



## Traps



### 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.

### GUIDE

**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.

## The traps at a glance

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

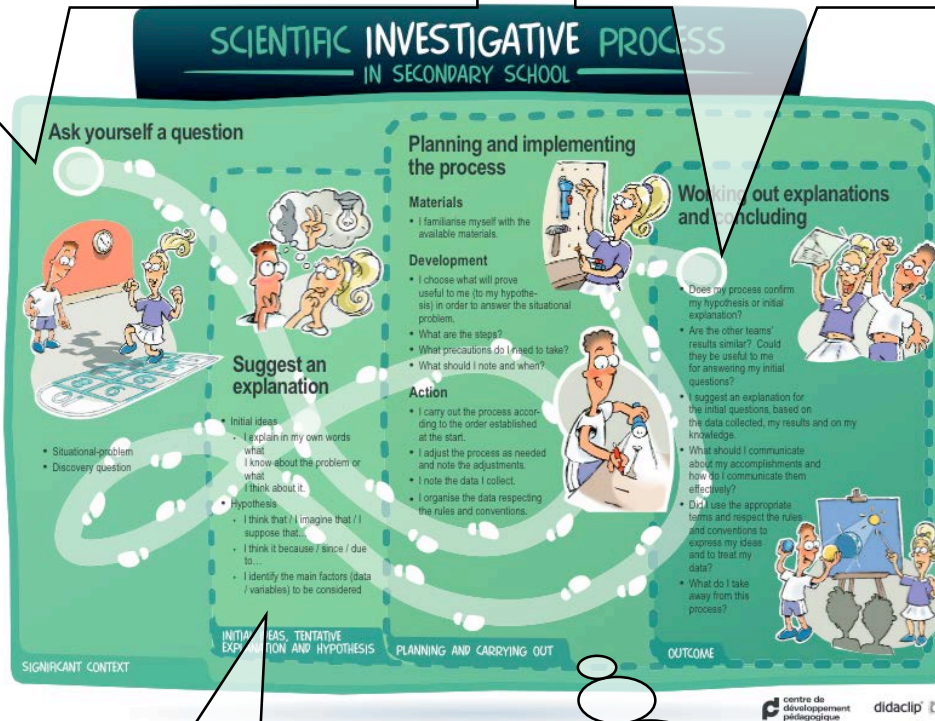


### Complex task proposed to students

Choose the better of two mouse traps using a scientific investigative procedure (performance test).

Main targeted learning (p. 4 to 6):

- Initiation to the scientific investigation procedure;
- Learning techniques related to measurement and safety.
- Understanding the importance of experimental factors (variables).



Targeted erroneous impressions:  
None in this LES

As learning activities:

- Using certain measurement instruments (e.g. dynamometer, scale)
- Safe manipulation of equipment, particularly as far as mouse traps are concerned.

**Traps**  
**Science and technology - 1st cycle of high school**  
**Overview**

**Pedagogical intentions**

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

- Be initiated to the implementation of a scientific investigation procedure in science and technology starting in the 1st cycle of high school;
- Be initiated to the use of certain measurement instruments (e.g. dynamometer, scale);
- Understand the importance of experimental factors during scientific investigations;
- Learn safety procedures when manipulating equipment.

**Suggested context**

In the *Traps* task, the student takes on the role of someone who has to test objects responding to the same need, in order to identify the best one. To do so, the student must design his own test and thus implement an entire scientific investigative procedure.

**Duration**

75 minutes (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)**

- Seeks answers or solutions to scientific or technological problems
- 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 vocabulary 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.

★ B.1.b.i. Explains the effects of a force in a technical object (change in the motion of an object, distortion of a material)

★ B.1.c.i. Identifies wheels, inclined planes and levers in simple technical objects

★ B.1.c.ii. Describes qualitatively the mechanical advantages of different types of levers (first-class, second-class, third-class) in different applications

★ D.1.b.i. Names the materials present in a technical object

## Techniques

↻ In elementary school: Students become familiar with the use of observational instruments (magnifying glass, stereomicroscope, binoculars) and simple measuring instruments (ruler, eyedropper, graduated cylinder, balance, thermometer, chronometer).

