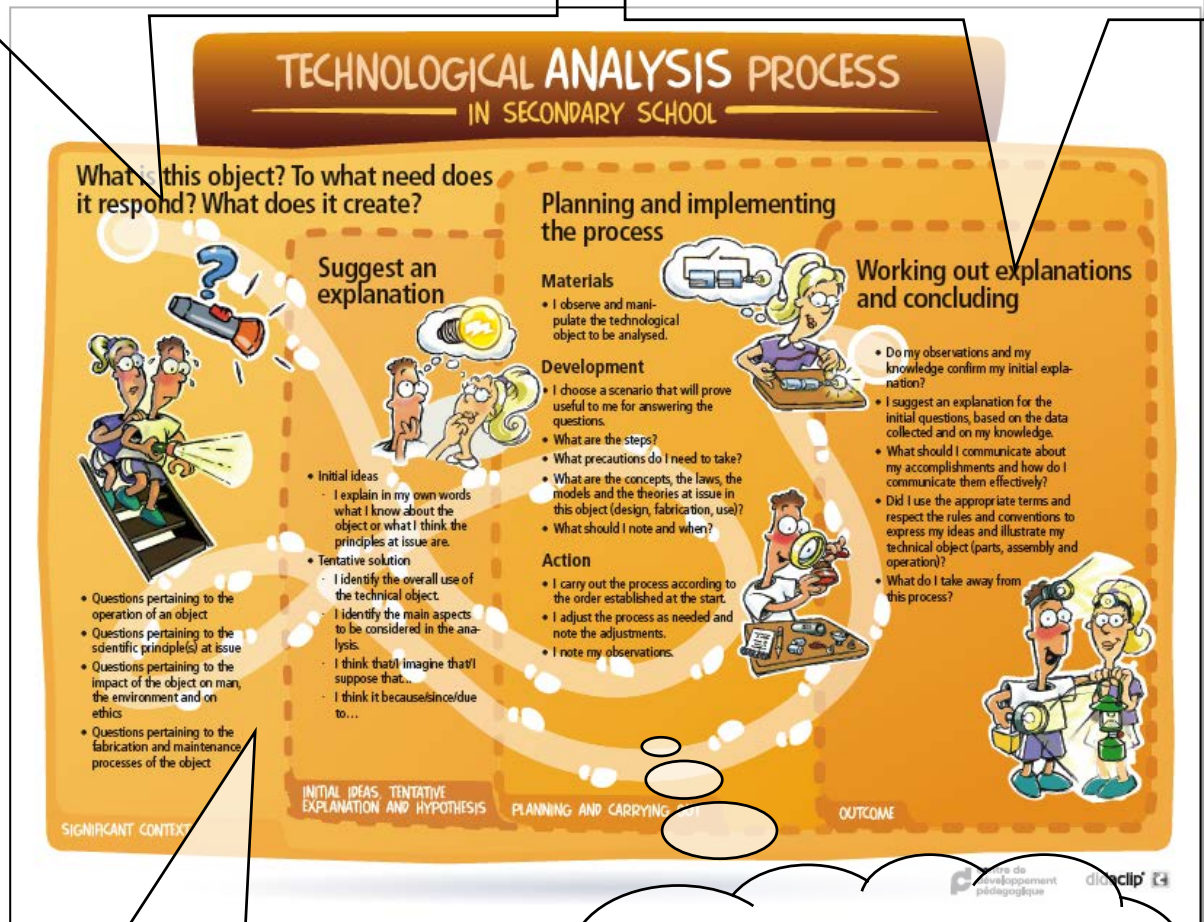


### Complex task proposed to students

Choose the better of two mouse traps using a technological analysis process

### Main targeted learning (p. 4 to 6):

- Initiation to the technological analysis process
- Learn techniques related to the analysis of technological objects and to drawing diagrams



Targeted erroneous impressions:  
None in this LES

### As learning activities:

- Simple machines (levers)
- Safe manipulation of equipment, particularly as far as mouse traps are concerned.

