With support from Oxfordshire County Council,
Science Oxford is pleased to present;

Sweetie Science

The Science of Sweeties

STEM Club Resource Pack

OXFORDSHIRE COUNTY COUNCIL

Introduction:

Have you ever wondered why sweets fizz, which type of liquorice is the strongest or how far you can stretch a wiggly worm?

Through a series of short experiments you can demonstrate and test scientific theory using sweets!

In this investigation you will be studying the properties of different sweets including;

- The fizziness of sherbet
- The structural abilities of marshmallows
- The strength of liquorice
- The melting temperature of chocolate
- The stretchiness of jelly sweets
- Different sweets abilities to float

Suggested Timetable:

Week 1 - Fizzing fun

Make your own fizzy sherbet

Week 2 - Marshmallow towers

A construction challenge

Week 3 - Lovely Liquorice

Test the strength of liquorice sweets

Week 4 - Melting Chocolate

Investigate the melting temperatures of different chocolates

Week 5 – Worms

Test the stretchiness of gummy worms

Week 6 - Floating & Sinking Sweets

Investigate the density and buoyancy of different sweets

Week 1: Fizzing Fun

Equipment needed:

Icing Sugar	Bicarbonate of Soda
Citric Acid	Plastic spoons
Small plates or dishes	Flavourings (optional)
Food colouring (optional)	Weighing scales

What to do:

Sherbet is made from Sugar, Citric acid and Bicarbonate of Soda.
Taste the three ingredients one at a time, which one tastes fizzy? Your challenge is to design the 'best' sherbet dip by experimenting with different quantities and combinations of each ingredient.

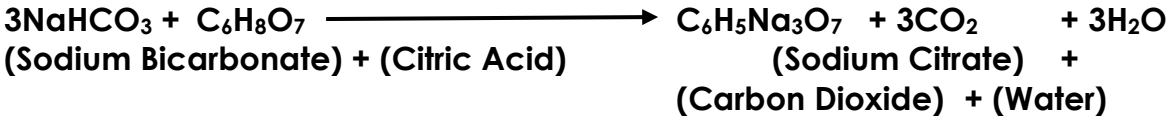
Things to think about:

- Can you work out what each ingredient does?
- Which powder was the fizziest?
- How could you measure this?
- What flavours could you add to your sherbet?

Science Note:

All the ingredients need to be dry when you start experimenting. The 'fizz' produced from sherbet is actually carbon dioxide gas, which is produced when the sherbet comes into contact with water (or the saliva in your mouth).

Sodium Bicarbonate reacts with citric acid in the presence of water to produce carbon dioxide, the sugar makes it sweet to taste and citric acid makes it sharp.



Health and Safety Note:

Do not taste the sherbet if you are allergic to any of the ingredients; also make sure you carry out the taste testing outside of the science laboratory.

Week 2: Marshmallow Towers

Equipment needed:

Marshmallows	Spaghetti
Timer	Tape Measure
Rubber egg	

What to do:

This is a construction challenge

You must build the tallest free-standing tower that will hold the egg for at least 30 seconds, using only the equipment provided.

Suggested constrictions:
- Work in teams of 3-5
- Each team should get 6 marshmallows and a handful of spaghetti
- Building time should be limited to around 30 minutes.

Things to think about:
- What building shapes make the tower stronger?
- How does the size of the base affect the strength of the tower?
- Does the placing of the marshmallows affect the strength of the tower?

Extension Activities:
Repeat the challenge using different brands of marshmallows and/or spaghetti. Are economy brands as good as premium brands? Compare ingredients and try and work out what might make a difference.

Science Note:
Some shapes and materials are stronger than others and even weak materials can be made stronger with good design techniques. Distribution of mass is an important consideration, as it will affect balance and therefore stability of the tower.

Health and Safety Note:
Do not eat any of the testing materials.

Week 3: Lovely Liquorice

Equipment needed:

Liquorice cables assorted sizes	Strawberry laces
Liquorice bootlaces assorted sizes	Assorted science equipment
Liquorice allsorts	Weights

What to do:

You will be given three to four different liquorice sweets. Plan and carry out an investigation to find out which is the strongest.

Things to think about:

- How will you measure the strength of liquorice sweet?
- How will you compare strength of various liquorice sweets?
- How will you make the test fair?
- How could your tests be improved?

Extension Activities:

Compare other sweets to liquorice, for example strawberry laces.

Science Note:

The focus of this activity is not really about finding the strongest liquorice sweet, but instead about how you test the principle and develop the investigation. It is a good opportunity to plan an investigation and consider the accuracy and reliability of your results.

Health and Safety Note:

Do not eat any of the testing materials.

Week 4: Melting Chocolate

Equipment needed:

White Chocolate Bar	Plastic bag
Milk Chocolate Bar	Thermometer
Dark Chocolate Bar	Kettle
Tub	Water

What to do:

- Unwrap each of your chocolate bars and place them in separate plastic bags.
- Predict what order the chocolate will melt in
- Place the bags in a tub of warm water.

Things to think about:
Were you accurate in your predictions?
What reasons can you give for your results?
How could you work out the exact temperature each chocolate bar melted at?

Extension Activities:

Does organic chocolate take longer? Does the colour or material of the wrapper make a difference to the melting point?

Science Note:

Different types of chocolate melt at different temperatures.

- White chocolate melts at 38-40^{o}C
- Milk chocolate melts between 40 and 45^{o}C
- Dark chocolate melts between 45 and 50^{0}C.

This is because they are made up of different ingredients.

- Dark chocolate is chocolate without milk as an additive. It is often called plain chocolate and contains a 15% concentration of chocolate liquor. This is a minimum of 35% cocoa solids.
- Milk chocolate is chocolate with milk powder or condensed milk added and contains 10% concentration of chocolate liquor. This is a minimum of 25% cocoa solids.
- White chocolate is a confection based on cocoa butter only.

Health and Safety Note:

Do not eat any of the testing materials.

Week 5: Worms

Equipment needed:

Jelly snakes	Assorted science equipment
Jelly worms	Assorted jelly sweets

What to do:

You will be given three to four different jelly sweets. Plan and carry out an investigation to find out which is the stretchiest.

Things to think about:

- How will you measure stretchiness?
- What problems might you encounter?
- How will you make the test fair?
- How accurate will your results be?

Extension Activities:

Compare other sweets to liquorice, for example strawberry laces.

Science Note:

The focus of this activity is not really about finding the stretchiest jelly sweet, but instead about how you test the principle and develop the investigation. It is a good opportunity to plan an investigation and consider the accuracy and reliability of your results.

Health and Safety Note:

Do not eat any of the testing materials.

Week 6: Floating & Sinking Sweets

Equipment needed:

Assorted pick'n mix sweets	Water
Tub	Sparkling water
Cooking oil	Washing up liquid

What to do:

Try putting different sweets into

- Cold water
- Hot water
- Fizzy water
- Cooking oil
- Washing up liquid

Predict what you think will happen before starting the experiment

Things to think about:

- Were your predictions as you expected?
- What other observations could you make?

Science Note:

There are two things at play here: one of which is density and the other is buoyancy. Density is the amount of mass a substance has per unit volume. As a rule, less dense substances float on more dense substances.

Buoyancy is the force the liquid exerts upwards on the object placed in it. Buoyancy is dependent upon the mass of the object and its size. For example a metal ship will float, despite steel being denser than water, because it displaces a lot of water with its size which creates a very large upwards force.

Health and Safety Note:

Do not eat any of the testing materials.