LES 10

**O B S E R V A T O R Y**
**SCIENCE AND TECHNOLOGY (ST)**
**Teacher's Guide A**
**Second Year of Secondary Cycle Two**

# TURNING LIKE CLOCKWORK

## STUDENT LOG

### WORKING DOCUMENTS



### EVALUATION DOCUMENTS



**PROCEDURE AND EVALUATION: SSC1 – TECHNOLOGY**


*Observatory* / Guide
11129-A

Name: _____ Group: _____ ST

# The project

## Cyclones may intensify with climate change

The enormous amounts of greenhouse gases generated by fossil-fuel combustion will cause **cyclones that are more violent than ever,** according to an article by three meteorologists, published in the international scientific journal *Nature*.

The trio of researchers analyzed the maximum wind speeds of cyclones that occurred between 1981 and 2006. During this period, weather satellites made precise observations and recordings of these natural disasters, allowing the scientists to classify them according to their severity. The research led to a surprising observation for the year 2005: although the average wind speed showed no change, the speed of the strongest winds increased—and even more so in the case of violent cyclones.

The scientists related this change to temperatures at the surface of ocean waters. This makes sense since the theory behind cyclone formation depends essentially on a transfer of energy from water to air. The study shows that, for the 10 percent of cyclones that are the most severe, an increase in temperature of 1°C increases the speed of the strongest winds by about 6.5 m/s. Simply put, the more human-induced climate change heats up the oceans, the more we will be at risk of severe cyclones.

Source: Adapted from the blog of Sylvestre Huet, journalist with *Libération*, "La violence des cyclones pourrait augmenter avec les changements climatiques," September 4, 2008 (accessed September 7, 2008). *[Translation]*

Montréal, September 17, 2008

Mr. Dennis Durning
Vice President, Research and Development
The Great Outdoors
140 Désormais Rd.
Estman, Québec H4Z 7Q9

Dear Sir:

We would like to inform you of a new project that will be assigned to your design team.

Climate change appears to be leading to an increase in strong winds. According to our marketing department, sailing and hang-gliding clubs are interested in procuring a device that their clients could use to assess the wind strength before they set out on an excursion.

To fulfill this market demand, we are entrusting your department with the design of such a device. Your team must submit a prototype that meets the enclosed specifications.

We plan to launch this new product next July and thank your team in advance for its invaluable cooperation.

Sincerely,

***Louise Lestman***
Louise Lestman
President, The Great Outdoors



In this context, you will play the role of a designer assigned the task of creating a technical object that can be used to gauge wind strength.

# The project *(continued)*

## SPECIFICATIONS

**General purpose of the prototype**

- The purpose of the prototype of the technical object is to gauge wind strength.

**Material constraints**

- The prototype must contain a variety of parts, which together make it possible to gauge wind strength.
- The prototype must include at least one motion transmission system.
- The prototype must include at least one motion transformation system.
- The prototype must include at least one speed change.

**Human constraint**

- The prototype must be easy to install and use.

**Aesthetic constraint**

- The prototype must be neat in appearance without necessarily being a work of art.

**Safety constraint**

- The edges of each part must not be sharp.

**Financial constraint**

- Using materials responsibly must be a priority.

**Environmental constraint**

- Using recycled materials must be a priority.

Name: _____ Group: _____ ST

# Creating the context

## I ask myself questions

**1.** Define motion transmission.

**2.** What is a motion transmission system?

**3.** What types of systems transmit motion? Give three examples.

**4.** How could you introduce a speed change into a motion transmission system?

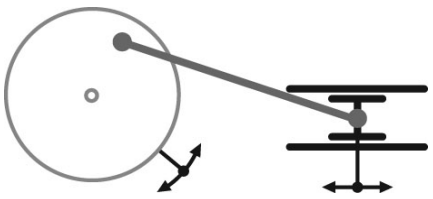
Name: _____ Group: _____ ST

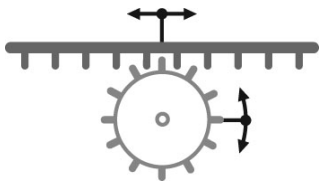
# Creating the context (*continued*)

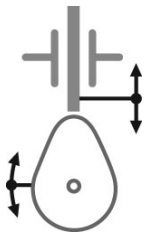
**5.** Define motion transformation.

**6.** What types of systems transform motion? Give five examples.

**7.** Which of these systems are reversible?







# Creating the context *(continued)*

**8.** Define the eight characteristics of links in mechanical parts.

**9.** What do we mean by *guiding* in a technical object?

# Creating the context (*continued*)

**10.** Name the main types of guiding controls and draw their symbols.

**11.** In what type of diagram would you depict guiding controls? Explain your answer.

**12.** What is a mechanical property of a material?

**13.** Why do the mechanical properties of materials have to be taken into consideration? Give an example.

## I must

**14.** Reformulate the goal of the project.

Name: _____ Group: _____ ST

# Creating the context *(continued)*

## I think

**15.** What do you think is the best design approach for your object?
Draw a design plan including the names of the parts, their types of motion, the forces at work and the constraints the materials will undergo.

