Sweet Sustainable Science

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Objectives

- To illustrate activities to make the bridge between traditional science teaching and food science
  - Gas Pressure
  - Modelling DNA
  - Chemical change
  - Miscibility
  - Sustainability
  - Perception
- To introduce the free teaching resources available from Chilled Food Association: www.chillededucation.org

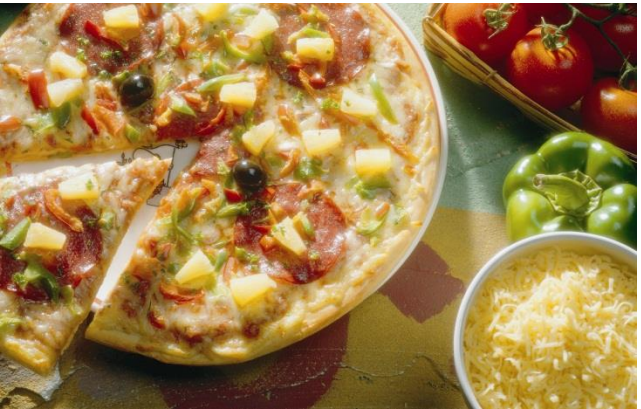

What Are Chilled Foods?

UK Chilled Food

Year	Market (£m)
1989	550
1999	4550
2005	7357
2010	9163
2017	11876

- Made in the UK
- Fresh! No preservatives
  - Must keep chilled
- 12,000+ different foods
- ~20 major companies
- 100+ UK production sites

- World-leading standards, systems and innovation
- Market growing at 3+% a year
- New foods all the time
- Applied science careers



People will always need to eat

Who Does it Take to Make Chilled Food?

70,000 people in the UK inc >1,000:

- Food scientists
- Plant scientists
- Environmental scientists
- Food technologists
- Food microbiologists
- Nutrition scientists
- Packaging technologists
- Engineers
- Hygiene and systems auditors
- New product developers

People who are

- Good communicators
- Problem-solvers: food forensics
- Passionate about food

Vacancies and long term demand!

Chilled Food Roles and Rewards

- Laboratory-based: Food safety and quality
- Product and process development: Developing new foods
- Working in the supply chain with suppliers and customers
- Working with factories developing good manufacturing practices

- Competitive salaries
- Graduate programmes
- Career development opportunities
- Foreign travel opportunities

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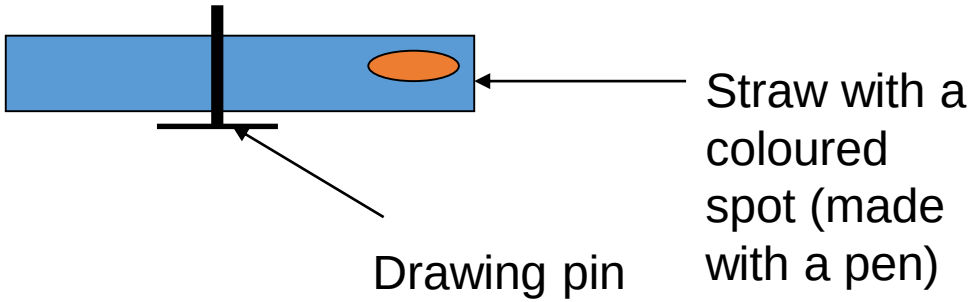
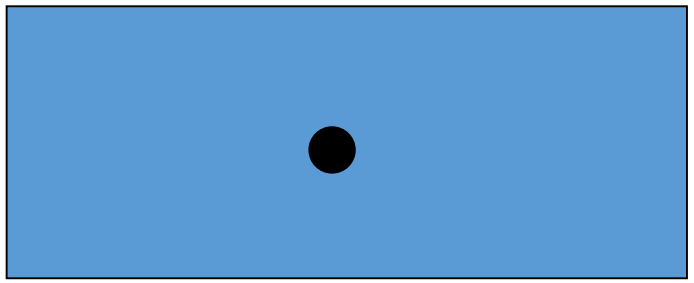
How do gas particles move?

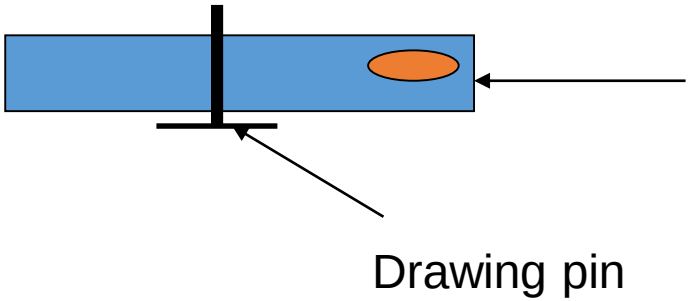
- Make a spinner, with one side marked.
- Put a spot in the centre of a double page.
- Spin and put a dot at the pointer end. Move the spinner to the dot, and re-spin. Connect the dots with an arrow.
- Do this 30 times and plot the path.

