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| **Measuring Noise** |
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| Measuring the amount of noise produced by different activities |
| **Subject(s):** Mathematics, Engineering**Approx time:** 45 – 70 minutes |  | **Key words / Topics:** * Noise
* Sound
* Decibel
* Microphone
* Sound meter
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| **Stay safe** Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:• ensuring that any equipment used for this activity is in good working condition• behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠ |
| **Suggested Learning Outcomes**  |  |  |
| * To be able to record noise levels using a sound meter
* To understand that high noise levels can damage hearing
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| **Introduction** |  |  |
| This is one of a series of resources designed to allow learners to use the theme of the future of flight to develop their knowledge and skills in in Design & Technology, Engineering and Mathematics. This resource focuses on measuring noise produced by different activities with a sound meter. |
| **Purpose of this activity**In this activity learners will measure noise produced by a range of activities using a sound meter to help them understand how noise is measured and that high noise levels can damage our hearing.This activity could be used as a main lesson activity to teach learners about sound, as part of a scheme of learning covering sound waves and how sound is generated or as part of a wider topic area covering health and safety considerations in the workshop.  |
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| **Activity** |  | **Teacher notes** |
| **Introduction (10-15 minutes)**Class to discuss what noise is and why it causes problems, particularly at airports and flight paths. Teacher to explain that learners are going to measure noise using sound meters and record the results. **Demonstration of what is required (10 – 15 minutes)**Teacher to discuss how noise is measured, introducing the decibel scale, and explaining that this is not a linear scale i.e. every +3 Db is double the noise level. Using the presentation, explain how noises from a number of sources, at certain levels, can cause hearing damage.Teacher to demonstrate how to operate a sound meter (or comparable smartphone app) and record a noise level.**Measuring noise activity (20-30 minutes)**Learners to complete the measuring noise worksheet to measure and record a range of noises in the classroom. **Plenary (5-10 minutes)**Learners to calculate the difference between the teacher’s noise (A2) and the noise from the activities A3, A4 and A5, and their relative effect on hearing (bearing in mind the noise level doubles with each 3 Db).Learners to discuss if any other factors (such as the size of the room) affect the level of noise. |  | This activity could be done as individuals or in small groups. In a group, one could take and record the noise level reading whilst the others produce the noise.This activity could be carried out using sound meters or smart phones. At the time of writing, a wide range of sound meters are available at prices under £30 from online suppliers. Sound meter apps for smart phones can be downloaded from the major app stores – in many cases these are free, although they may not be as accurate as dedicated sound meters.As learners will be completing the noise activity within a classroom be aware of any students that may need additional ear protection i.e. foam inserts or ear muffs.**Measuring the noise levels**The distance from the source of the noise will affect the recorded level – noise reduces by approximately 1 Db per meter. Sound level readings could be taken at varying distances from the source of the sound, e.g. 1 m, 3 m, 5 m away and outside a room. Learners could also plot a chart of their results.The activities could be repeated within the school hall and the sound levels compared with those in the classroom. |
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| **Differentiation** |  |  |
| **Basic** |  | **Extension** |
| * Mark out set positions to make and record the noise.
* Provide learners with exemplar calculations to practice calculating the differences between noise levels.
 |  | * Learners could take measurements at varying distances from the source of the sound, (e.g. 1 m, 3 m, 5 m, and outside the room) and plot a chart of their results.
* Learners could measure noise levels of other activities, such as machines and equipment within the classroom or workshop. Are any over 85 Db?
* Watch video YouTube: Acoustic engineering: The art of engineering a silent world: https://www.youtube.com/watch?v=n6dQNvOqm2I
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| **Resources** |  | **Required files** icon-docicon-pdficon-ppt |
| * Sound meters (or smart phones with sound meter apps)
* Calculator
* Graph paper (for extension activity)
* Tape measure (for extension activity)
 |  | icon-ppt Presentation – Measuring noiseicon-doc Measuring noise – worksheet |
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| **Additional websites** |
| * **YouTube**: Acoustic engineering: The art of engineering a silent world: https://www.youtube.com/watch?v=n6dQNvOqm2I
* **YouTube**: Comparison: Loudest Sounds: <https://www.youtube.com/watch?v=t7mIWTaGnWI>
* **BBC Bitesize**: Sound and noise: https://www.bbc.co.uk/bitesize/guides/zdc6fg8/revision/3
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| **Related activities (to build a full lesson)** |  |  |
| **Starters (Options)** * What are the loudest noises that learners can think of?
* Watch YouTube video Comparison: loudest sounds: <https://www.youtube.com/watch?v=t7mIWTaGnWI>
 | **Plenary*** Learners to share their experiences of recording the noise for various activities. Which noise levels were the highest and lowest? Which noises are the most unappealing to the ear?
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| **The Engineering Context** film |
| * Acoustic engineers are concerned with the control and management of noise, so they need to be able to take accurate sound measurements. They work with architects to help reduce the noise levels when designing new buildings.
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| **Curriculum links**  |
| **England: National Curriculum**KS3 ScienceSound waves* auditory range of humans and animals.
 | **Northern Ireland Curriculum**KS3 ScienceForces and energy* Sound and light
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| **Scotland: Curriculum for Excellence**KS3 ScienceWavesEnergy and waves * waves transferring information for conversion to electrical signals by microphone.
 | **Wales: National Curriculum** KS3 ScienceHow things work* how familiar devices/machines work by using electricity, light, sound and other energy transfers
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| **Assessment opportunities** |
| * Informal teacher assessment by regular questioning throughout the activity,
* Formal teacher assessment of completed work, including results of testing.
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