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

# IT'S ELECTRIC!

## STUDENT LOG

### WORKING DOCUMENTS



### EVALUATION DOCUMENTS



**PROCEDURE AND EVALUATION: SSC1 – TECHNOLOGY**

*Observatory* / Guide
11129-A

Name: _____ Group: _____ EST AST

# The project

From: Alexandra Plummer
To: Stephen Morse
Date: Monday, 2008-09-08 10:55
Subject: Water gauge project

Dear Sir:

Last week, you sent out an invitation to electrical engineering students, asking them to submit a project in technical design and manufacturing related to the environmental issue of drinking water.

In light of the growing interest in rainwater recovery systems in public buildings, increasing numbers of homes can be expected to adopt such systems, too. In my opinion, the tank, an essential component of this type of system, should be equipped with a water gauge that indicates how much water has been collected. My project is to design and build such a device.

I hope that my project meets your requirements and thank you for considering my proposal.

Yours truly,
***Alexandra Plummer***
Student

From: Stephen Morse
To: Alexandra Plummer
Date: Monday, 2008-09-15 19:55
Subject: Water gauge project

Dear Alexandra,

A water gauge for rainwater tanks would be an excellent way to reduce the consumption of drinking water and contribute to sustainable development. I would be happy to supervise your project. However, since your proposal provides only a general description of the project, I am sending you a set of specifications (see the attached document). Please follow these requirements.

Best regards,
***Stephen Morse***
Professor, Department of Engineering

Specifications

# The project (*continued*)

## WATER GAUGE

### Specifications

**General purpose of the prototype**

- The prototype must indicate the water level in a tank.

**Material constraints**

- The prototype must indicate at least five different volumes.
- The prototype must include an electrical system.
- The prototype must use as little power as possible.
- It must be possible to turn off the electrical system.

**Human constraint**

- The prototype must be easy to use.

**Aesthetic constraint**

- The prototype must be neat in appearance without necessarily being in its definitive form.

**Safety constraints**

- The edges of each part must not be sharp.
- The prototype must be safe to use.

**Financial constraint**

- Using materials responsibly must be a priority.

**Environmental constraint**

- Using recycled materials must be a priority.

In this context, you will play the role of Alexandra Plummer. You will design and build a prototype of a water gauge that measures the water level in a tank.

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# Creating the context

## I ask myself questions

**1. a)** What is an electrical circuit?

**b)** What distinguishes direct current from alternating current?

**c)** Name a source of direct current and a source of alternating current.

**2. a)** What is the electrical function of power supply?

# Creating the context (*continued*)

**b)** In the table below, give some examples of components that provide a power supply. Draw the symbol for each component and write at least one advantage and one disadvantage of using it as a power source.

| Component | Symbol | Advantage | Disadvantage |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

**3. a)** What is the difference between conduction and insulation?

_____

_____

_____

_____

_____

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# Creating the context (*continued*)

**b)** Name a component that acts as a conductor and draw its symbol, if it has one.

**c)** Name a component that acts as an insulator and draw its symbol, if it has one.

**4. a)** What is the electrical function of protection?

**b)** Name a component that acts as a protective device and draw its symbol.

EST **c)** What is a resistor? What is its symbol?

EST **d)** Which electrical function does a resistor perform?

EST **e)** What do the coloured bands on a resistor mean? Explain your answer.

# Creating the context (*continued*)

**5. a)** What is the electrical function of control?

**EST b)** Give some examples of components that control circuits and draw their symbols.

**c)** What is the difference between an open circuit and a closed circuit?

**d)** Do you think you have to include a control component in the device you are going to design? Explain your answer.

**6. a)** What is the electrical function of the transformation of energy?

**b)** Name some electrical components that transform energy and draw their symbols, if they have one.

# Creating the context (*continued*)

**c)** Which of these components could you use in your device? Explain your answer.

EST **d)** What is a diode?

EST **e)** Name an advantage of using light-emitting diodes (LEDs).

EST **f)** What precautions must be taken with LEDs?

## I must

**7.** Reformulate the goal of the project.

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# Creating the context (*continued*)

## I think

**8.** What do you think is the best approach to designing your water gauge? Draw a circuit diagram for this technical object. Make sure you include all the components you need for your device to work.

## Reflection

| | Yes | No |
|---|---|---|
| Do I fully understand the concepts covered in this situation? | ☐ | ☐ |

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# Planning the project

## I plan

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

# Planning the project (*continued*)

**2.** How will you calibrate your device to measure the volume of water in the tank? Explain your answer.

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

# Planning the project (*continued*)

**4.** Draw the technical diagrams for your prototype. Make sure that you indicate the following:

- the names of the parts
- the materials you will use
- the linking components you will use
- any other useful information

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# Planning the project (*continued*)

## Reflection

| | Yes | No |
|---|---|---|
| Have I considered other approaches to making each of the parts? | ☐ | ☐ |

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# Completing the project

## I build

**1.** Build your prototype, following your technical diagrams. Make sure that you record and justify any change you make to your drawings.

**2.** Did you work safely while building your prototype? 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? | ☐ | ☐ |

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# Testing the prototype

## I evaluate my prototype

After testing your prototype, answer the following questions.

**1.** Does the prototype fulfill the general purpose described in the specifications? Justify your answer.

**2.** Does your prototype meet all the requirements of the specifications? If not, explain your answer.

**3.** Did you alter your plan of action? Explain your answer.

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# Testing the prototype (*continued*)

**4.** What difficulties did you encounter while building your prototype?

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

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

**7.** What improvements would you make to your prototype?

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# 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 circuit diagram | | ☐ With help | |
| 2 | **Planning the project**<br>Relevance of the elements of the plan of action: list of materials and technical diagrams | | ☐ With help | |
| 3 | **Completing the project**<br>Compliance with the technical diagrams and the 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: _____

EST AST

## 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 circuit diagram | The goal is very clearly defined and relevant to the project, AND the circuit diagram is complete. | The goal is very clearly defined and relevant to the project, AND the circuit diagram contains a few minor errors. | The goal is not very clearly defined or is irrelevant to the project, OR the circuit diagram contains many errors. | The goal is not very clearly defined or is irrelevant to the project, AND the circuit diagram contains many 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 diagrams | The choice of materials is relevant, AND the technical diagrams are complete. | The choice of materials is relevant, AND the technical diagrams contain a few minor errors. | The choice of materials is not very relevant, OR the technical diagrams contain many errors. | The choice of materials is not very relevant, AND the technical diagrams contain many errors. | The work must be done again. |
| 3 | **Completing the project**<br>Compliance with the technical diagrams and the safety rules | The prototype complies with the technical diagrams, AND the work was done safely. | A few elements of the prototype do not comply with the technical diagrams, AND the work was done safely. | Many elements of the prototype do not comply with the technical diagrams, AND the work was done safely. | The prototype does not comply with the technical diagrams, 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, AND 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