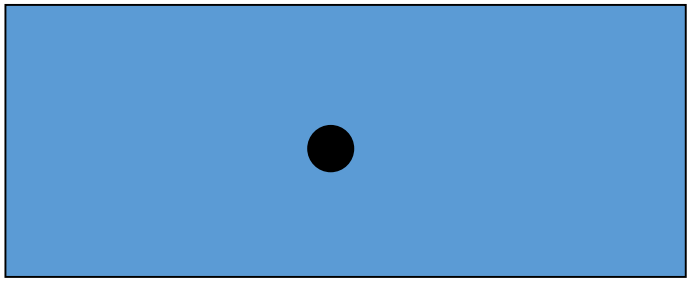




Understanding our model

- In our model:
  - What does the spinner represent?
  - What does the edge of the paper represent?
- So, use the model to explain what gas pressure is.





Gas Pressure

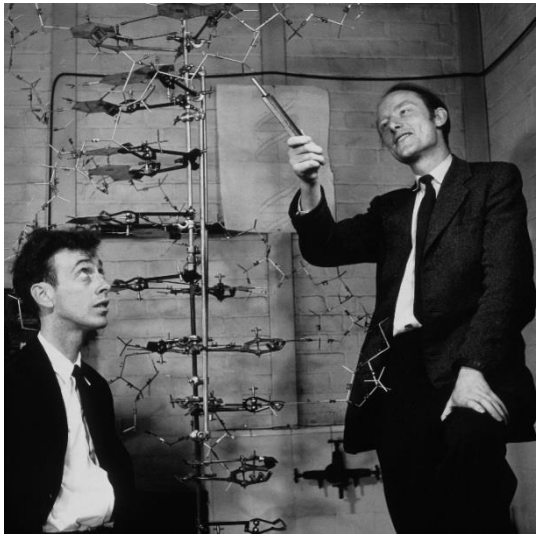
Real Life Food Examples

- **Atmospheric gas control use to preserve food**
- **3 main techniques:**
  - **Controlled Atmosphere Packing**
    - Large scale fresh fruit & veg storage
  - **Modified Atmosphere Packaging**
    - Reduced O_2 increases risk of anaerobic growth such as *C. botulinum.* Must control using e.g. low water activity (Aw), keep chilled if high Aw
  - **Vacuum Packing – retard oxidative rancidity**
    - Reduced O_2 increases risk of anaerobic growth, e.g. *C. botulinum* – must control

'Packaged in a protective atmosphere'

Structure of DNA

- Deoxyribonucleic acid forms a double helix.
- Watson and Crick suggested the structure in the 1950s using Rosalind Franklin's images of DNA.
- Watson and Crick received a Nobel Prize in 1962 for their work.

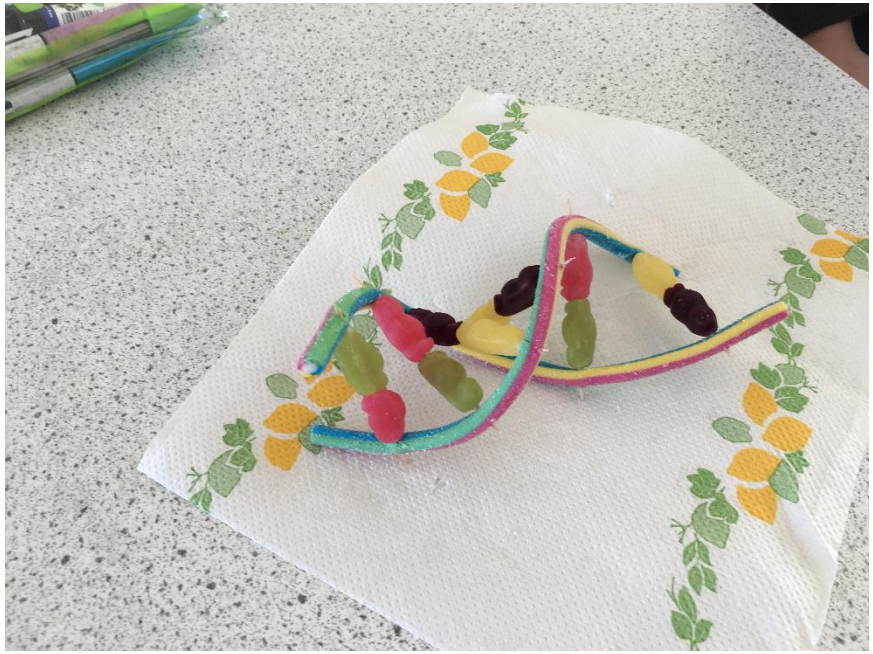


Key Terms

Key word	Definition
Model	Deoxyribonucleic acid, a natural polymer found in the nucleus of cells.
DNA	A section of DNA which has information about one protein which determines a characteristic.
Gene	Made of thousands of genes.
Chromosome	A simplified version of what is happening. Used to help us understand observations and make predictions.