**Mouse Traps**  
**(Technological analysis)**  
*Science and technology* - 1st cycle of high school  
Overview

**Pedagogical intentions**

This learning and evaluation (LES) situation allows the student to:

- Be initiated to the implementation of a technological analysis process in Science and Technology starting in the 1st cycle of high school;
- Be initiated to drawing diagrams;
- Learn about concepts from the *Technological World* and make connections to concepts from the *Living World*;
- Learn safety procedures when manipulating equipment.

**Suggested context**

The context of this task is comparative analysis. The student must test objects responding to the same need in order to make a wise choice. To do so, the student must analyse the operation of two different models of mouse trap.

**Duration**

75 minutes in class and 20 minutes of homework (to be validated)

**Broad area of learning**

Environment and consumption

- Responsible use of goods and services: desire to make informed consumer choices.

Competencies in *Science and technology* (1st cycle)

- Making the most of your scientific and technological knowledge
- Communicates in the languages used in science and technology

**Statements from the *Progression of Learning (Science and technology in high school)***

As a complement to the statements below, a glossary and useful references have been added on pages 6 and 7.

Legend

★ : Worked on

↺ : Previous cycle(s)

+: If desired

**The Living World**

- ↺ In elementary school: Students classify animals by kingdom and, in the case of vertebrates, by class (mammals, reptiles, birds, fish, amphibians). They describe the physical and behavioural characteristics that demonstrate that an animal has adapted to its environment (e.g. fins, claws, colour, ability to burrow into the ocean floor, migration).
- + A.a.i. Names the characteristics that define a habitat (e.g. geographic location, climate, flora, fauna, proximity of man-made constructions)
- + A.a.ii. Describes the habitat of certain species
- + A.b.i. Names the characteristics that define an ecological niche (e.g. habitat, diet, daily rhythms)
- + A.b.ii. Describes the ecological niche of an animal species

## Technological World

☺ In elementary school: Students describe the characteristics of motion (direction, speed). They describe the effect of a force on an object and on certain materials or structures. They become familiar with simple machines. They identify mechanical parts (e.g. gear assemblies, cams, springs), distinguish between translation and rotation and describe a simple sequence of mechanical parts in motion.

- ★ A.a.i. Defines a diagram of principles as a representation used to effectively explain the operation of a technical object
- ★ A.a.ii. Associates the functional elements of a technical object with the appropriate diagram of principles
- ★ A.a.iii. Explains the operation of a simple technical object by drawing a diagram illustrating the active forces and the resulting motion
- ★ A.a.iv. Names the subassemblies and parts essential to the operation of a technical object.
- ★ A.a.v. Indicates certain principles of simple machines illustrated in a technical object (e.g. a lever in a wheelbarrow, a wedge in an axe)
- ★ B.1.a. Identifies parts that move in a specific way in a technical object (rectilinear translation, rotation, helical)
- ★ B.1.c.i. Identifies wheels, inclined planes and levers in simple technical objects
- ★ B.3.a.i. Describes the role of links and guiding controls in a technical object
- ★ B.3.a.ii. Identifies a guiding control in a technical object, as well as the related links (e.g. a pizza wheel is guided by a pivot, which links it to the handle)
- + D.1.b.i. Names the materials present in a technical object

## Techniques

☺ In elementary school: The student becomes familiar with the safe use of tools (pliers, screwdriver, hammer, wrench, templates). He becomes familiar with motion symbols and interprets a drawing or a plan containing symbols.

- ★ A.1.c.ii. Uses different colours for each part of a technical object
- ★ A.1.c.iii. Indicates all the information needed to explain the operation or construction of an object
- ★ B.a. Safe use of laboratory materials
  - i. Uses the equipment safely (e.g. lets a hot plate cool, uses beaker tongs)

## Strategies

### Exploration strategies

- Studying a problem or a phenomenon from different points of view (e.g. social, environmental, historical, economic)
- Anticipating the results of his or her approach

### B. Instrumentation strategies

- Using different tools for recording information (e.g. diagrams, notes, graphs, procedures, logbook)

