LES 18

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

THE SUBMARINE

STUDENT LOG

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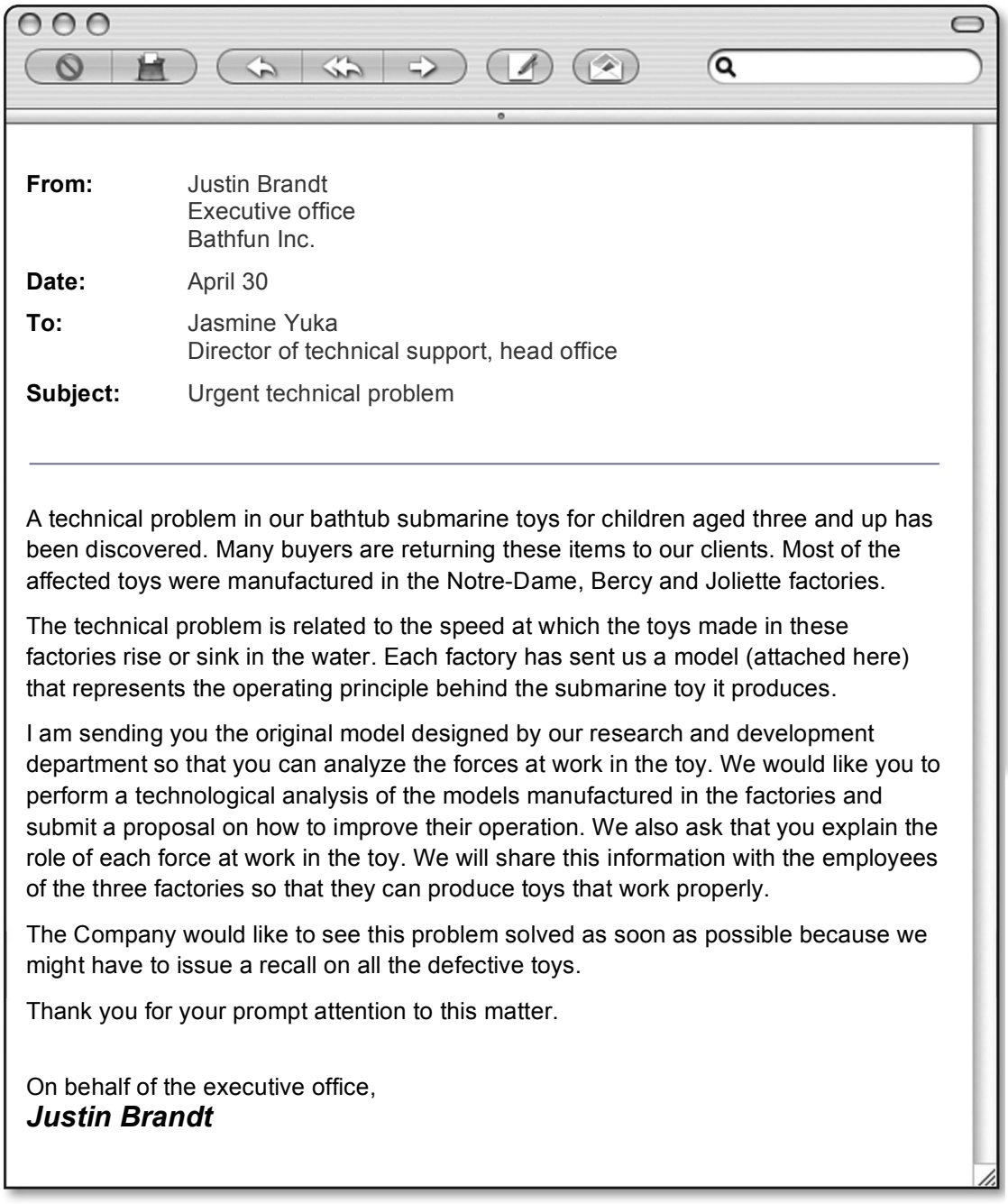
PROCEDURE AND EVALUATION: SSC2 – TECHNOLOGY

Observatory / Guide
11129-A

Name: _____ Group: _____ AST

The case study



From: Justin Brandt
Executive office
Bathfun Inc.