## Reflection

| | Yes | No |
|---|---|---|
| • Does my design plan meet the specifications? | ☐ | ☐ |
| • Do I fully understand the technological concepts related to the project? | ☐ | ☐ |

Name: _____ Group: _____ ST

# Planning the project

## I plan

**1.** Which motion transmission and transformation systems will you use in your prototype?

_____

_____

**2.** Draw the technical diagram or diagrams for your prototype. Remember to include the following information:

- the names of the parts
- the linking components
- the materials
- the guiding controls
- any other useful information for building your prototype

Name: _____ Group: _____ ST

# Planning the project *(continued)*

**3.** Make a list of the equipment and materials you will need to build your prototype.

**4.** What safety rules should you follow while building your prototype?

Ask your teacher to approve your plan of action before building your prototype.

Teacher's initials

## Reflection

| | Yes | No |
|---|---|---|
| Have I considered other approaches to building my object? | ☐ | ☐ |

Name: _____ Group: _____ ST

# Completing the project

## I build

**1.** Prepare a table for recording your results when you test your prototype. Give your table a title.

**2.** Build the prototype of your object, following your technical diagrams. If you alter your plan of action, make the appropriate changes in your diagrams and in the list of equipment and materials. Make sure you keep a record of any changes.

**3**. Did you work safely? Justify your answer with at least two examples of safety-conscious behaviour.

## Reflection

| | Yes | No |
|---|---|---|
| Did I record and justify each of the changes I made to my plan of action? | ☐ | ☐ |

Name: _____ Group: _____ ST

# Testing the prototype

## I evaluate my prototype

After you have recorded the results of your test, answer the following questions.

**1.** Does the prototype fulfill the general purpose of the object? Justify your answer.

**2.** Explain how you met the requirements described in the specifications.

**3.** Did you alter your plan of action? If so, justify each of your changes.

**4.** Did you have any problems designing and building your prototype? If so, what were they?

# Testing the prototype *(continued)*

**5.** What are the advantages of your prototype?

**6.** What are the disadvantages of your prototype?

**7.** Suggest some improvements you could make to your prototype.

Name: _____ Group: _____ ST

# My evaluation

Use the evaluation grid on the following page to evaluate yourself. Write A, B, C, D or E in the "Me" column of the chart below.

| SSC1—Seeks answers or solutions to scientific or technological problems | | | | |
|---|---|---|---|---|
| **Criteria*** | **Observable indicators** | **Me** | **Teacher** | **Comments** |
| **1** | **Creating the context**<br>Definition of the goal and completion of the design plan | | ☐ With help | |
| **2** | **Planning the project**<br>Relevance of the elements of the plan of action: list of materials and technical diagram | | ☐ With help | |
| **3** | **Completing the project**<br>Compliance with the technical diagram and with safety rules | | ☐ With help | |
| **4** | **Testing the prototype**<br>Analysis of the prototype operation and suggested improvements | | ☐ With help | |



*** Evaluation criteria**

**1** Appropriate representation of the situation
**2** Development of a suitable plan of action for the situation
**3** Appropriate implementation of the plan of action
**4** Development of relevant conclusions, explanations or solutions

# Evaluation grid

Name: _____ Group: _____

## SSC1 Seeks answers or solutions to scientific or technological problems

| Criteria* | Observable indicators | A | B | C | D | E |
|---|---|---|---|---|---|---|
| 1 | **Creating the context**<br>Definition of the goal and completion of the design plan | The goal is very clearly defined and relevant, AND the design plan is complete. | The goal is clearly defined and relevant, AND the design plan contains a few minor errors. | The goal is not very clearly defined or is irrelevant, OR the design plan contains many errors. | The goal is not very clearly defined or is irrelevant, AND the design plan contains major errors. | The work must be done again. |
| 2 | **Planning the project**<br>Relevance of the elements of the plan of action: list of materials and technical diagram | The choice of materials is appropriate, AND the technical diagram is complete. | The choice of materials is appropriate, AND the technical diagram contains a few minor errors. | The choice of materials is partly appropriate, OR the technical diagram contains many errors. | The choice of materials is partly appropriate, AND the technical diagram contains many errors. | The work must be done again. |
| 3 | **Completing the project**<br>Compliance with the technical diagram and with safety rules | The prototype complies with the technical diagram, AND the work was done safely. | A few elements of the prototype do not comply with the technical diagram, AND the work was done safely. | Many elements of the prototype do not comply with the technical diagram, AND the work was done safely. | The prototype does not comply with the technical diagram, OR the work was not done safely. | The work must be done again. |
| 4 | **Testing the prototype**<br>Analysis of the prototype operation and suggested improvements | The prototype works and meets all the specifications, AND the suggested improvements are relevant. | The prototype meets most of the specifications, AND most of the suggested improvements are relevant. | The prototype meets most of the specifications, but the suggested improvements are not very relevant. | The prototype does not meet most of the specifications. | The work must be done again. |

*** Evaluation criteria**

**1** Appropriate representation of the situation
**2** Development of a suitable plan of action for the situation
**3** Appropriate implementation of the plan of action
**4** Development of relevant conclusions, explanations or solutions