★ B.a.i. Uses laboratory materials and equipment safely

★ B.d. Using measuring instruments

i. Adopts the appropriate position for reading an instrument

ii. Measures the mass of a substance using a balance

## Strategies

### Exploration strategies

- Issue hypotheses
- Anticipating the results of his or her approach
- Take into account the constraints at issue in the resolution of a problem (e.g. available resources, time allowed)
- Ensuring that the procedure is appropriate and safe and making the necessary adjustments

### B. Instrumentation strategies

- Using technical design to illustrate a solution (e.g. diagrams, sketches)
- Using different tools for recording information (e.g. diagrams, notes, graphs, procedures, logbook)
- Using observation techniques or tools
- Select observation techniques or tools

### C. Analysis strategies

- Determine the constraints and the elements essential to resolving a problem

### D. Communication strategies

- Comparing different possible explanations for or solutions to a problem in order to assess their relevance (e.g. full-group discussion)
- Resort to tools allowing the data to be represented in the form of tables or graphs or to draw diagrams

## 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.**



## **Useful complementary references**

### **Centre de développement pédagogique**

Scientific investigation procedure poster

[http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/affiches\\_sec/invest\\_ang\\_sec\\_8x11.pdf](http://www2.cslaval.qc.ca/cdp/UserFiles/File/downloads/affiches_sec/invest_ang_sec_8x11.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>• Initial ideas: hypothesis</li> </ul>	<p>1</p> <p>1</p>
<b>Manufacturing stage</b>	
<ul style="list-style-type: none"> <li>• Planning the test</li> <li>• Carrying out the procedure</li> <li>• Noting data and observations</li> </ul>	<p>2</p> <p>2 and 3</p> <p>3</p>
<b>Integration stage</b>	
<ul style="list-style-type: none"> <li>• Results of the test and explanations</li> <li>• Review of hypothesis</li> <li>• Comparing results with others'</li> </ul>	<p>4</p> <p>4</p> <p>4</p>
<b>Learning activities (at a time judged appropriate)</b>	<b>Optional</b>
<ul style="list-style-type: none"> <li>• Using a dynamometer</li> <li>• Using a scale</li> <li>• Safely manipulating a mouse trap</li> <li>• Review the appropriate use of known observation or measurement instruments</li> </ul>	<p>These activities are not in the student booklet.</p>



## Animation guide Important!

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

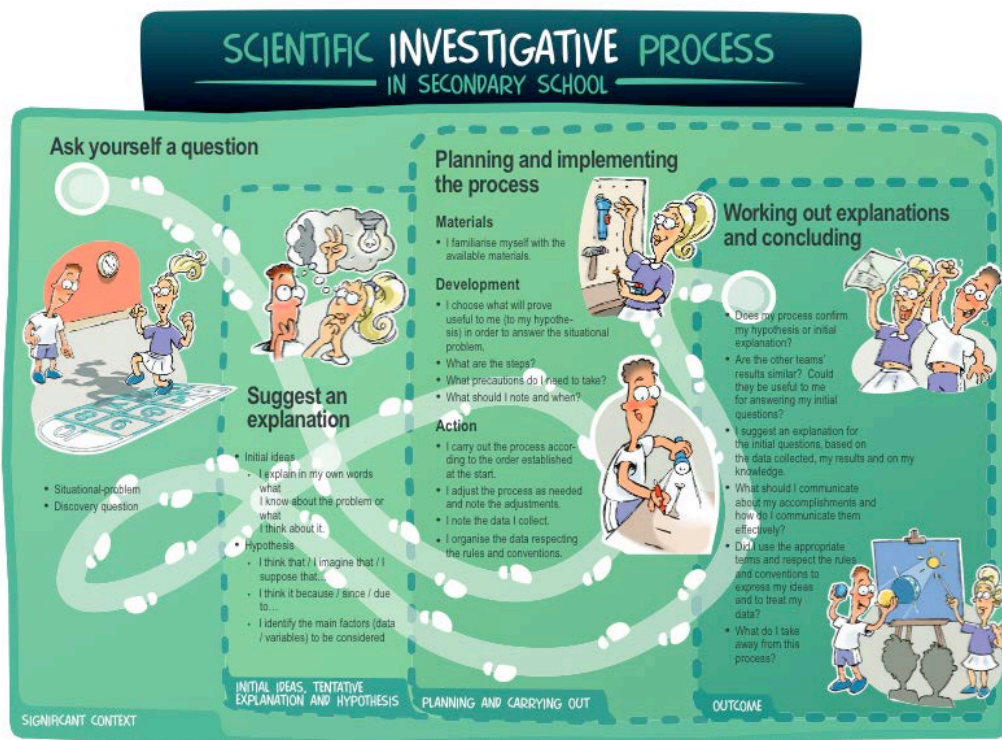
For the *Traps*, there is a single version of the student booklet: an "open" booklet. This four (4) page booklet was designed to be printed two-sided. That way, the students can see pages 2 and 3, where the planning and implementation of the scientific investigative procedure are found, at a glance.

