University of Limerick
Ollscoil Luimnigh

TEMI
Teaching Enquiry with Mysteries Incorporated

EPI-STEM
National Centre for STEM Education

Student Handbook

Homemade Heroes

Table of Contents

Introduction:

Over the next 8 weeks we will be covering different topics that will broaden your knowledge of the three science subjects and set you up for what might come ahead. For it to be a success it will require your co-operation and participation. Your questions are what will make it to be fun and enjoyable as its set out to be. It is also essential that you get involved and no matter how silly you think a question or answer is you speak up. Group work is a big part of this so it requires you to have discipline and ensure that what is being asked of you is being met. It is important that the lab is treated with the same care as all other classroom situations and that the teacher is obeyed at all times.

GENERAL LAB RULES:

- Nobody has permission to enter the lab without supervision of an appropriate teacher.
- No eating/drinking in the lab.
- Bags etc. must be kept tidy under desks at all times.
- PPE (goggles, lab coats, gloves etc.) must be used when carrying out experiments.
- Equipment must be cleaned and returned to appropriate storage place after use.
- Carefully follow directions, both written and oral. Do only the steps described in the procedure of the experiment or that are described and/or approved by the teacher. If you are in doubt about any procedure, ask your teacher for help.
- Proceed with caution when in the lab. Do not carry materials around the classroom if at all possible.
- Misbehaviour in the lab will not be tolerated.
- If an accident occurs e.g. glassware is broken, chemical spill etc., notify the teacher immediately
- All students must familiarise themselves with the location of fire exits and eye wash facilities in case of emergency
- Do not taste, touch, or smell any reagents unless directed to do so by your teacher. When smelling chemicals or gases, use a wafting motion to direct the odour toward your nose.
- Extreme caution should be used when using a Bunsen burner. Keep your head and clothing away from the flame and turn off the burner when it is not in use. Long hair should be tied back to avoid it catching fire. Before leaving the lab, check to see that all gas valves and hot plates are turned off
- Keep insoluble waste material out of the sink. Dispose of waste material as instructed by your teacher.
- Wash hands thoroughly with soap and water before leaving the lab

Student contract:

I, _____, have thoroughly read the Laboratory Safety Rules and agree to follow all safety rules and procedures. I will conduct myself in a safe and cautious manner in the laboratory. I will not perform any unauthorized lab procedure. I understand that misbehaviour in the lab or failure to follow safe lab procedures could cause a serious accident. I further understand that a violation of these rules could result in my not being allowed to participate in future lab exercises.

Student Signature_____ Date: _____

Unit 1: The disappearing act

Single Lesson: Hide and seek

What do you think has happened in the cup? (Write all possible ideas, no matter how crazy)

_____
_____
_____
_____

Next demonstration: can you expand on and try explain what you seen in the previous demonstration.

_____
_____
_____
_____
_____
_____

Can you think of advantages or disadvantages to the way this works?

_____
_____
_____
_____

Name uses for this material. And any items that might be similar.

_____
_____
_____

What is the link between what you have just seen and the picture your teacher showed you?

_____

_____

Cat litter why is this not used instead? Think about this

- Have you seen cat litter before?
- What does it look like?
- Feel like?

_____

_____

_____

You just watched a video clip what new information did you learn?

_____

_____

_____

How can we test 2 different nappy types against each other? (Remember: What needs to be kept constant to ensure a fair test?)

_____

_____

_____

_____

_____

_____

_____

How can we test different age groups against each other?

_____

_____

_____

_____

_____

Double class: Test for the best.