Date: April 30

To: Jasmine Yuka
Director of technical support, head office

Subject: Urgent technical problem

A technical problem in our bathtub submarine toys for children aged three and up has been discovered. Many buyers are returning these items to our clients. Most of the affected toys were manufactured in the Notre-Dame, Bercy and Joliette factories.

The technical problem is related to the speed at which the toys made in these factories rise or sink in the water. Each factory has sent us a model (attached here) that represents the operating principle behind the submarine toy it produces.

I am sending you the original model designed by our research and development department so that you can analyze the forces at work in the toy. We would like you to perform a technological analysis of the models manufactured in the factories and submit a proposal on how to improve their operation. We also ask that you explain the role of each force at work in the toy. We will share this information with the employees of the three factories so that they can produce toys that work properly.

The Company would like to see this problem solved as soon as possible because we might have to issue a recall on all the defective toys.

Thank you for your prompt attention to this matter.

On behalf of the executive office,
Justin Brandt

In this case study, you will play the role of a member of the technical support staff. In teams of two, you will analyze the original design of the research and development department and draw design plans of the toy during descent and resurfacing. You will also analyze one of the factory models and draw design plans of it during descent and resurfacing. You will then write a proposal on how to improve the model, and you will explain the forces involved.

Name: _____ Group: _____ AST

Creating the context

I ask myself questions

1. What is a submarine?

2. What is speed?

3. What is a force?

4. What questions should guide you in your technological analysis of the model representing the operating principle of the bathtub submarine toy?

Creating the context *(continued)*

I must

5. Reformulate the goal of the case study.

I think

6. What type of defect do you think could prevent the factory model from working properly?

7. How do you think you could repair the model?

What I know and what I must find out

8. Write the information you already know and the information you need to find out.

What I know	What I must find out

Creating the context *(continued)*

I prepare my work

9. Where and how will you find the information you need to do your work?

10. Define the main steps of your case study in chronological order.

Reflection

	Yes	No
Do I fully understand what I have to do?	☐	☐

Name: _____ Group: _____ AST

Gathering information

I do research

1. How will you calculate the descending and ascending speeds of the model?

2. Will the calculated speed be an average speed or an instantaneous speed? Explain your answer.

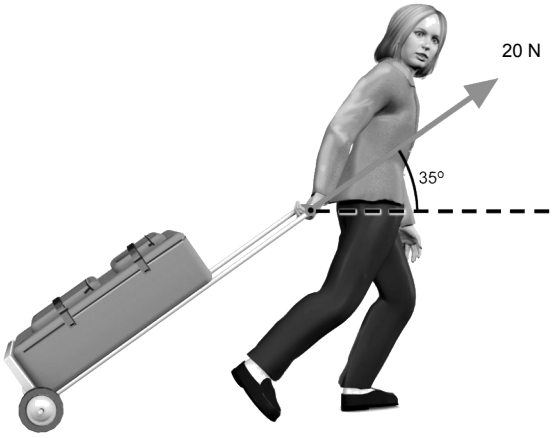
3. What mathematical relationship do you use to calculate speed? Identify each variable and its unit of measurement.

4. What is the unit of measurement for force?

5. What instrument is used to measure force?

Gathering information *(continued)*

6. Identify the four elements of the illustration below that represent the force at work.



7. What are the four types of force? Give a short definition of each type.

8. What is the difference between mass and weight?

9. What formula relates mass and weight? Identify each variable and its unit of measurement.

Gathering information *(continued)*

10. How is the equilibrium of two forces achieved?

11. What can you observe when the equilibrium of two forces on an object is achieved?

12. What is pressure?

13. How does pressure vary in relation to depth in a liquid?

14. What is Pascal's principle?

15. What is Archimedes' principle?

16. What is Bernoulli's principle?

Gathering information *(continued)*

I analyze my results

17. Which principles explain how submarines work? Explain your answer.

18. What are the necessary conditions for a submarine to maintain a certain depth?

19. What are the necessary conditions for the toy submarine to sink?

20. What are the necessary conditions for the toy submarine to resurface?

21. What is the general purpose of the toy?

Gathering information *(continued)*

22. What material and human constraints do you think may have guided the design of the toy submarine?

23. What do the metal rods in the bottle do?

24. What does the balloon in the bottle do?

25. What does the syringe do?

26. Take the measurements of the original model to collect the data you need to calculate the buoyant force. Then perform the calculation.