### C. Analysis strategies

- Determine the constraints and the elements essential to resolving a problem
- Using different types of reasoning (e.g. inductive and deductive reasoning, comparison, classification, prioritization) in order to process information

### D. Communication strategies

- Using different means of communication to propose explanations or solutions (e.g. oral presentation, written presentation, procedure)
- Comparing different possible explanations for or solutions to a problem in order to assess their relevance (e.g. full-group discussion)

## **Evaluation of learning**

The evaluation criteria as well as elements fostering understanding of the criteria related to the proposed activities are an integral part of the student booklet. Since this is a task in context and calling upon the development of a procedure, all the criteria may be used for the teacher to provide feedback.

**When an activity presented in the booklet is replaced by an activity which is very closely supervised by the teacher (which imposes a process), we suggest that the criteria be grayed out in the student booklet. This indicates that it is not desirable to evaluate the student on that element.**

## Mouse Traps – Glossary

### Glossary directly related to the Progression of Learning

Diagram of principles	Mass
Diet	Metal
Distortion	Motion
Ecological niche	Parasite, parasitism*
Force	Plastic
Guiding control	Sketch
Habitat	Spring
Lever	Wood
Link	

### The glossary associated to the technological analysis process

Adjustment	Observations
Ergonomic, ergonomics	Report
Ethics	Safety
Initial explanation	Testing

### Complementary glossary

This vocabulary is not subject to formal evaluation, but it is recommended that you present it to the students.

Arm	As well as any equipment necessary to carry out
Bait	the test (e.g. dynamometer, tweezers)
Exterminator	Torsion, compression, traction
Field mouse	
Mouse	
Pest control	
Trap	
Trigger	

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\* In the *Progression of Learning in Science and technology* in elementary school. It may be necessary to teach or review the significance of this term.

## Useful complementary references

### Centre de développement pédagogique

Technological analysis process poster

[http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/affiches\\_sec/analysis\\_tech\\_sec\\_8x11.pdf](http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/affiches_sec/analysis_tech_sec_8x11.pdf)

Document for stakeholders in *Science and Technology* which briefly presents the usefulness of the technological analysis process and various aspects of the analysis.

<http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/analysis.pdf>

Document for stakeholders in *Science and Technology* that guides the selection of a technical object in order to perform a technological analysis in class (available in French).

[http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/objets\\_analyse.pdf](http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/objets_analyse.pdf)

Document for students in *Science and Technology* that benchmarks the production of diagrams (available in French).

[http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/07\\_depliant\\_dessin.pdf](http://www2.cslaval.qc.ca/cdp/UserFiles/File/telechargement/07_depliant_dessin.pdf)

Videos or documents of a method for safely arming and manipulating mouse traps (to come)

### Suggestion for a trigger for the LES

Funny ad from Nolan's Cheddar (Prize winning ad)

<http://www.youtube.com/watch?v=-lqbchlgZY8>



## Description of the learning and evaluation situation

<b>Preparation stage</b>	<b>Pages from the student booklet</b>
<ul style="list-style-type: none"> <li>• Background</li> <li>• Tentative explanation</li> </ul>	Page 1 Page 2
<b>Manufacturing stage</b>	
<ul style="list-style-type: none"> <li>• Planning the analysis</li> <li>• Carrying out the procedure</li> <li>• Recording observations</li> </ul>	Pages 3 to 7
<b>Integration stage</b>	
<ul style="list-style-type: none"> <li>• Explanations</li> <li>• Review of the initial explanation</li> <li>• Comparing results with others'</li> </ul>	Page 8 Page 8 Page 8
<b>Learning activities (at a time judged appropriate)</b>	<b>Optional</b>
<ul style="list-style-type: none"> <li>• Symbols useful for drawing diagrams</li> <li>• Safely manipulating a mouse trap</li> <li>• Links and guiding controls</li> <li>• Simple machines: types of levers</li> </ul>	These activities are not in the student booklet.

## Animation guide Important!

The following section in the guide is related to the student booklet. There are suggestions for animation.

