



YSISTE

ASSESSMENT OF SCIENCE AND TECHNOLOGY ACHIEVEMENT PROJECT (ASAP)

Science and Technology Exemplars

Grade 4: Energy and Control - Light and Sound Energy

Exemplar Task (4EC/PT02/Dec 2000)

To the Rescue



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The word "EDUCATION" is written in a bold, purple, sans-serif font. Above the letters, there are several horizontal lines of varying lengths, suggesting an open book or a stack of papers.

Preface

This task is one of a series developed by the Assessment of Science and Technology Achievement Project (ASAP) which is being used for the ASAP Science and Technology Exemplars Project.

This task is organised in three parts:

- A. Task Overview
- B. Student task sheet – designed to be photocopied for the students
- C. Teacher Information – providing essential information relating specifically to this task

For further information, contact the ASAP office at 416-736-5269 or email: asap@edu.yorku.ca

Task Overview



Description of the Task

In this task students are asked to use a variety of materials which will reflect light in order to complete a challenge. This challenge asks them to reflect light from a source around a barrier to make a signal on a screen. They are then asked to produce a spectrum of light on a screen and identify the colours of light in the spectrum. This task will work best in a darkened classroom.



Suggested Timeline

Part 1

- develop a light signal (60 minutes)
- writing the report (60 minutes)

Part 2

- producing a spectrum of light (30 minutes)
- writing the report (60 minutes)



Suggested Grouping

- developing a light signal and producing a spectrum of light (student pairs)
- writing reports to parts one and two (individual)

This task assesses the following **specific expectations**:



Understanding Basic Concepts

- identify a variety of natural and artificial light sources
- describe the behaviour of light using their observations, and identify some of its basic characteristics
- identify through observation, colour as a property of light



Developing Skills of Inquiry, Design and Communication

- formulate questions about and identify needs or problems related to their own experiences with light and sound, and explore possible answers and solutions
- use appropriate vocabulary including correct science and technology terminology in describing their investigations and observations

- communicate the procedures and results of investigations and explorations for specific purposes using media works, oral presentations, written notes and descriptions, drawings and charts
- follow safe work procedures in all investigations



Relating Science and Technology to the World Outside the School

- identify common phenomena related to light and sound



Materials and Equipment Needed

Each student should have:

Cardboard box/shoe box
2 small mirrors or tinfoil
or mylar
White card for screen

Flashlight/ray box
Card (5cm x 5cm) with
pin hole

Triangular glass prism
Card (5cm x 5cm) cut
into shape

In order to focus the beam of the flashlight the card with the pinhole should be taped over the front of the flashlight. Alternatively thin card could be rolled and taped onto the flashlight to simulate a ray box. Some flashlights may have a good enough beam to use without either of these. The triangular glass prism may be replaced by a clear glass of water and students can direct the beam through the glass and move the glass and/or flashlight until a visible spectrum can be seen.



Prior knowledge and skills

Students should have been taught the background knowledge required for this task (see Appendix 1).



Students should also be familiar with:

- problem solving
- communicating their procedures and results



Introductory activities

Display the materials and equipment for the students.

Brainstorm with the whole class to recap the properties of light.

Allow the students to respond with ideas.

Read the scenario to the whole class, this may have to be repeated with individual students.

Review appropriate vocabulary. Cards with words could be displayed around the class.

Discuss the assessment criteria with the students.

Assign the student work sheets.

Clarify how each student will be presenting his/her work (see Collecting the Evidence).



Safety First

Students should be familiar with using the equipment required for the task. Students should be warned to take care when they are directing the beam of light. They should not stare into flashlights or shine the light into other students' eyes. Students should take care not to drop or break the mirrors or triangular glass prisms.



Collecting the Evidence

Teachers will need to collect evidence to submit for the exemplars project. In this task students should produce the following:

- completed responses written on student sheet
- oral responses scribed by teacher onto student sheet if appropriate
- if limited writing skills a video tape or audio tape of an oral presentation (A-V arrangements will be required)

We will also require a teacher observation checklist (Appendix 2) – completed with brief comments and circled levels. **Please number student work to correspond with the checklist.**

DRAFT RUBRIC FOR GRADE 4: To the Rescue!