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. Using the open booklet 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 some of the activities in the booklet by more guided elements if it proves necessary. This will need to be taken into account when comes time to evaluate, however.

We have produced an animation guide that groups all the aspects required for a smooth progression (overview, animation, preparation of the equipment, etc.). While allowing the students to experience a scientific investigation procedure, the following pages propose animation suggestions related to the student booklet.

The animation may appear linear. Nonetheless, as scientists and technologists do, it is possible, and even preferable to allow the students to go back over certain elements in order to readjust them.

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





### Preparation stage

**Background and statement of the problem to be resolved.**

**Estimated time: 10 minutes, including the time to explore questions in the vignette (to be validated)**



centre de  
développement  
pédagogique  
pour la formation générale  
en sciences et technologie

### Student booklet

Name: .....



### Traps

The world of science and technology is also to observe the objects around us in order to better understand them. Scientific methods must sometimes be used to answer certain questions.

#### Your mission

You will be presented two models of mouse traps. You have to think up a test in order to test them. You must select the one that seems best to you, based on experimental proof.



Note: The available materials do not include live or dead animals.

### 1. Background and statement of the problem

Read the context and the statement of the problem with the students.

Depending on the experience of the students, it may be necessary to explore certain aspects related to the problem, but also to the test they will have to design. The questions found in the vignette in the middle of the page allow the problem to be better understood, and to introduce important elements in a scientific investigation procedure.

Exploring these questions may be carried out as a full group discussion or in another animation structure, at the teacher's discretion. It is important to pay particular attention to what may be considered experimental proof.

The elements necessary to experimental proof may vary a bit from one problem to another, but here are certain elements that should be understood by the students:

- The experimental conditions are constants;
- Measurements are carefully made.
- Observations are objective and rigorously describe what is happening or what is observed.
- The results can be replicated over several tests.
- It is possible to validate the conclusion with a different test, but which targets the same variable, the same experimental factor.

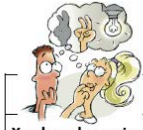
Here are some questions to guide your thought process and imagine your test:

- What is this object used for?
- How does it work?
- What should a good mouse trap do?
- What could be supplied as proof?

It is possible to complete this part of the task by exploring the critical points on the poster of the scientific investigative procedure.



**Preparation stage**  
**Proposing an explanation: initial ideas and hypothesis**  
**Estimated time: 10 minutes (to be validated)**



**Initial ideas**

You have been given two models of mouse traps.

**Your hypothesis:**

1. In your opinion, which is the better mouse trap? Why?

.....

.....

.....

.....

.....

Here are some questions to guide your thought process and imagine your test:

- What is this object used for?
- How does it work?
- What should a good mouse trap do?
- What could be supplied as proof?

### 1. Formulating a hypothesis

Each student must formulate a hypothesis. Ideally, this hypothesis should be able to be validated experimentally afterwards. However, since the students have little experience and since they must work in teams for planning and carrying out the process afterwards, we must accept hypotheses which are not able to be directly validated experimentally.

If the task is carried out further in the cycle, rather than at the very beginning, it may also be possible to require the students to use the knowledge acquired to justify their hypothesis (e.g. refer to the lever).

In addition, it is important to remind the students that there is no "right answer" in this section. The hypothesis will either be confirmed or refuted. The quality of the hypothesis will be judged based on the statement of its justification.

Strategy for writing the hypothesis:

Require that the hypothesis be written in ink. Indeed, many students are tempted to modify their hypothesis as they go along, believing they will be penalised for a "wrong answer".

### Safety

Mouse traps can be manipulated safely. Some precautions need to be taken. **There must be a formal teaching process in this regard.** To this end, videos presenting the precautions to take when manipulating and arming traps are available on the CDP site (*to come*).

Even if all the precautions are taken, it is possible that a student or an adult gets their fingers stuck in a trap. By using some types of traps rather than others, you may not avoid the unpleasant sensation of getting your fingers stuck, but will avoid injury. Recommendations about the types of traps can be found on page 17 of the guide (Suggestions for materials).