Fun fact:

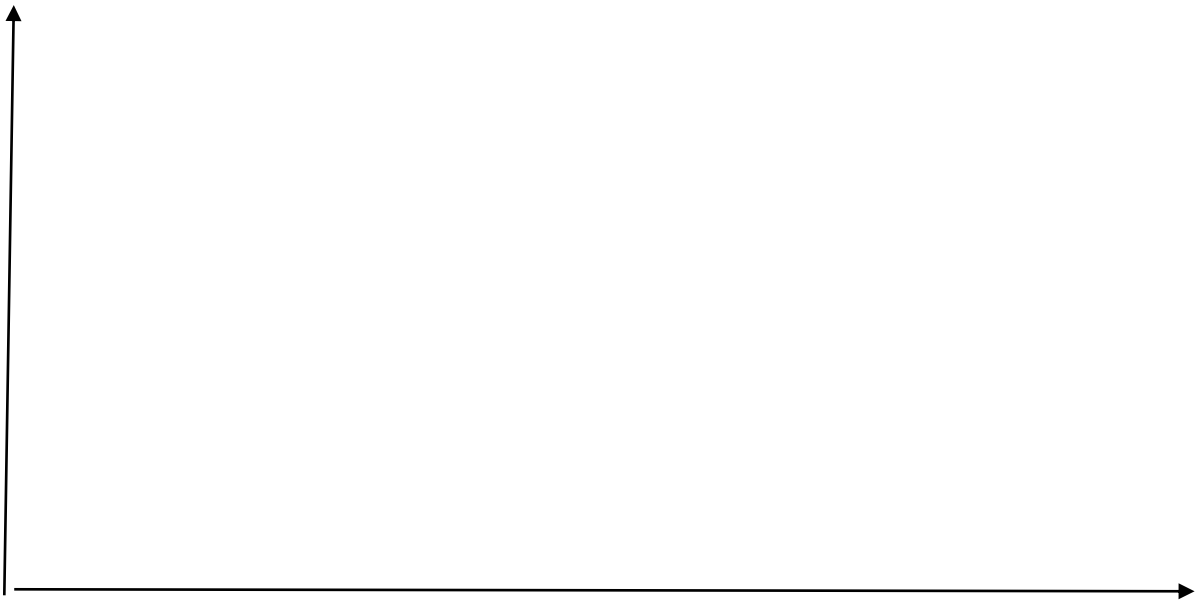
Hydrogels can absorb up to 500 times their own weight.

Yesterday we looked at the materials in nappies. We looked at the way they absorbed water. Today we will be measuring various nappies and there absorption.

Draw a diagram of the apparatus required for the testing:

Calculations:

Graph:
Ensure to label axis, use a ruler and pencil and take time to ensure a neat and accurate graph.



Fun Facts:

Many people in tropical countries don't use diapers at all. This is actually true although more likely in the rural areas. Partly because the weather is better, in the hotter tropical areas many families simply watch the baby for tell-tale clues something is about to happen and take them outside to perform in the open. No doubt this is a fairly efficient method or it wouldn't be so widespread.

Was your method successful? Did it require any alterations?

_____
_____
_____

What is the difference in the age groups from your experimentation?

_____
_____
_____

What conclusions can be drawn from the experiment that you have carried out?

_____

_____

_____

What was your best brand for absorbing? Did all groups have the same results?

_____

Did price play a part in the level of absorbency? Explain.

_____

_____

_____

Explain in your own words what hydrogel polymers are from what you have learned.

_____

_____

_____

Can you think of a reason why the absorbency levels vary?

_____

_____

Single lesson (optional): How it works.

What's the link?

_____

_____

_____

Explain in your own words what hydrogel polymers are from what you have learned.

_____

_____

_____

Group work: each group will be given a topic to research.

There is two ways this project can be submitted.

- **PowerPoint**
- **Poster**

Questions that need to be looked at when carrying out the project.

1.
2.
3.
4.
5.

What will your role in this group project be?

Unit 2: Now you see me, now you don't!

Single lesson: Hidden message

Teacher needs a volunteer will it be you!!!!!!

Teacher just wrote a message why isn't it showing up?