Gathering information *(continued)*

27. Take the measurements you need to calculate the average speed of the original model in cm/s. Calculate the average speed of the model as it dives and resurfaces.

28. Draw the design plans of the original model, depicting it during descent and resurfacing. Identify the magnitude of the forces acting on it. Indicate the names of the parts and their motion (where applicable) and include any other information that would help to explain how the model works.

Reflection

	Yes	No
Do I fully understand the scientific concepts covered in this case study?	☐	☐

Completing the case study

I make suggestions

1. Analyze how the factory model works. Draw design plans of it during descent and resurfacing. Indicate the magnitude of the forces acting on the model.

Completing the case study *(continued)*

2. Briefly explain the problem with the factory model.

3. Write a proposal on how to improve the factory model.

Reflection

	Yes	No
Have I considered other approaches?	☐	☐

Validating the case study

I justify my approach

1. Refer to the scientific concepts you know to justify your proposal on how to make the model work better. Remember to explain the role of each force at work in the toy.

2. What are the advantages and disadvantages of your proposal?

Name: _____ Group: _____ AST

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.

SSC2—Makes the most of his/her knowledge of science and technology				
Criteria*	**Observable indicators**	**Me**	**Teacher**	**Comments**
1	**Creating the context** Definition of the goal and description of the procedure		☐ With help	
2	**Gathering information** Completion of the design plans for the original model		☐ With help	
3	**Completing the case study** Completion of the design plans for the factory model and formulation of the proposal		☐ With help	
4	**Validating the case study** Justification of the proposal and explanation of the forces at work		☐ With help	

*** Evaluation criteria**

1 Formulation of appropriate questions
2 Appropriate use of scientific and technological concepts, laws, models and theories
3 Relevant explanations, solutions or actions
4 Suitable justification of explanations, solutions or actions

Name: _____ Group: _____

Evaluation grid

SSC2 Makes the most of his/her knowledge of science and technology

Criteria*	Observable indicators	A	B	C	D	E
1	**Creating the context** Definition of the goal and description of the procedure	The goal of the case study is very clearly defined, and all of the tasks described are relevant.	The goal of the case study is clearly defined, and most of the tasks described are relevant.	The goal of the case study is not very clearly defined, OR only some of the tasks described are relevant.	The goal of the case study is not very clearly defined, AND only some of the tasks described are relevant.	The work must be done again.
2	**Gathering information** Completion of the design plans for the original model	The design plans are complete. All the calculations and data are relevant and correct.	The design plans represent the model but contain minor errors. All the calculations and data are relevant and correct.	The design plans contain many errors, OR only some of the relevant data was properly collected and recorded.	The design plans contain many errors, AND only some of the relevant data was properly collected and recorded.	The work must be done again.
3	**Completing the case study** Completion of the design plans for the factory model and formulation of the proposal	The design plans for the factory model are complete. The proposal is relevant.	The design plans for the factory model contain a few minor errors. The proposal is relevant.	The design plans for the factory model contain many errors, OR the proposal is irrelevant.	The design plans for the factory model contain many errors, AND the proposal is irrelevant.	The work must be done again.
4	**Validating the case study** Justification of the proposal and explanation of the forces at work	The justification of the proposal and the explanation of the forces at work are relevant and very clear.	The justification of the proposal and the explanation of the forces at work are relevant but contain a few minor errors.	The justification of the proposal is not very relevant, OR the explanation of the forces at work contains many errors.	The justification of the proposal is not very relevant, AND the explanation of the forces at work contains many errors.	The work must be done again.

***Evaluation criteria**

1 Formulation of appropriate questions
2 Appropriate use of scientific and technological concepts, laws, models and theories
3 Relevant explanations, solutions or actions
4 Suitable justification of explanations, solutions or actions