Science Stage 4 Physical world

## Energy

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| Guiding questions |  |
| What are your students going to learn? (Objectives) | Students will develop working scientifically skills and their understanding of sound energy and energy transformations. |
| How are they going to learn it? (Resources and Strategies) | Students engage with the [Arduino Science Journal](https://www.arduino.cc/education/science-journal) app to develop and conduct a suitable procedure to investigate the sound absorbing properties of different materials. In this activity students are required to develop a scientific procedure which fairly tests the materials and produce data to appropriately represent their findings in a report. Students can practise experimental design through the [Fair Test](https://www.scootle.edu.au/ec/resolve/view/L540) app on Scootle. |
| Target date for completion | 5 lessons (1 week) |
| How are you going to know that they learned it? (Success criteria) | Students can:   * Propose a hypothesis * Plan and perform a fair test * Clearly represents data and information using appropriate scientific formats * Describe trends, patterns and relationships in the effectiveness of different materials in blocking sound * Identify the energy transformations involved in the production and detection of sound |
| Differentiation including HPGE | Adapting process: Students can explore a wider range of situations in their experiments such as using different sound frequencies to measure the sound dampening response of a material.  Adapting product: quantitative vs qualitative analysis of results. Method and apparatus can be described using scientific diagrams or alternatively using a photo or video. |
| Collecting evidence of student learning (Verification) | Students will produce a concise experimental report outlining the process undertaken and the results obtained. This report could be submitted via e-mail, Google Classroom or Microsoft Teams to the teacher for feedback. |
| Feedback (Evaluation) | Teachers can provide feedback via the submission pathway (e-mail, Google Classroom or Microsoft Team) to students on their progression towards the learning outcomes. An example [rubric for the Working Scientifically Skills](https://schoolsequella.det.nsw.edu.au/file/bebc596d-7e55-4bf2-83dc-be16daabe9fd/1/science-s45-rubricskills.docx) can be found on the Science Curriculum Support website. |
| Communication | **Orientation** Teacher will post the activity description on the class’ Teams notice board. Students will be expected to independently complete a short activity before the orientation online lesson. Teams video or audio conference will be used to guide students through learning activities and a short brainstorming session will be run using [padlet](https://padlet.com/).  **Sharing information:** All relevant information can be included as links on the activity description. Initial orientation conference and brainstorming will be posted to Teams for students to access asynchronously.  **Promoting student-teacher interactions:** Students may require clarification and assistance at various times in their investigation. Using an [asynchronous discussion](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/580#.XmbrZ3MkfVI.link) or chat will make questions and answers visible to all students. The teacher communicates a deadline for student submission of draft hypotheses/methods along with a timeframe for the provision of feedback.  **Promoting student-student interactions:** Students can use the chat post function to communicate between the class members and teacher to facilitate collaboration, discussion of questions and feedback obtained.  **Monitoring and supporting progress in student learning:** Students can share their hypothesis and method at the end of lesson 2 for teacher feedback using the [rubric for Working Scientifically Skills](https://schoolsequella.det.nsw.edu.au/file/bebc596d-7e55-4bf2-83dc-be16daabe9fd/1/science-s45-rubricskills.docx). Modifications to this hypothesis and method can inform future progress in the experimental design and reporting. |

### Resources

[Arduino Science Journal](https://www.arduino.cc/education/science-journal) - A free app available on student mobile devices. This app provides access to record data using the phone sensors and record this data for students to analyse and present through their school google accounts.

[Fair test](https://www.scootle.edu.au/ec/resolve/view/L540) - A online simulation for the process of experimental design. This encourages students to explore the concepts of fair testing with a range of proposed investigations and the ability to manipulate a range of experimental variables.

[Block that noise!](https://www.sciencebuddies.org/teacher-resources/lesson-plans/sound_insulation?utm_source=googlesciencejournallanding&utm_campaign=GSJ&utm_medium=referral) – Summaries, materials, teacher preparation and other helpful information can be found on the Science buddies website.

[Rubric for the Working Scientifically Skills](https://schoolsequella.det.nsw.edu.au/file/bebc596d-7e55-4bf2-83dc-be16daabe9fd/1/science-s45-rubricskills.docx) - A simple rubric for the overall assessment of Working Scientifically Skills which can be used in this sequence of lessons.

[Padlet](https://padlet.com/) - An online brainstorming tool where teachers can pose questions and students can collaborate and freely contribute responses that appear in the format of a sticky note.

[Asynchronous discussion](https://app.education.nsw.gov.au/digital-learning-selector/LearningActivity/Card/580#.XmbrZ3MkfVI.link) - A template from the digital learning selector gives a format to which students can respond to the lesson provided by the teacher at times where synchronous lessons are not possible.

[Sound Dampening](https://www.youtube.com/watch?v=VDCl-PysXLE) - A YouTube video which introduces the activity and shows the applications which link to the lesson sequence provided.

[Anechoic Chamber](https://www.youtube.com/watch?v=mXVGIb3bzHI%20%20anechoic%20chamber) - A YouTube video which shows the overall application of this learning for the progression of scientific investigations beyond this lesson sequence.

[Phyphox: physical phone experiments app](https://phyphox.org/) - An alternative app to Google science journal, available for apple and android phones that provides access to the phone’s sensors. It displays sensor readings in simple formats and allows data to be exported for further analysis on a computer.

[Bubbl.us](http://www.Bubbl.us) - An online mind-mapping tool that can be used to collaboratively develop ideas. Teachers and students can log in using their google account ([@education.nsw.gov.au](http://@education.nsw.gov.au)) and participants can be invited to collaborate by sharing a link or using email.

