

Grade 4

**Matter and Materials /
Energy and Control**

The Mood Machine

The Task

Students were asked to use their knowledge of the properties of light and of how materials affect light to design and construct a device to provide a “mood light” for the classroom. Specifically, they were to:

- rephrase the problem;
- list the materials needed;
- outline how the devices will work and what moods (effects) they will create;
- construct a device that:
 - includes an artificial light source;
 - provides sufficient light for the teacher to read;
 - uses transparent, translucent, and opaque materials;
 - demonstrates transmission, reflection, and absorption of light;
- sketch the final products, including changes;
- label sketches of their proposed devices;
- analyse their work.

Expectations

This task gave students the opportunity to demonstrate their achievement of all or part of each of the following selected overall and specific expectations from the strand Matter and Materials: Grade 4 – Materials That Transmit, Reflect, or Absorb Light or Sound and the strand Energy and Control: Grade 4 – Light

and Sound Energy. (The codes that follow the expectations are from the Ministry of Education’s *Curriculum Unit Planner*.)

Students will:

1. demonstrate understanding that certain materials can transmit, reflect, or absorb light or sound (4s20);
2. investigate materials that transmit, reflect, or absorb light or sound and use their findings in designing objects and choosing materials from which to construct them (4s21);
3. explain why materials that transmit, reflect, or absorb light and/or sound are used in a variety of consumer products (4s22);
4. demonstrate an understanding of the characteristics and properties of light and sound (4s45);
5. investigate different ways in which light and sound are produced and transmitted, and design and make devices that use these forms of energy (4s46);
6. identify technological innovations related to light and sound energy and how they are used and controlled at home and in the community, and determine how the quality of life has been affected by these innovations (4s47);
7. formulate questions about and identify problems related to the ways in which materials transmit, reflect, or absorb sound or light, and explore possible answers or solutions (4s30);

8. plan investigations for some of these answers and solutions, identifying variables that need to be held constant to ensure a fair test and identifying criteria for assessing solutions (4s31/4s61);
9. compile data gathered through investigation in order to record and present results, using tally charts, tables, and labelled graphs produced by hand or with a computer (4s33/4s63);
10. communicate the procedures and results of investigations for specific purposes and to specific audiences using oral presentations, written notes and descriptions, drawings, and charts (4s34/4s64).

Prior Knowledge and Skills

To complete this task, students were expected to have some knowledge or skills related to the following:

- the design process
- construction techniques
- the topics that pertain to light from the strands Energy and Control, and Matter and Materials

For information on the process used to prepare students for the exemplar task and on the materials and equipment required, see the Teacher Package reproduced on pages 119–126 of this document.

Task Rubric – Grade 4: The Mood Machine

Expectations*	Level 1	Level 2	Level 3	Level 4
Understanding of Basic Concepts				
The student:				
1, 4	<ul style="list-style-type: none"> – demonstrates limited understanding of some of the properties of light (e.g., light travels in a straight line, is reflected, has colour) – demonstrates limited understanding of how different materials affect light (i.e., they transmit, reflect, or absorb light) 	<ul style="list-style-type: none"> – demonstrates some understanding of some of the properties of light (e.g., light travels in a straight line, is reflected, has colour) – demonstrates some understanding of how different materials affect light (i.e., they transmit, reflect, or absorb light) 	<ul style="list-style-type: none"> – demonstrates general understanding of some of the properties of light (e.g., light travels in a straight line, is reflected, has colour) – demonstrates general understanding of how different materials affect light (i.e., they transmit, reflect, or absorb light) 	<ul style="list-style-type: none"> – demonstrates thorough understanding of some of the properties of light (e.g., light travels in a straight line, is reflected, has colour) – demonstrates thorough understanding of how different materials affect light (i.e., they transmit, reflect, or absorb light)
Design Skills				
2, 5	The student:			
– identifying the problem/need 7	– demonstrates limited understanding of the problem, with limited reference to the specified criteria	– demonstrates some understanding of the problem, with some reference to the specified criteria	– demonstrates general understanding of the problem, with reference to the specified criteria	– demonstrates thorough understanding of the problem, with reference to the specified criteria as well as additional criteria and implications
– making the plan 8	– creates a limited plan/sketch that meets a few of the criteria	– creates a somewhat organized plan/sketch that meets some of the specified criteria	– creates an organized, labelled plan/sketch that meets most of the specified criteria	– creates a highly organized, labelled plan/sketch that meets all or almost all of the specified criteria
– executing and evaluating the plan 9	<ul style="list-style-type: none"> – creates a device that works and meets a few of the criteria – demonstrates to a limited extent that the design process has been used to meet the criteria – provides a limited reflection about how the model could be improved 	<ul style="list-style-type: none"> – creates a device that works and meets some of the criteria – demonstrates to some extent that the design process has been used to meet the criteria – provides a somewhat reasonable reflection about how the model could be improved 	<ul style="list-style-type: none"> – creates a device that works and meets most of the criteria – appropriately demonstrates that the design process has been used to meet the criteria – provides a reasonable reflection about how the model could be improved 	<ul style="list-style-type: none"> – creates a device that works and meets all or almost all of the criteria in logical ways – effectively demonstrates that the design process has been used to meet the criteria – provides a detailed and extensive reflection about how the model could be improved