Finally, **this is the perfect opportunity for introducing the notions regarding safety in Science and technology.**



**Manufacturing stage**  
**Planning the procedure**  
**Estimated time: 20 minutes (to be validated)**

*Planning and production*

---

**2. Observe the equipment and plan your test.**  
 How do you plan to determine which of the two mouse traps is the best?

☛ If you must change the elements as you go along, use a **different colour pencil** to adjust and annotate your initial plan.

Cr2 Development of a suitable procedure	Planning the procedure Selection of resources (materials, equipment, etc.)	
Cr3 Appropriate implementation of the procedure	Adjustments during the implementation of the procedure Observances of safety rules	

Centre de développement pédagogique  
trappes\_invest\_sciens\_eleve\_EN.docx
Winter 2015  
Page 2

**1. Planning the procedure**

In teams of two, the students plan a test for testing their mouse traps. The plan may take several forms. It may be a numbered list, but you may also find an annotated drawing or a graphical organiser.

For the list of equipment, the students may present a formal listing but the choice of resources may also be found in the plan, where the names of the items are written or drawn.

Strategies for making student planning easier:

- Suggest that the students identify the experimental factor against which they will judge the best trap from the outset.
- Encourage them to manipulate the equipment from the start, before even having left traces to this effect.
- Allow the students to be inspired by tests done by consumer protection organisations for other products.

**2. Readjustments during the process**

It is likely that the students will have to readjust the initial idea in their plan. Some may even abandon their initial idea and find another one. The students must be invited and encouraged to note the adjustments made as they go along.

With some groups of students, it may be interesting to take some time with the whole class so the teams can present their ideas. The plans may thus be compared to each other. Exchanges between students will allow some to readjust their test. Here are ideas of questions to ask when animating these exchanges:

- What experimental factor (variable) is tested using this test?
- How are measurements carried out?
- What safety measures are foreseen?
- How does this test represent a mouse or small rodent that has to be trapped?
- Can this test be carried out in class with the equipment at your disposal in the allotted time?



**Manufacturing stage**  
**Carrying out the procedure - Noting data and observations**  
**Estimated time: 20 minutes (to be validated)**



*Carrying out the procedure*

3. Present your data and your observations:

--

C3 Appropriate implementation of the procedure

Recording the data

Using appropriate types of representation (tables, graphs)

### 1. Note data and observations

It may be difficult for a student who has not regularly experienced the implementation of an investigative procedure to rigorously note the data collected and observations made.

Several strategies can be adopted to learn how to take notes and make observations:

- Encourage the students to loosely note, or draw what they measure or observe;
- Encourage the students to quickly reorganise the presentation of their data after this first note-taking;
- Require that the students include the units of measurement with their measurements;
- Model data collection and noting observations;
- Allow the use of additional pages to reorganise data.

The students have been using data tables since the beginning of grade school. It may be appropriate to remind them of the usefulness of these tables. In the heat of the action, however, students often don't think to make a table

when they plan their procedure.

### 2. Replicating the test

Ideally, the test should be replicated a few times to ensure that the results aren't random. If time does not allow this, it will need to be brought to the attention of the students that an important part of the procedure was omitted.

#### Using CITs - Optional


To note data, but especially to keep traces of observations, it is possible to use tools from CIT. For this LES, using a digital camera would allow videos and pictures to be taken. In some cases high-speed cameras would even allow the students to see the trap being triggered in slow motion.



**Integration stage**

**Outcome**

**Estimated time: 15 minutes or more if a full group discussion takes place (to be validated)**



*Outcome*

4. Explain which trap is better based on the results of your test and on your observations.

-----

-----

-----

-----

5. Is your initial hypothesis confirmed or refuted? Justify your answer.

-----

-----

-----

-----

6. Did the tests carried out by the others enable them to come to the same conclusion? Explain your answer.

-----

-----

-----

Cr4 Development of relevant explanations, solutions or conclusions	Formulation of explanations or conclusions in accordance with the data collected and knowledge acquired	
	Verification of consistency of the hypothesis with the analysis of the results.	
	Use of appropriate terminology, rules and conventions	

**1. The best trap**

Using the data collected and observations made during the implementation of the procedure, the students can draw a conclusion and determine which trap is the better of the two. If it is necessary, the student may also complete his explanation using acquired knowledge (e.g. talking about the lever at issue).

