

Physical World: Recognise that some substances conduct heat better than others.

THE ROLE OF EFFICIENT HEAT TRANSFER IN THE MILKING SHED.

ESSENTIAL QUESTION

Is my milk too cool for school?

WHAT ARE WE LEARNING?

- Demonstrate that heat will flow from a hotter to a colder object
- Explore a technological or biological application of physics.
- Understand how the milking shed employs the laws of thermodynamics.

TRY THIS WITH

- Year 9-10
- Students who connect with real world problems.
- Students who enjoy replicating models.

FIND

- Identify
- Compare
- Recognise
- Illustrate
- Give Examples
- Observe

Challenge students to explain what occurs in the balloon, water and match test.

Encourage students to conclude that heat transfer is relying on liquid.

Explain that heat transfer actually occurs via three methods - Conduction, Convection and Radiation.

Make popcorn to demonstrate these three methods of heat transfer.

Support students to use photography to capture the moment of transfer.

Introduce the 2nd law of Thermodynamics.

Brainstorm a list of scenarios where we are trying to keep things warm (insulation).

Think about insulation and understand we are trying to do the opposite.

Ask students to experiment with ways to cool a beaker of 40 degree liquid.

Introduce students to the variable of surface area as a factor influencing cooling.



APPLY

- Choose
- Solve
- Connect
- Research
- Select
- Compare

Explain the Milking System diagram to students. Ask students how hot they think milk is when it comes out of a cow?

Challenge students to use YouTube to find as many methods of cooling liquids quickly online as they can.

Assign each viable experiment discovered online to an individual group.

Support each group to replicate the experiment modelled online.

Identify a set of criteria by which the experiment will be judged successful (rapidity, technique, efficiency, etc.).

Document each method and identify the most successful.

Identify where heat transfer (conduction) is occurring.

Research good materials for conduction.

Have each group take the most successful experiment but re-test it with each group using a different material for conduction.



PRODUCE

- Construct
- Hypothesise
- Prioritise
- Measure
- Infer
- Devise

Revisit the Milking System diagram and the temperature at which milk is produced.

Explain that a new standard for milk cooling will be introduced in 2016.

Use Pinterest to research current innovations.

Contact experts within New Zealand and abroad.

Challenge students to invent a solution for fast chilling milk in the shortest time possible.

Consider learnings from previous experiments involving the role of both surface area and conduction.

Create and document a working model of each milk cooling system design.

Evaluate models in class against each other (consider logistics, affordability and practicality).

Seek feedback from the professionals on your models with the DairyNZ and Fonterra teams using the hashtag #dairynz or by emailing them to hello@schoolkit.co.nz



SUCCESS CRITERIA

Students can check they have successfully completed the task by:

- Demonstrate at least one way to reduce the temperature of water (possibly by introducing surface area as a factor in cooling).
- Replicating a model found online for quickly cooling a liquid.
- Creating a workable model for chilling milk quickly that considers an agreed set of factors.

PRINCIPLES	VALUES	KEY COMPETENCIES	LEARNING AREAS	WORD BANK	KEY CONCEPTS
Future Focus High Expectations	Innovation, inquiry and curiosity Community and participation Ecological sustainability	Thinking Participating and Contributing Excellence	Science Mathematics and Statistics	1. Conduction 2. Convection 3. Radiation 4. Thermodynamics	1. Conduction 2. Heat Transfer 3. Surface Area 4. Insulation