# LESSON 6 - WAVES AND OPTICS FINAL PROJECT

**Overview:**
Through a presentation or display, students will teach their classmates how a piece of technology works or how an observed phenomena can be explained. Students will use the information on waves and optics learned in the unit and additional researched information to explain their chosen topic. This project is intended to take the place of a unit exam.

**Suggested Timeline:** 3 hours research + presentation time (if this option is chosen)

**Materials:**
- Physics Show and Tell (Student Handout)
- Physics Showcase Display Project (Student Handout)
- Waves and Optics Final Project Ideas List (Teacher Support Material)
- computers with Internet access
- access to library resources
- samples of past student work (if possible)
- piece of technology, such as a cell phone

**Method**:

**NOTE**: The teacher may choose to offer the Science 21 student a choice between the Physics Show and Tell Project or the Showcase Display Project or assign one or the other. He/she must take into consideration the setting in which the Science 21 student is learning.

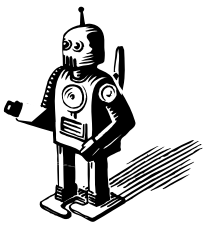
1. Introduce the idea of show and tell or a display project by starting to explain how a piece of everyday technology works, such as a cell phone.
2. Brainstorm a list of other pieces of technology or observed phenomena that students are interested in learning about. Place check marks beside the ones that students could explain, starting with information on waves and optics learned in the unit. Explain that this list can serve as a pool of ideas from which students choose their topic for the project, although other topics can be chosen.
3. Carefully explain the expectations for the project, using the student handout as a guide. Emphasize the importance of getting teacher approval for the topic choice before beginning research.
4. Explain the rationale for using a rubric and go through the rubric with students. Encourage students to regularly review the expectations of the project, as outlined in the rubric, while working on the project.
5. If possible, provide samples of past student projects by showing photos or describing student work. Show students what different grades for the project 'look like' so that they have a target to aim for.
6. Clearly set out a timeline for completion and presentation of the projects.
7. Provide students with several class periods to research information in the library and/or using computers.

# WAVES AND OPTICS FINAL PROJECT IDEAS LIST

AM vs. FM radio
TV reception
tsunamis
musical instruments
earthquakes and earthquake detection
shock waves and sonic booms
mufflers
microphones
SONAR
ultrasonic cleaning of jewelry
removing kidney stones and gallstones with ultrasound
periscopes
reflecting microscopes
reflecting telescopes
solar collectors or cookers
fiber optics
endoscopes used in surgery
refracting telescopes
eyeglasses
rainbows
why stars twinkle and planets do not
how CDs work
cell phones

Student Handout

# PHYSICS SHOW AND TELL



**Your Task:**

- Explain how the functioning of an object can be explained by physics through the use of an oral presentation. You must use your knowledge of waves as learned in this unit (in addition to any other learned physical concepts) to explain how your object works.
- This will be done individually and will be presented to the class at a time determined by your teacher.
- Your project mark will serve as your major final piece of evaluation for the unit.

**Requirements:**

1. Think about something that you have observed or frequently used. Perhaps its functioning has intrigued you. Example: How does a microscope work? Be sure to pick something that you can bring in to show your classmates.

2. Do some research and figure out whether or not you would like to choose that object as a subject for your research. Remember that you **must** give evidence of your knowledge of waves and optics that you have learned in this unit. **Your topic must be approved by your teacher before you begin to formally prepare your presentation.**

   **Due date for topic choice: _____**

   **Topic choice: _____**

   **Teacher signature: _____ Date: _____**

3. Comprise a 3-5 minute presentation to explain your object to your classmates. Your presentation must not consist of only reading information from an overhead, powerpoint presentation, or cue cards. You should hold your object, point to the parts, demonstrate its use and explain how the parts work. This will help to ensure that you truly understand what you are attempting to tell the class about. Be sure to ask the class if there are any questions at the end of your talk and be prepared to answer them well.

   NOTE: You must submit a list of sources of information (e.g., website, books, journals, magazines) to your teacher. **You must have a minimum of 5 sources.**


**Remember:** Be entertaining, but still informative. Think about how you will keep the attention of your audience (e.g., questions, demonstrations). Anticipate questions that the audience might ask you and prepare yourself to answer such questions. In order to do this, you must fully understand concepts that you are 'teaching' to others.