Modelling DNA

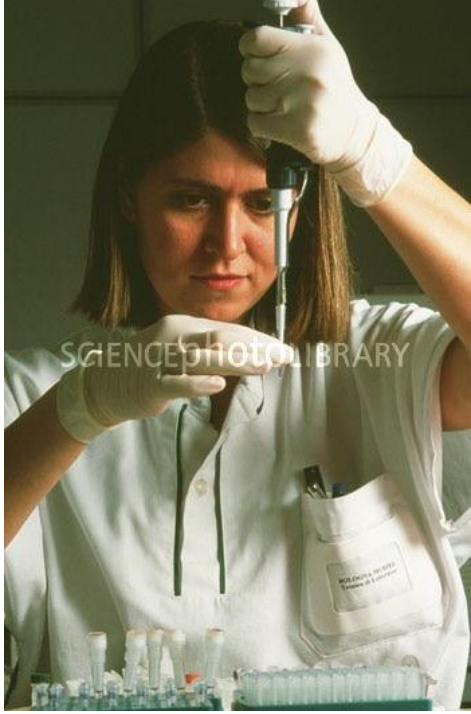
- You are going to use sweets to make a model of DNA.



- Why do you need four colours of sweets?
- What is modelling the polymer backbone?
- What is modelling the base pairs?

Modelling DNA

Real Life Food Example



- Food (and human) samples can help identify pathogen presence and help track foodborne illness: Next Generation Sequencing including Whole Genome Sequencing
- DNA can be analysed to identify any microorganisms present
  - DNA will be detected even if microorganisms are dead
    - Are microorganisms a potential threat if they are dead?
  - Could the samples be contaminated?
    - Could lead to false positives
  - A buttered egg and ham salad sandwich filling will contain chicken, pig, cow and what other potential DNA? **Why?**

How did the Victorians make ice cream?

Victorian 'Hokey Pokey' (ice cream) cart

Ice Cream seller in the 1930s

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Chemical change

Match the key word to the definition

Word	Definition
Miscible	A physical process to separate a mixture.
Immiscible	Two liquids that remain mixed to form a solution.
Separation technique	Two liquids that do not remain mixed.
Density	How heavy something is for its size. (=mass/volume)

Miscibility

Real Life Food Example

- **Mayonnaise (oil in water)**

  - ~80% oil, 20% vinegar, + egg* + seasoning
  - Oil dispersed as tiny droplets in a continuous phase of vinegar (o/w)
  - Mayonnaise does not feel greasy in the mouth – we sense only the continuous watery vinegar phase and not the dispersed oil droplets

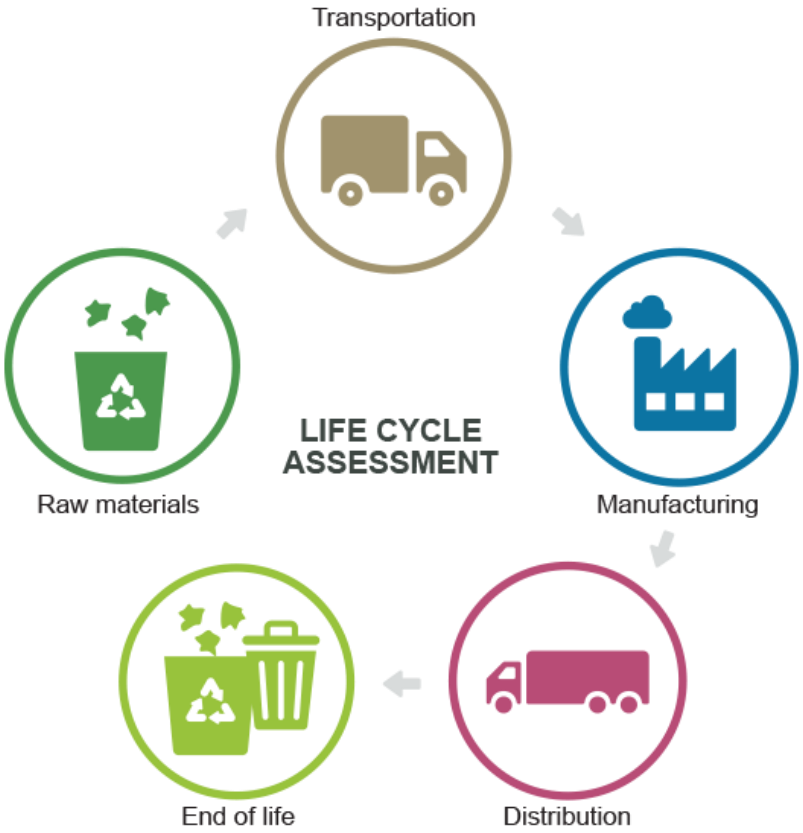
*emulsifier: stabilises oil droplets

- **Vinaigrette (water in oil)**

  - 3-4 vols oil + 1 vol vinegar
  - Vinegar dispersed as droplets in a continuous phase of oil
  - A w/o vinaigrette feels very oily compared with mayonnaise