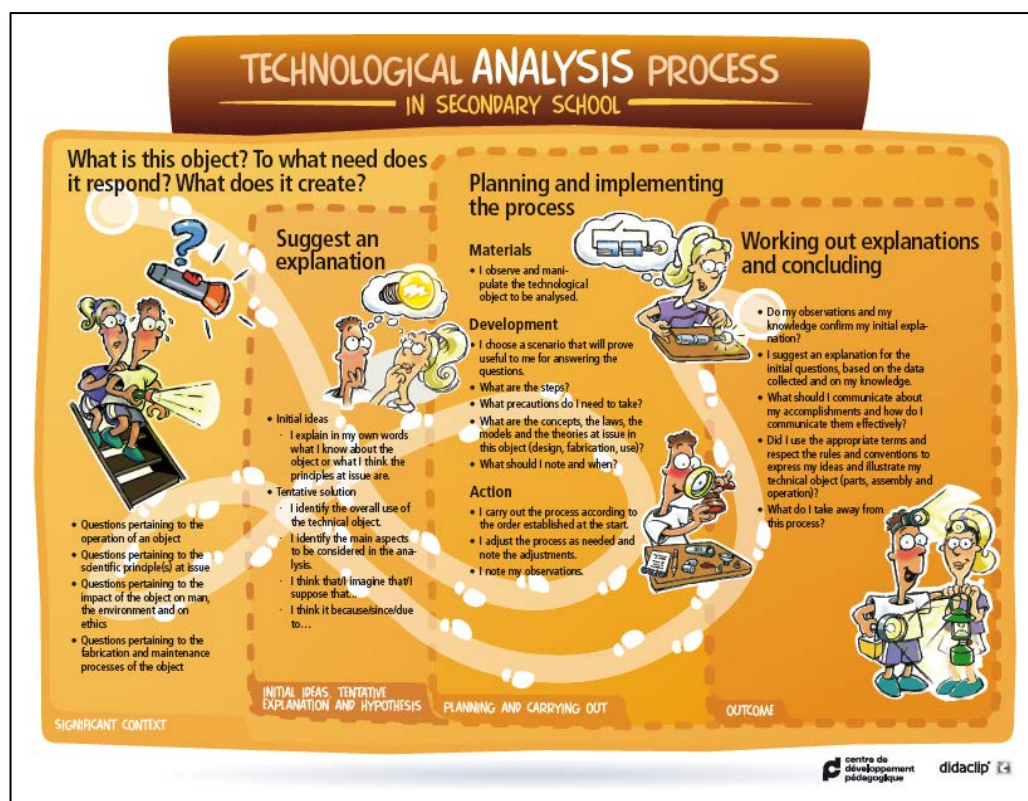
For *Mouse Traps (technological analysis)* the student booklet has eight (8) pages. It is designed for two-sided printing. To save paper, you could print only pages 3 to 7 of the student booklet with two-sided printing and complete in a notebook or on loose-leaf paper.

To respond to specific pedagogical intentions, the booklet may be adapted based on the targeted class, the timing in the cycle and the experience (or autonomy) of the students. A completely autonomous procedure is the ideal to be reached, but the teacher must plan his teaching so as to allow the student a certain degree of autonomy. It is possible to replace the activities in the booklet by more or less guided elements when necessary. This will need to be taken into account when comes time to evaluate, however.

We have produced this guide that groups all the aspects required for a smooth progression (overview, materials preparation, safety, correction guide etc.).

In appendix 1, you will find a correction guide for pages 3 to 7 of the student booklet as well as some explanatory notes for personnel.

There is an LES on the same theme, complementary to this one, but in a scientific investigation context. These two LES are independent from one another, but can be used successively in class.



## The evaluation

The evaluation criteria as well as elements fostering understanding of the criteria related to the proposed activities are presented in the student booklet throughout the process.

The table below will allow you to trace the evaluation elements found in the student booklet.

