Noisy Balloons

You will need:

- Two balloons
- A balloon pump,
- A marble or round bead
- A hexagonal nut.

What to do

1. Place each object in a different balloon and inflate both balloons with the pump
2. Now try swirling each balloon in a fast circular motion so that the object inside moves in circles
3. What can you hear? Which object causes the most noise?
4. Now try swirling the balloon containing the nut quickly and then stop. What happens to the sound as the movement of the nut slows down?

Work Responsibly

- **Adult supervision is required**.
- Balloons are made from latex. Do not do this experiment if you have a latex allergy.
- Use a balloon pump to inflate balloons containing objects. Inflating them by mouth presents a choking hazard. If you don’t have a balloon pump, ask an adult to inflate the balloon *before* adding the object. This is tricky, but possible with an extra pair of hands!
- Latex balloons take months to biodegrade, and are hazardous to wildlife. Please dispose of your balloons responsibly in your household waste

What is going on?

Sounds occur when a vibrating object causes the stuff around it, such as air, to vibrate. When the vibrations reach our ears our auditory nerve carries information about the vibration to our brain, which interprets it as sound.

The smooth object is able to roll around inside the balloon without causing it to vibrate much, so not much noise is generated. The edges and corners of the nut cause it to bounce off the inner surface of the balloon, making the balloon vibrate strongly, generating the whirring sound.

The pitch of a sound depends on the *frequency* of the vibrations (how many vibrations occur every second). The higher the frequency, the more high pitched the noise. As the nut slows down, the vibrations drop in frequency, and the sound drops in pitch.

What we do

We are a research group at the University of Manchester. We use mathematics to model and test the properties of materials and waves. Examples of our research include understanding and reducing noise; modelling the behaviour of ligaments and tendons; and the design of *metamaterials*: special materials with extraordinary properties.

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Mathematics of Waves and Materials