### LES **13**

#### OBSERVATORY

**SCIENCE AND TECHNOLOGY (ST)** 

Teacher's Guide A Second Year of Secondary Cycle Two

## IT'S ELECTRIC!

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PROCEDURE AND EVALUATION: SSC1 – TECHNOLOGY



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#### 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.

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Yours truly, *Alexandra Plummer*Student

From: Stephen Morse

To: Alexandra Plummer Date: Monday, 2008-09-15

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

Q

#### 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**

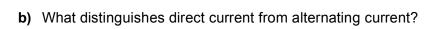
Using recycled materials must be a priority.

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.

#### **Creating the context**

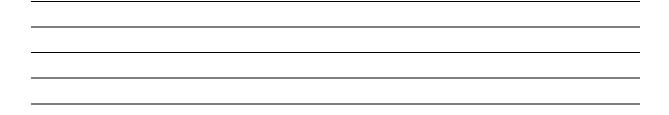
#### I ask myself questions

1. a) What is an electrical circuit?



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

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



**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?

- 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.

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

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

c) 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.

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

#### I must

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

#### 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?

#### Planning the project

#### I plan

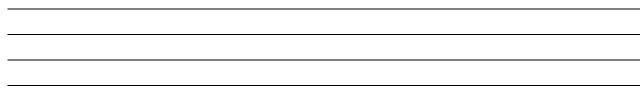
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	-	
	-	

#### 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 linking components you will use

• the materials 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?

Name:	Group:	 ST

#### **Completing the project**

#### I build

<ul> <li>Build your prototype, following your technical diagrams. Make sure that you re change you make to your drawings.</li> </ul>	ecord and jus	tify any
Did you work safely while building your prototype? Justify your answer with at of safety-conscious behaviour.	least two ex	amples
eflection	Yes	No
d I record and justify each of the changes I made to my plan of action?	Π	Π

#### **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.

#### 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.

				r solutions to scientific problems
Criteria*	Observable indicators	Ме	Teacher	Comments
1	Creating the context			
	Definition of the goal and completion of the circuit diagram		□ With help	
2	Planning the project			
	Relevance of the elements of the plan of action: list of materials and technical diagrams		□ With help	
3	Completing the project			
	Compliance with the technical diagrams and the safety rules		□ With help	
4	Testing the prototype			
	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** 

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# Seeks answers or solutions to scientific or technological problems



*sinetina	Observable indicators	A	В	С	Q	ш
1	Creating the context	The goal is very clearly defined and relevant to	The goal is very clearly defined and relevant to	The goal is not very clearly defined or is	The goal is not very clearly defined or is	The work
	Definition of the goal and completion of the circuit diagram	the project, AND the circuit diagram is complete.	the project, AND the circuit diagram contains a few minor errors.	irrelevant to the project, OR the circuit diagram contains many errors.	irrelevant to the project, AND the circuit diagram contains many errors.	done again.
2	Planning the project	The choice of materials is relevant, AND	The choice of materials is relevant, AND the	The choice of materials is not very relevant, OR	The choice of materials is not very relevant, AND	The work must be
	Relevance of the elements of the plan of action; list of materials and technical diagrams	the technical diagrams are complete.	technical diagrams contain a few minor errors.	the technical diagrams contain many errors.	the technical diagrams contain many errors.	done again.
3	Completing the project	The prototype complies with the technical	A few elements of the prototype do not comply	Many elements of the prototype do not comply	The prototype does not comply with the technical	The work must be
	Compliance with the technical diagrams and the safety rules	diagrams, AND the work was done safely.	with the technical diagrams, AND the work was done safely.	with the technical diagrams, AND the work was done safely.	diagrams, OR the work was not done safely.	done again.
4	Testing the prototype	The prototype works and meets all the	The prototype meets most of the specifi-	The prototype meets most of the specifi-	The prototype does not meet most of the speci-	The work must be
	Analysis of the prototype operation and suggested improvements	specifications, AND the suggested improvements are relevant.	cations, AND most of the suggested improvements are relevant.	cations, AND the suggested improvements are not very relevant.	fications.	done again.

# **Evaluation criteria**

Appropriate representation of the situation

Development of a suitable plan of action for the situation

3 Appropriate implementation of the plan of action

1 Development of relevant conclusions, explanations or solutions