_____

_____

What is in the bottle 1? :

What is in bottle 2? ;

Can you think of any reason at all why they might act in this manner? Use your knowledge from junior certificate.

_____

_____

What type of a reaction is this?

_____

Why does the colour fade and disappear after time? Could you speed this up?

_____

_____

_____

If you sprayed again would it reappear?

_____

_____

_____

Take the lead test it in a test tube and draw step-by-step diagrams of what happens to the solutions.

Blow through the mixture with a straw what happens?

_____

_____

_____

Write down 3 points of information that you have learned in this class.

1.
2.
3.

Double lesson: Homemade heroes

Hidden messages:

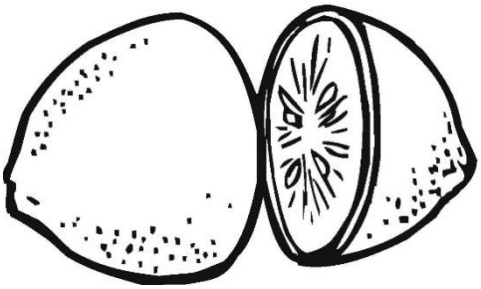
I want you to think of their uses:

Is there any other method you can think of at home that might be useful?

not involving chemicals or food

This one is all down to you! Come up with a plan first yesterday we looked at uncovering secret messages using chemicals. Today is your opportunity to trial household items with chemicals, heating and other methods to see if you can uncover a secret message.

How are you going to start off? Will there be a method to your madness:



If one does not work what will you do?

Results Table:

Recipe	Pass	Fail

Is it fun to try out stuff that might not work? This is how things are discovered.

Is there any item that shocked you?

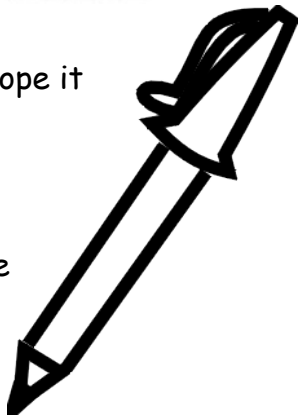
Do you think you will ever use this technique to communicate?

What was your most effective secret message?

Development:

What will happen to the egg for the message to become visible?

Single lesson optional: Pentastic



Get your eggs- 2 minutes to find the person holding your egg so I hope it was a good message!

Hope you brought your felt tip pens:

When you were younger did you ever get a secret writing pen or one that changes the colour of another pen?

How did they work?

_____

_____

_____

_____

Today we will try make our own secret writing pen. In the previous class we found loads of recipes what worked and what didn't, today we will use some of the ingredients to make our own.

Method:

THE BIG QUESTION: did it work?

Unit 3: Ice, Ice baby

***Single lesson: Ice cold class*:**

What is the melting point of ice? _____

What was the melting point in the beaker the teacher has? _____

Is there a difference and if so what could it be? _____

_____

What happens ice as it is melting?

_____

_____

_____

Teacher just showed you a photo can you explain what is going on? How is it relevant to what we are doing?

_____

_____

_____

Can this be called a reaction? Explain answer.

How can this be of benefit to us in this day and age? Come up with individually and then join with the person beside you. Discuss how it will work as well.

Double lesson: Melting time

Hypothesis: _____

_____

_____

Are you using salt or sugar? _____

1. Record your measurements on the chart below.

Mass of salt (g)	Initial volume of water (mL)	Initial mass of ice (g)	Final volume of water (mL)	Temp at start (°C)	Temp after 3 mins (°C)	Change in Temperature (°C)
0						
15						
20						
30						
40						
50						

Plot a diagram describing how the Temperature of water varies with the salt concentration.

Why did some of the ice melt even without the addition of salt?

Explain in two short sentences why the melting temperature of water decreases in the presence of salt.

Ice packs: notes on what you are required to do.

-
-
-
-
-

Single lesson optional: I scream for……

It's your turn in the previous lesson you were given a task to do on ice packs what information did you gather? Let's share it with the class.