Student Handout

**Evaluation:**
Your project will be evaluated according to the following rubric. It is in your best interest to carefully read through the following chart to recognize what will be expected from you. If you are aiming for 100%, check out what would describe a maximum mark for each evaluation category in the rubric and aim for it. This project will take the place of the unit exam in this unit. Start preparing early. Start now.

Student Handout

# "Physics Show and Tell" Project Grading Rubric

| CATEGORY | 25 | 17 | 10 | 3 |
|---|---|---|---|---|
| **SCIENTIFIC ACCURACY**<br>• the extent to which the working of the object is accurately described and explained by using concepts learned in this unit | • thorough understanding demonstrated through the use of many concepts involving waves and optics<br>• concepts are thoughtfully described<br>• student's answers to questions asked give clear evidence of deep understanding | • satisfactory understanding demonstrated through the use of several concepts learned in this unit<br>• student answers questions asked with thoughtful answers that give evidence that adequate research has been done | • some understanding demonstrated through the use of a couple of physical concepts; some of the 'physics' clearly absent<br>• student answers most questions with a basic response | • inadequate understanding of the 'physics' of the phenomenon or object is demonstrated; some physical concepts not included in explanation<br>• student unable to correctly answer most questions |
| | **10** | **8** | **5** | **3** |
| **INTRODUCTION AND CLOSURE** | • student delivers opening and closing remarks that capture the attention of the audience, set the mood and summarize the main points of the presentation | • student delivers effective and clear introductory and closing remarks | • student delivers either an effective opening or closing remark, but not both | • student delivers either an opening or closing remark |
| **CATEGORY** | **2.0 each** | **1.5 each** | **1.0 each** | **0.5 each** |
| **PRESENTATION a) BODY LANGUAGE** | • movements seem fluid and help the audience to visualize | • made movements or gestures that enhanced articulation and aided in emphasis of important points | • some movements or gestures that could sometimes be considered useful in emphasis and articulation | • very little movement or descriptive gestures |
| **b) EYE CONTACT** | • hold attention of entire audience with the use of direct eye contact and animated eye expressions | • consistent use of direct eye contact with audience; some eye expressions aid in information delivery | • often uses direct eye contact with audience | • displayed minimal eye contact with audience |

| | | | | |
|---|---|---|---|---|
| **c) PACING AND VOICE** | • good use of drama<br>• student meets time guidelines (3-5 min)<br>• use of fluid speed, inflection and good enunciation to maintain the interest of the audience | • delivery includes appropriate drama and pace, but does not quite meet time guidelines<br>• satisfactory use of inflection, but does not consistently use fluid speech and does not always enunciate well | • delivery is in bursts<br>• presentation quite off from time guidelines<br>• displays some level of inflection throughout the delivery | • delivery is either much too quick or too slow<br>• presentation far off time guidelines<br>• very little inflection<br>• monotone voice<br>• frequently mumbles<br>• speech is not fluid |
| **d) POISE** | • student displays relaxed, self-confident nature about self with no mistakes | • makes minor mistakes, but quickly recovers from them; displays little or no tension | • displays mild tension; has trouble recovering from mistakes | • tension and nervousness is obvious; has trouble recovering from mistakes |
| **CREATIVITY** | **10** | **7** | **4** | **1** |
| • the extent to which the student describes the workings of the object in an unpredictable manner that engages others | • exceptionally unique approach to explaining how the object works that is engaging, captivating, unique and thoughtful | • somewhat unique method of explaining information<br>• most students engaged and seemingly interested by method(s) of delivery | • method chosen for presentation not unique or innovative, but some of the audience's interest and attention is still maintained | • chosen method of delivery is predictable and mundane<br>• audience is not engaged and their attention wanes |
| **REFERENCES** | **5** | **4** | **3** | **1** |
| | • 5 or more sources cited | • 4 sources cited | • 3 sources cited | • 1 source cited |

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Student Handout

# PHYSICS SHOWCASE DISPLAY PROJECT

**Your Task:**

- Explain how the functioning of an object or an observed phenomena can be explained by physics through the use of a display. You must use your knowledge of waves as learned in this unit (in addition to any other learned physical concepts) to explain how your object or a phenomena works.
- This will be put on display at a time determined by your teacher.
- Your project mark will serve as your major final piece of evaluation for the unit.