Expectations*	Level 1	Level 2	Level 3	Level 4
Communication of Required Knowledge				
The student:				
10	<ul style="list-style-type: none"> – provides a limited explanation of the device and of how certain materials affect its light – makes limited use of appropriate science and technology vocabulary – creates a minimally organized and minimally labelled drawing of the completed model that illustrates a few of the specified criteria 	<ul style="list-style-type: none"> – provides some explanation of the device and of how certain materials affect its light – makes some use of appropriate science and technology vocabulary – creates a somewhat organized and partially labelled drawing of the completed model that illustrates some of the specified criteria 	<ul style="list-style-type: none"> – provides a complete explanation of the device and of how certain materials affect its light – makes general use of appropriate science and technology vocabulary – creates an organized and appropriately labelled drawing of the completed model that illustrates most of the specified criteria 	<ul style="list-style-type: none"> – provides a detailed and complete explanation of the device and of how certain materials affect its light – makes extensive use of appropriate science and technology vocabulary – creates a highly organized and appropriately labelled drawing of the completed model that illustrates all or almost all of the specified criteria
Relating of Science and Technology to Each Other and to the World Outside the School				
The student:				
3, 6	<ul style="list-style-type: none"> – demonstrates limited understanding of how examples of specialized lighting in the community work 	<ul style="list-style-type: none"> – demonstrates some understanding of how examples of specialized lighting in the community work 	<ul style="list-style-type: none"> – demonstrates general understanding of how examples of specialized lighting in the community work 	<ul style="list-style-type: none"> – demonstrates thorough understanding of how examples of specialized lighting in the community work

*The expectations that correspond to the numbers given in this chart are listed on pages 66–67.

Note: This rubric does not include criteria for assessing student performance that falls below level 1.

Student Task Description

Students were presented with the following scenario and task instructions:

The Challenge: A Mood Machine

Your teacher is planning a special story time and wants to change the mood in the classroom by changing the lighting. Your task is to design and construct a device that will provide an alternative light source for the room with an interesting lighting effect and enough light for the teacher to read.

You will have to convince your class and your teacher that your device meets the challenge and includes the required criteria. This challenge tests your understanding of the properties of light and how materials affect or control light.

Criteria

Your project should:

- use an artificial light source;
- provide sufficient light for your teacher to read by;
- use transparent, translucent, and opaque materials;
- demonstrate transmission, reflection, and absorption of light.

Before you build your device, you will need to hand in the following:

- a description/restatement of the problem in your own words and a list (or sketches) of possible solutions

- a labelled sketch of your proposed project that shows the transparent, translucent, and opaque materials you plan to use
- a list of the materials you will need to build your device
- an outline of how your device will work and what mood (what effect) it will create (Use appropriate science and technology vocabulary.)

After you have constructed your device, you must hand in the following:

- a drawing of your final project that points out the changes between your final project and your original proposal (Include labels using appropriate science and technology vocabulary.)
- an analysis of your work using the prompts in the student booklet
- examples of specialized lighting in your community with a description of their purpose