Knowledge/Skills	Level 1 The student:	Level 2 The student:	Level 3 The student:	Level 4 The student:
Understanding basic concepts	<ul style="list-style-type: none"> • with many errors identifies a variety of artificial and natural light sources • with many errors describes the behaviour of light and identifies some of its basic characteristics • with many errors identifies the colours of the spectrum 	<ul style="list-style-type: none"> • with some errors identifies a variety of artificial and natural light sources • with some errors describes the behaviour of light and identifies some of its basic characteristics • with some errors identifies the colours of the spectrum 	<ul style="list-style-type: none"> • with few errors identifies a variety of artificial and natural light sources • with few errors describes the behaviour of light and identifies some of its basic characteristics • with few errors identifies the colours of the spectrum 	<ul style="list-style-type: none"> • with no errors identifies a variety of artificial and natural light sources • with no errors describes the behaviour of light and identifies some of its basic characteristics • with no errors identifies the colours of the spectrum
Inquiry skills	<ul style="list-style-type: none"> • develops a limited signal • records observations with many errors • needs frequent reminders to use tools and equipment safely • results and conclusion are unclear and not supported by their observations 	<ul style="list-style-type: none"> • develops an adequate signal • records observations with some errors • needs some reminders to use tools and equipment safely • results and conclusion are somewhat clear by may not be supported by their observations 	<ul style="list-style-type: none"> • develops an appropriate and adequate signal • records observations with few errors • needs few reminders to use tools and equipment safely • results and conclusion are clear and are supported by their observations 	<ul style="list-style-type: none"> • develops an appropriate, clear and adequate signal • records observations with no errors • consistently uses tools and equipment safely • results and conclusion are clear, well supported by their observations and fully explained
Design skills				
Communication of required knowledge	<ul style="list-style-type: none"> • communicates with limited clarity and precision • rarely uses science and technology terminology 	<ul style="list-style-type: none"> • communicates with some clarity and precision • sometimes uses science and technology terminology 	<ul style="list-style-type: none"> • communicates clearly and precisely through most of the task • often uses science and technology terminology 	<ul style="list-style-type: none"> • communicates clearly and precisely through all of the task • always uses science and technology terminology
Relating Science and Technology to the world outside the school	<ul style="list-style-type: none"> • identifies with many errors the conditions when rainbows are formed 	<ul style="list-style-type: none"> • identifies with some errors the conditions when rainbows are formed 	<ul style="list-style-type: none"> • identifies with few errors the conditions when rainbows are formed 	<ul style="list-style-type: none"> • identifies with no errors the conditions when rainbows are formed

Appendix 1



Background knowledge – To the Rescue!

Students should have been introduced to a variety of natural and artificial light sources. They should be aware that a light source is a place or object that light comes from.

Students should have been introduced to the characteristics and behaviour of light:

- Light travels in a straight line
- Light is reflected from mirrors and other shiny surfaces - **reflection**
- Light changes direction when it passes into denser materials – **refraction**
- White light is a mixture of different colour, these can be seen in a spectrum and in order are red, orange, yellow, green, blue, indigo, violet

Students should be taught that rainbows are natural phenomena of light. They occur when light passes through raindrops. Rainbows occur when it is raining and the sun is shining at the same time.

Appendix 2



Teacher Observation Checklist – To the Rescue

Please number student work to correspond with this checklist.

Student #	Uses materials and equipment safely			
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4

Appendix 2A



Teacher Observation Checklist – To the Rescue

Please number student work to correspond with this checklist.

Student #	Uses materials and equipment safely			
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4
	1	2	3	4

**ASSESSMENT OF SCIENCE AND TECHNOLOGY
ACHIEVEMENT PROJECT (ASAP)**

Science and Technology Exemplars Project

Grade 4: Energy and Control – Light and Sound Energy

To the Rescue!

Student Task Sheets

To the Rescue!