<b>Evaluation criteria</b>	<b>Elements fostering understanding of the criteria</b>	<b>Page</b>
<b>Cr1 Appropriate interpretation of the problem</b>	Identifying operating principles	2
	Formulation of a tentative solution or explanation	2
<b>Cr2 Relevant use of scientific and technological knowledge</b>	Selection and use: of concepts, laws, models and theories	4 to 7
<b>Cr3 Appropriate formulation of explanations or solutions</b>	Formulation or explanation of explanations related to the problem	8
	Use of appropriate terminology, rules and conventions	8
<b>Proficiency of subject-specific knowledge targeted in the <i>Progression of Learning</i></b>	Technological World - mechanical engineering Techniques - Drawing diagrams	

## Suggestions for equipment and instruments

Materials to be put at the students' disposal for a class of 32 students

Articles	Notes
16 "traditional" wood-based mouse traps	<p>The Victor® brand is easy to find. The model with a yellow plastic bait support is recommended. You must <b>take the time to give the safety instructions</b>.</p> <p>It is possible to use traps bought at the grocery or dollar store in which the springs are often less powerful.</p> <p>It is also possible to remove the arming rod in order to avoid arming the trap. The students can hold the lever themselves and carry out the tests.</p>
16 plastic mouse traps	<p>There are many plastic mouse traps. Some are very powerful and could injure even the most careful of people. Other are less powerful. It is recommended you use the latter.</p>
Chopstick or popsicle stick	<p>To trigger the trap without touching it.</p>
Tweezers	<p>Tweezers may be used to safely place objects on the traps. (Tweezers or condiment tongs)</p>
32 pairs of safety glasses	<p>It is <b>mandatory</b> to wear glasses. This is to avoid accidents that could come about if a part should become detached during the manipulations.</p>

### CAREFUL!



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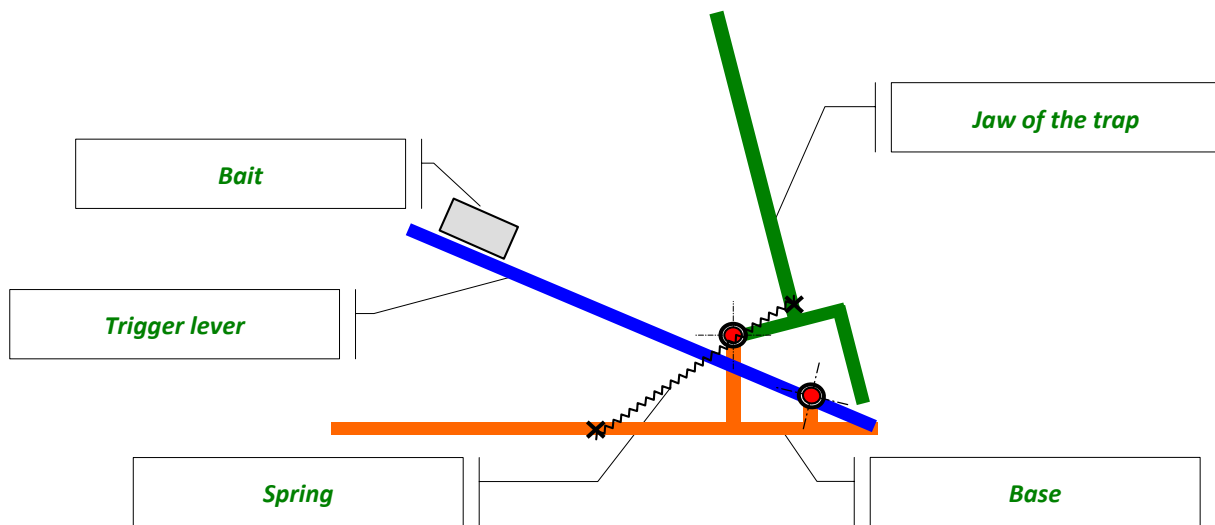
It is the teacher's responsibility to make the adjustments judged necessary, depending on the targeted audience. It may be appropriate to remove the retaining rod to prevent the trap being armed.