Life Cycle Assessment

- Extracting and processing raw materials
- Manufacturing and packaging
- Use and operation during its lifetime
- Disposal at end of useful life, including transport and distribution at this stage



https://www.youtube.com/watch?v=6RNnzfUHwY8

Yoghurt Pots

Real Life Food Example

- **Beef lasagne:**
  - **Chilled prepared vs home prepared**
- Weigh all the fresh ingredients used
- Record weights of any peelings and what you do with them (e.g. throw them away, compost)
- Record any jars and sauces you use and how they are disposed of, e.g. recycled, thrown away etc
- Make lasagne noting how long you cooked components
- Weigh then cook lasagne, recording temperature and how long it took from turning on the oven for lasagne to cook
- Weigh lasagne after cooking
- Eat it
- Weigh the food waste and record how it was disposed of
- Calculate heat energy used in cooking, and % food waste
- Difference in heat energy: microwave vs oven?

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What are the tastes you can sense on your tongue?

www.chillededucation.org/food-teacher/food-teacher-lesson-plans

Perception

Real life food example

Taste Panel

NAME

PRODUCT

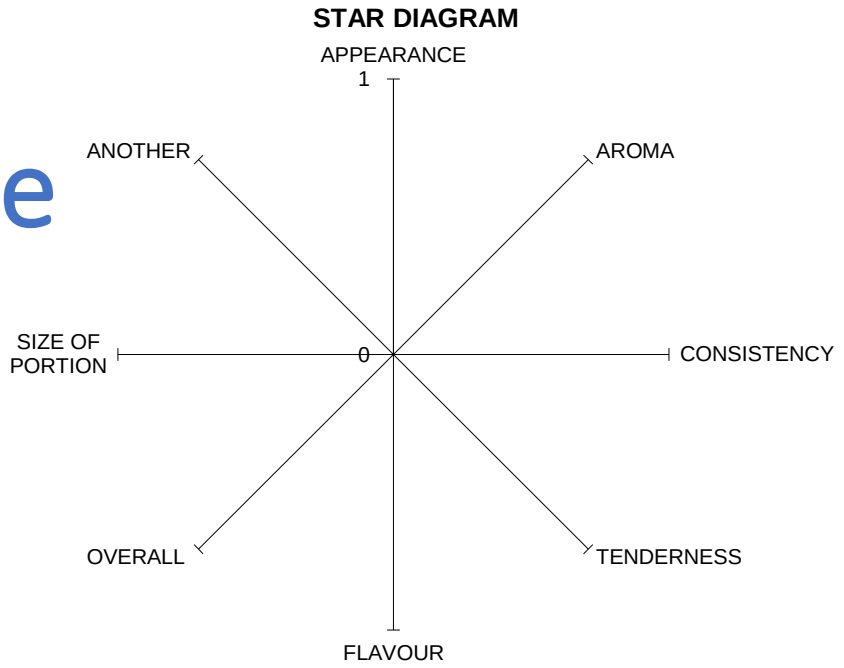
Directions

Place the numerical score in box in upper left hand
1) corner
Comments should reflect numerical
2) score
3) Evaluation of food products must be done individually

Scoring System

1 Very poor / nothing
2 Poor
3 Fair
4 Medium
5 Good
6 Very Good
7 Excellent

APPEARANCE /COLOUR					
AROMA /SMELL					
CONSISTENCY /TEXTURE					
TENDERNESS (IN MOUTH)					
FLAVOUR					
OVERALL EATING QUALITY					
SIZE OF PORTION					
ANOTHER					



Resources Available

- **Lesson plans (inc homework and teacher notes):**
  - www.chillededucation.org/im-a-teacher
- **Consumables:**
  - **MicroTrumps, Nanobugs microbe tattoos, fridge thermometers, Glo-germ UV kit, food science poster:**
  - www.chillededucation.org/food-teacher/food-teacher-practical-resources
- **Career path interviews**
  - **New graduates/placements:** www.chillededucation.org/food-teacher-case-studies
  - **Established chilled scientists:** www.chillededucation.org/career-paths

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Please stay in touch.

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