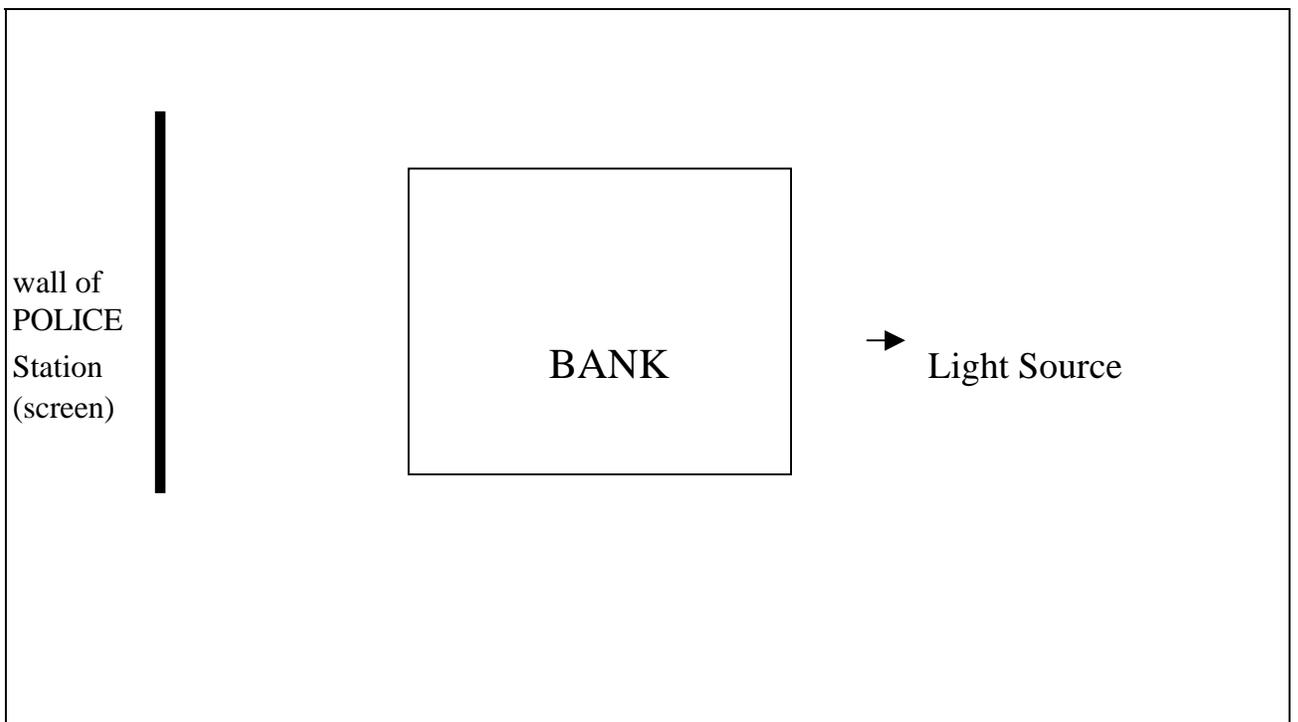
There is an emergency! There has been a blackout at the bank! You will investigate a way of contacting the police. With the following materials, develop a light signal that will shine around the bank and reappear on the wall of the police station in order to alert the police.

PART ONE: EMERGENCY SIGNAL

Materials:

- a medium sized barrier (the bank)
- a flashlight or ray box
- 2 mirrors or mylar or tinfoil
- card (5cm x 5cm) with pin-hole
- card (5cm x 5cm) cut into a shape
- white card for screen (wall of police headquarters)

1. Set up your materials as shown in the diagram below. Use the materials to develop your signal.
2. Draw on the diagram to show how you got your signal to show on the wall of the police station (screen). Use arrows to show the path of the light from the flashlight to the screen.

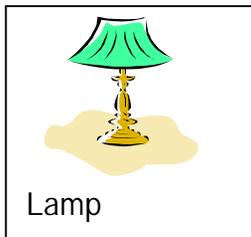
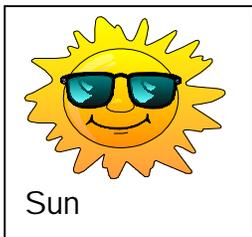


3. Use words and/or pictures to explain how the light from the flashlight got to the wall of the police station. Use scientific words in your answer.

4. Is the flashlight a **natural** or **artificial** light source?

5. Explain the differences between natural and artificial light sources

6. Look at these sources of light.



Complete this table to show which sources of light are **natural** and which are **artificial**. One has been done for you. Add some of your own.

Natural sources of light	Artificial sources of light
	lamp

PART TWO - SPECTRUM SENSATION

Materials: Triangular glass prism, flashlight, wall or screen

1. Use the triangular prism to get a spectrum of light on the screen.

Draw a diagram to show how you did this. Label the **names** of the colours of the spectrum.

2. Use words and/or pictures to explain how this spectrum of light is formed.

3. What might you see when the sun shines and it rains at the same time?

Use words and/or pictures to explain why you might see this.