## Execution

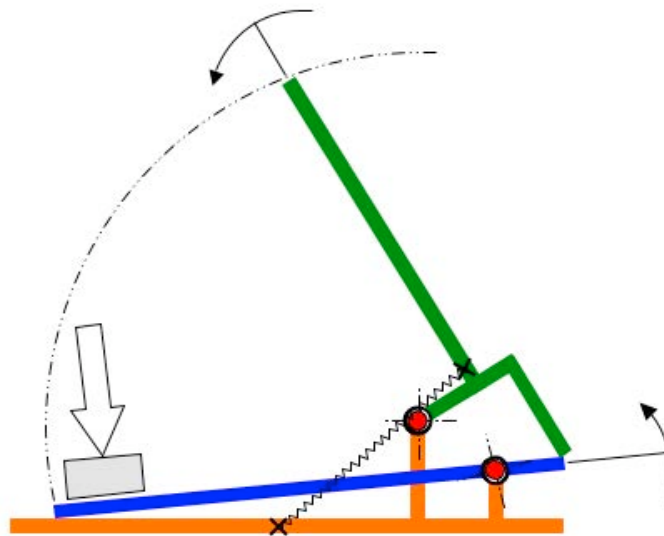
### Trap 1

Identification of the parts: *Base - Bait - Trigger lever - Spring - Jaw of the trap*

#### ARMED MECHANISM



#### MECHANISM IN ACTION

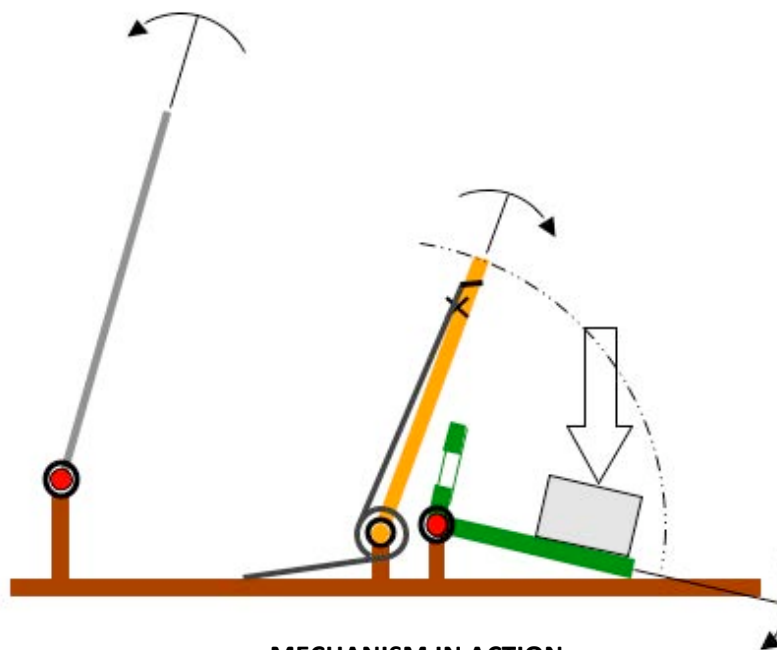
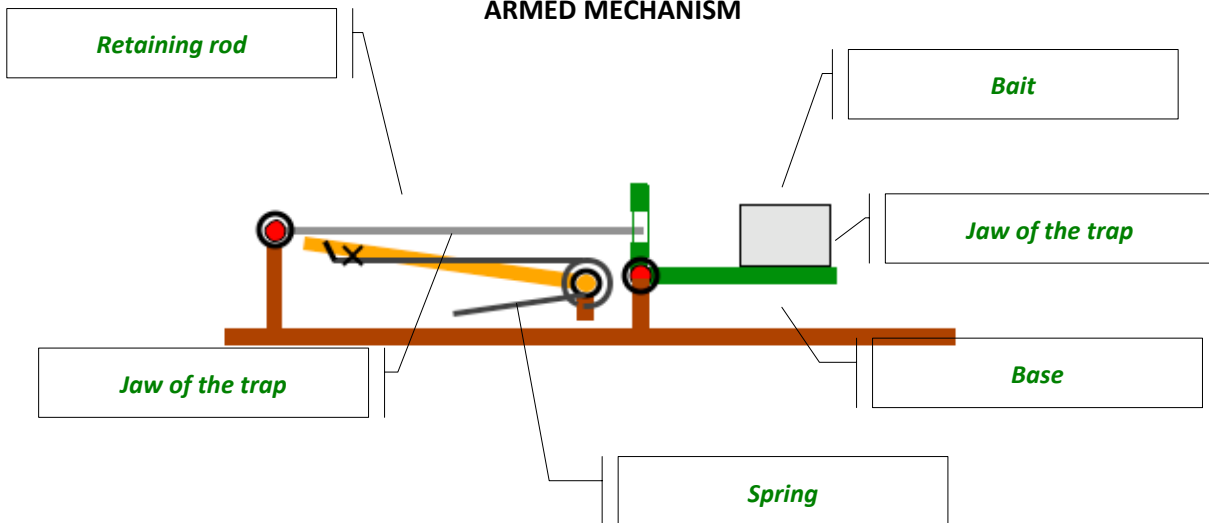