**2. A test that does not distinguish the best trap**

Sometimes, students could have planned a test that does not allow the best trap to be identified. Then, the student must describe or explain why the test was not significant. In addition, two strategies are possible:

- If time allows, the students may plan and carry out a new test.
- If time does not allow, it is possible to require the students to propose a new test, without carrying it out.

**3. Review of hypothesis**

Next, the student must review his initial hypothesis and state whether it is confirmed or refuted. In either case, the student must justify his answer. To do so, he will have to use the data collected and observations made during his

procedure.

In addition, for the student whose hypothesis is refuted, it may be pertinent to identify what made him believe his initial hypothesis was true. Here are some examples of questions to guide his justification:

- Was the hypothesis consistent with what was planned afterwards?
- Did the hypothesis rest on the belief or influence of publicity, for instance, rather than on direct observation of the two traps?
- Was the hypothesis issued randomly?

**4. Comparing results with others'**

Finally, the students will have to compare results. This may be shared orally - time will have to be set aside for this exchange. If the time is not sufficient, they will need to compare to at least one other team.

Means other than a full group discussion may be used. For example, it is possible to make a compilation in an electronic file (word document or spreadsheet) which is then projected onto an interactive board or consulted in another manner. In all cases, a description of the test carried out must accompany the results.

Ideally, a single trap should not work on all tests. If this were the case, it is likely to be the "traditional" trap that succeeds at all the tests. It would then be possible to propose a test that enables the other trap to succeed. If the students did not think of testing the time required to arm a trap, this test could be carried out as a demonstration, for example.

The importance of this step is to discover that there is not one single type of test that determines if an object is the best. It would be by using a series of tests, using different experimental factors (or variables) that is it possible to evaluate the performance of one product relative to another. This last part of the LES allows not only the elements related to the *Environment and consumption BAL* to be broached, but also the importance of defining the problem well before beginning its resolution.

## 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>Pages</b>
Cr1 Appropriate representation of the situation	Formulating hypotheses	1
Cr2 Development of a suitable procedure	Planning the procedure	2
	Selection of resources (materials, equipment, tools, etc.)	2
Cr3 Appropriate implementation of the procedure	Observance of safety rules*	2 (Direct observation)
	Recording the data	3
	Adjustments during the implementation of the procedure	2
	Using appropriate types of representation (tables, graphs)	3
Cr4 Development of relevant explanations, solutions or conclusions	Formulation of explanations or conclusions in accordance with the data collected and knowledge acquired	4
	Verification of consistency of the hypothesis with the analysis of the results.	4
	Use of appropriate terminology, rules and conventions	4
Proficiency of subject-specific knowledge targeted in the <i>Progression of Learning</i>	Technological World - mechanical engineering  Using measuring instruments and observational instruments	

Notes:

- The elements marked with an asterisk (\*) may be used for direct feedback to the students at the time the procedure is carried out.



## Suggestions for equipment and instruments

Materials to be put at the students' disposal for a class of 32 students  
Other than the two (2) types of traps and safety glasses, diversified equipment should be made available to the students so that they can create original tests.

Articles	Notes
16 "traditional" wood-based mouse traps	The Victor® brand is easy to find. The model with a yellow plastic bait support is recommended. <b>You must take the time to give the safety instructions.</b> It is possible to use traps bought at the grocery or dollar store in which the springs are often less powerful. 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.
16 plastic mouse traps	There are many plastic mouse traps. Some are very powerful and could injure even the most careful of people. Others are less powerful. It is recommended you use the latter.
Plasticine	The plasticine could be used to simulate the body of an animal. A small quantity (about the size of a golf ball) is sufficient. We recommend you use the type of plasticine used in art, rather than the brands that are water-soluble, which dry out, but which are also more malleable.
Chopstick or popsicle stick	To trigger the trap without touching it. May be used for other types of manipulations.
Rulers	Ideally, you would use metal rulers with graduations right from the edge.
Tweezers	Tweezers may be used to safely place objects on the traps. (Tweezers or condiment tongs)
Timer	To measure the time.
Scale	To measure mass.
Dynamometer	To measure force.
Various equipment	Adhesive tape, paper clips, string, etc.
32 pairs of safety glasses	It is mandatory to wear glasses. This is to avoid accidents that could come about if a part should become detached during the manipulations.

### CAREFUL!



This task proposes that students work with mouse traps, but at no time may students work with animals, alive or dead. In addition, 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.**