**Requirements:**

1. Think about something that you have observed or frequently used. Perhaps its functioning has intrigued you. Example: How does a cell phone work? Be sure to pick something that you can bring in to put on display for others to see or that you can create a model of to put on display.

2. Do some research and figure out whether or not you would like to choose that object or phenomena as a subject for your research. Remember that you **must** give evidence of your knowledge of waves and optics that you have learned in this unit. **Your topic must be approved by your teacher before you begin to formally prepare your presentation or display.**

   **Due date for topic choice: _____ Topic choice: _____**

   **Teacher signature: _____ Date: _____**

3. Create a display explaining how an object works or explaining an observed phenomena. The display is to be featured for one week in an area of the classroom as indicated by your teacher. Your display should include a clear and bright title, posters, the object being explained (or a model of it) and other creative elements that will attract observers to the area. Remember to choose an object that can be explained well using the knowledge of waves and optics that you have learned in this unit!

   NOTE: You must submit a list of sources of information (e.g., website, books, journals, magazines) to your teacher. **You must have a minimum of 5 sources.**


On the Monday morning of your assigned week you must place your display in the showcase. Projects must be put on display prior to the beginning of the school day. At the end of the Friday of your assigned week, your group must remove the display from the showcase and leave the area clean for the next group. All display materials must be removed from the classroom that day.

**Display dates: _____**

Student Handout

**Evaluation:**
Your project will be evaluated according to the following rubric. It is in your best interest to carefully read through the following chart to recognize what will be expected from you. If you are aiming for 100%, check out what would describe a maximum mark for each evaluation category in the rubric and aim for it. This project will take the place of the unit exam in this unit. Start preparing early. Start now.

Student Handout

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# "Showcase Display Project" Grading Rubric

| CATEGORY | 30 | 20 | 10 | 5 |
|---|---|---|---|---|
| **SCIENTIFIC ACCURACY**<br>• the extent to which the topic or phenomenon is accurately described and explained by using concepts in physics | • thorough understanding demonstrated through the use of many concepts in physics that are thoughtfully described and elaborated upon<br>• student's explanations give clear evidence of their understanding of waves and optics<br>• it is likely that another science 21 student would have a clear understanding of the topic after reading the display | • satisfactory understanding demonstrated through the use of several physical concepts<br>• a good understanding of waves and optics demonstrated<br>• it is likely that another science 21 student would understand most of the display | • some understanding demonstrated through the use of a couple of physical concepts; some of the 'physics' of waves and optics clearly absent<br>• it is likely that another science 21 student would not have a clear understanding of the topic from the display | • inadequate understanding of the 'physics' of the phenomenon or object is demonstrated; some physical concepts not included in explanation<br>• another science 21 student would likely be confused by the explanations given |
| | **10** | **7** | **5** | **3** |
| **CREATIVITY**<br>• the extent to which the student describes the workings of the object or explains the phenomena in an unpredictable manner that engages others | • exceptionally unique approach to presenting a topic that is engaging, captivating, unique and thoughtful | • somewhat unique method of explaining information<br>• students would most likely be engaged and interested in learning from the display | • method chosen for presentation not unique or innovative<br>• it is likely that few students would be attracted to learn from the display | • chosen method of presenting material is predictable and mundane<br>• display does little or nothing to attract learners to it |
| | **5** | **4** | **3** | **1** |
| **TIMING**<br>• how well the student adheres to the guidelines set forth for set up and take down of the display | • display is set up promptly at the start of the week and taken down on time at the end of the week<br>• the display area is left clean for the next group | • display is set up promptly at the start of the week and taken down on time at the end of the week<br>• some materials are left behind in the classroom after take down | • display is either set up on time or taken down on time<br>• some materials may be left behind in the classroom after take down | • display is not put up on time or taken down on time<br>• display area is left untidy for the next group |
| | **5** | **4** | **3** | **1** |
| **REFERENCES** | • 5 or more references cited | • 4 references cited | • 3 references cited | • 1 reference cited |