### Lesson sequence

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| Session | Learning Sequence | Evidence of learning |
| 1 (approx. 40mins) (asynchronous) | An outline of the activity can be shared by email or using an online platform e.g. Google classroom, Microsoft Teams.  Stimulus for this experiment can be provided through a short clip on Sound Dampening. Stimulus for this experiment can be provided through a [short clip on Sound Dampening](https://www.youtube.com/watch?v=VDCl-PysXLE).  Students will complete the [Fair Test](https://www.scootle.edu.au/ec/resolve/view/L540) app on Scootle to explore and practise their understanding of experimental design concepts. Through this activity they are provided with opportunities to design an experiment to satisfy the needs of an investigation question and report on their findings.  Orientation with [Arduino Science Journal](https://science-journal.arduino.cc/sj/module/sound/lesson/decibels) and the sound sensor as an example of the process that they could undertake. | Students suggest range of potential factors that would influence sound absorption.  Students propose a testable hypothesis for teacher feedback. |
| 2 (approx. 30mins) (synchronous is preferred) | Students brainstorm variables affecting sound absorption using padlet and propose an initial hypothesis that they could test using available materials.  Students can draw parallels between their experiments in Fair Test to the investigation question: “What materials are best at reducing the transmission of sound energy?” and develop their own hypothesis and method to investigate.  A suitable experimental design structure for students can is outlined in [Block that noise!](https://www.sciencebuddies.org/teacher-resources/lesson-plans/sound_insulation?utm_source=googlesciencejournallanding&utm_campaign=GSJ&utm_medium=referral). | Students submit their draft hypothesis and method for teacher feedback. |
| 3 (approx. 1 hour) (asynchronous) | Students will be collecting their data and conducting their investigation. | Students can collect and organise first-hand data using scientific formats. |
| 4 (approx. 1 hour) (asynchronous) | Reporting and feedback.  Further exploration of this topic can be found by examining the application of these concepts in constructing an [Anechoic Chamber](https://www.youtube.com/watch?v=mXVGIb3bzHI%20%20anechoic%20chamber). | Final report submission for teacher feedback. |

### Student handout for distribution

#### Introduction

**Inquiry question:** What materials are best at reducing the transmission of sound energy?

**Scenario:** Whether you are building a house or designing a professional sound recording studio, noise can be a problem. Certain materials are selected specifically for their effectiveness in blocking out unwanted noise.

**Task description:** You will be planning and conducting an investigation to compare the effectiveness of different materials on reducing the transmission of sound energy. After completing your investigation, you will produce and submit a report outlining your method and results.

#### Orientation – do this before our lesson **<date/time>**

1. Watch this video outlining issues with the blocking of noise: [Sound dampening as fast as possible](https://www.youtube.com/watch?v=VDCl-PysXLE).
2. Complete the [Fair test](https://www.scootle.edu.au/ec/resolve/view/L540) activity. Follow the exercises to explore the features of a fair test.
3. Answer the following questions.
   1. Identify some materials that you think are good at blocking noise.
   2. What is a fair test?
4. Download the Google science journal app. Login with your school google account.
5. Join the class Team using this link **<insert link to Microsoft Team site>**.

#### Getting Started

On **<date/time>**, join the class in Microsoft Teams for a discussion and introduction to your task this week. A sample investigation is outlined in the Google science journal activity [Block that noise!](https://www.sciencebuddies.org/teacher-resources/lesson-plans/sound_insulation?utm_source=googlesciencejournallanding&utm_campaign=GSJ&utm_medium=referral) We will be:

1. Brainstorming variables affecting sound absorption using our padlet **<insert padlet link>**
2. Proposing our initial hypotheses that you will be testing this week.
3. Answering any of your questions about getting started with your investigation

Note: A video of this session, along with the results of the brainstorm

#### Planning your investigation

1. Complete the template below to plan your investigation.
2. Send your completed investigation plan to your teacher by **<posting on Teams/emailing teacher>** before **<date/time>**.
3. Feedback on your investigation plan will be provided by your teacher by **<date/time>**.

#### Collecting data

* Use the Google Science Journal or alternative app to collect your data and record in a suitable format.
* When collecting data seek assistance early if you are finding difficulty by posting a message to your teacher by **<posting on Teams/emailing teacher>**.
* Keep detailed records of all data, any observations and adjustments made during the experiment.

#### Sharing your findings

Share the conclusions of your investigation with your class. You can do this using any of a range of formats including a written report, a poster, a short video or on a few PowerPoint slides.

So that your findings are understood and justified, it is important your presentation includes the following:

1. What were you investigating? What was your hypothesis?
2. How did you collect your evidence?
3. What did you find out? A clear evidence-based conclusion.
4. What evidence supports this? Show the experimental evidence (data tables, graphs etc).

Submit your task by **<posting on Teams/emailing teacher>** before **<date/time>**.

### Investigation plan template

#### Variables

Use the following mnemonics, **c**ows **m**oo **s**oftly means to **c**hange one variable, **m**easure one variable and keep all other variables the **s**ame. **I** **d**on’t **c**are means the **i**ndependent variable, **d**ependant variable and **c**ontrolled variables. The sequence of these two mnemonics gives the linkages between each item as shown in the table below.

|  |  |  |
| --- | --- | --- |
| Cows moo softly | I don’t care | Variable(s) |
| Change one variable | Independent variable |  |
| Measure one variable | Dependant variable |  |
| Keep other variables the same | Controlled variables |  |

#### Hypothesis

Your proposed prediction for the connection between the variables which is testable by the experimental method.

#### Method

Your proposed method for testing your hypothesis and answering the inquiry question. Clearly describe the materials used and steps taken to undertake your experiment.