

BREAKING IT DOWN

with Dr. Michelle Dickinson



MATERIALS

Welcome to Breaking It Down with Dr Michelle Dickinson.

This worksheet is to help you to support your teaching after students have watched the 'Materials' episode. It contains a summary of the science knowledge, experiment instructions, topics for further inquiry, and links to the NZ curriculum at levels 3-5.

Use this sheet alongside the video for the Materials episode of "Breaking It Down with Dr Michelle Dickinson" to help with your teaching around the science and technology of materials. During the episode, Dr Michelle Dickinson will cover different material properties and how to test them, talk to expert Associate Professor Nicola Gaston from the MacDiarmid Institute and conduct an experiment which students can follow along with.

For this session, your students will each need:

- **2 pieces of chocolate (one at room temperature, one kept in the freezer)**
- **Spoon (or hammer if one is available)**
- **2 x sandwich bags**
- **Margarine (or any good 'insulating' material)**
- **(If using margarine) a spoon or knife**
- **Container of icy water**
- **Notebook and pencil to write down their observations**

Achievement Aims

NZ Curriculum Strand: Material World

Properties and changes of matter:

Group materials in different ways based on observations and measurements of characteristic chemical and physical properties.

Distinguish between pure substances and mixtures.

Chemistry and Society: Relate the observed characteristic chemical and physical properties of a range of different materials to technological uses and natural processes.

NZ Curriculum Strand: Technological Knowledge

Technological products: understand that materials can be formed, manipulated and/or transformed to enhance the fitness for purpose of a technological product.

Learning Outcomes

- Understand how and why engineers test different properties of materials.
- Understand that materials can be designed with specific properties to meet specific needs.
- Carry out an experiment to test the effect of insulating materials.
- Understand the challenges around implanting materials in the body.

BREAKING IT DOWN:

Science of Materials

Materials engineers invent and test materials to perform different functions. They do this by tailoring a material's properties such as strength, ductility, heat and electrical conductivity.

For centuries people used materials found in nature like wood, stone and

bone to make tools, jewellery and buildings. Natural fibres like silk and wool have been used for clothing for centuries and while we still use them today they aren't as common as more modern fabrics, which can be engineered to have a specific weight, feel or durability. Much later on humans invented plastics and all of these materials have been able to help us invent new solutions for the world.

Scientists are still discovering and creating new materials to try to improve what we already have. For example successfully mixing different materials resulting in a new material with a great combination of properties. Different metals can be mixed together to form alloys, or different material types like metals and ceramics can be mixed to form composites.

EXPERIMENT INSTRUCTIONS

Experiment 1: Brittle or ductile?

- Place one chocolate piece in the freezer and one at room temperature for an hour.
- Put both pieces on an impact resistant surface and hit with a hammer or spoon.
- Study the impact points on both. The cold chocolate should have shattered (brittle failure) whereas the warm one should have just compressed or squashed (ductile failure).

Experiment 2: Insulation Station

- Half fill one sandwich bag with your chosen insulating material (e.g. margarine, tissue paper)
- Place one hand inside the second sandwich bag, then place the covered hand inside the insulated bag.
- Place both hands into icy water and feel which hand detects the change in temperature first.

EXPLORE FURTHER

(Use these prompts to start a discussion or further inquiry on the topic of materials)

- What other materials are good and bad conductors of heat?
- Why do we need insulation?
- What properties would you want to design into a car body?
- What sort of clothes will we be wearing in the future, and what materials will they be made from?
- What other properties are easy to test?
- What's the rarest material on earth, and where do we find it?
- If we're so good at engineering synthetic materials, why do we still take so many natural resources?

FURTHER EXPERIMENTS & INFORMATION

Further science experiments and worksheets from the MacDiarmid Institute for primary school teachers can be found [here](#).



Thank you to
our Sponsors

CallaghanInnovation
New Zealand's Innovation Agency



If you have any questions, please contact info@nanogirllabs.com or check out Nanogirl's Lab – a new science adventure at home every weekday!