## Execution

### Trap 2

Identification of the parts: *Base - Bait - Trigger lever - Spring - Jaw of the trap - Retaining rod*

#### ARMED MECHANISM



#### MECHANISM IN ACTION



## Execution

2. Observe each of the traps and answer the following questions:

a. Name the **type of spring** involved in the mechanism.

Trap 1 ..... **traction**  
*traction - compression - torsion*

Trap 2 ..... **torsion**  
*traction - compression - torsion*

b. Associate the type of lever present as **the trigger lever**. Justify your answer.

Trap 1 ..... **first-class**  
*First-class, second-class, third-class*

Justification

**The pivot (fulcrum) is located between the jaw of the trap (force) and the bait (resistance).**

Trap 2 .....  
*First-class, second-class, third-class*

Justification

**The pivot acts as a fulcrum and is located between the retaining rod (force) and the bait (resistance).**

c. Associate the type of lever present as **the jaw of the trap**. Justify your answer.

Trap 1 ..... **first-class**  
*First-class, second-class, third-class*

Justification

**On the mechanism in action, the pivot acts as a fulcrum and it is located between the spring (force) and the trigger lever (resistance).**

Trap 2 ..... **first-class**  
*First-class, second-class, third-class*

Justification

**The pivot acts as a fulcrum and is located between the spring (force) and the trigger lever (resistance).**

Note: This is a particular case. The type of lever varies between the position where the mechanism is armed and is in action. In fact, the toggle movement of the jaw makes the spring go from one side to the other of the support point. This makes the type of lever go from third-class (armed) to first-class (in action).

Note: The point of view is important. When the user arms the trap, the spring acts as a resistance force, so it is a second-class lever. When the trap is triggered, the spring acts as a force, so then it is a third-class lever.

## Execution

d. Find **a link** and identify the parts involved.

Trap 1

**Some possible answers:**

- Spring linked to the base by two notches in the base
- Spring linked to the jaw by a groove
- Jaw linked to the base by the spring
- Lever linked by its wings and slits in the base

by .....

Trap 2

**Some possible answers:**

- Retaining lever linked to the base by an eyelet (a staple)
- Trigger lever linked to the base by an axle (a staple)
- Jaw linked to the base by two staples (eyelets)
- Spring linked to the jaw by its shape (elongated arm)

by .....

e. Find **a guidance control** and identify the parts involved.

Trap 1

**Some possible answers:**

- The jaw is guided in (partial) rotation by its pivot points with the base and the force of the spring
- Trigger lever is guided in (partial) rotation by its wings

by .....

Trap 2

**Some possible answers:**

- Accept: The retaining rod is guided in (partial) rotation by the eyelet
- The trigger lever is guided in (partial) rotation by the axle
- The jaw is guided in (partial) rotation by its axle (which is a part of the jaw itself) inserted in the pivots that are the eyelets (staples)

by .....

f. Is one of the two models better suited to the user than the other? (Ease of use, safety, etc.)

**Variable answers**