Let's move on, no matter what time of the year everyone loves ice cream, let's try a little technique of our own.

(*if anyone student has food allergies please tell teacher immediately)

Write down the procedure so you can make it anytime you want!

1.
2.
3.
4.
5.

Was it as tasty and easy as you hoped?

Write down 3 things you have learned in this unit about the use of salt and ice together.

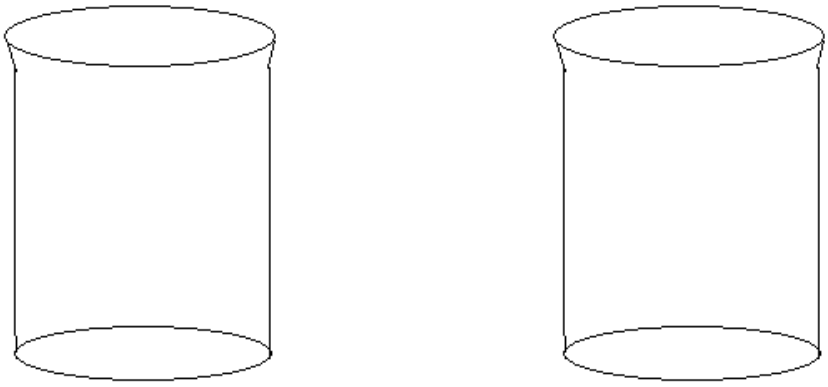
1.
2.
3.

Unit 4: What floats your boat?

Single lesson 1: egg-celent

To introduce you to what we will be covering the teacher will carry out a demonstration.

What is happening in the two cups up the front of the class?
Draw your answer:



Can you come up with any reasons to what is going on?

1._____

2._____3._____

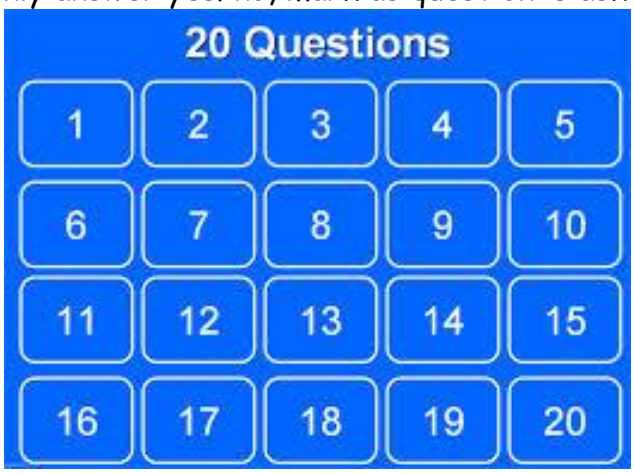
_____4._____

_____

Its game time you get to question the teacher:

The aim find out what is going on with.

*The teacher can only answer yes/no, mark as question is asked.



If I was to add water to the 2nd cup what would happen? Can you explain this?

_____

_____

_____

The teacher has just described an activity for you to carry out, in your own words describe what you have to do:

_____

_____

_____

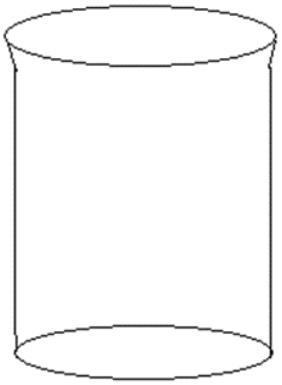
Materials:

-
-
-

Method:

1.
2.
3.
4.
5. Observe what happens and take note of the results.

Results:



_____
_____
_____
_____

Explain a hydrometer in your own words.

_____
_____
_____

Calculations:

Double lesson: Let's get accurate!

Is there a difference between swimming in an ocean and a pool? Explain in relation to yesterday's class.

_____
_____
_____
_____
_____
_____
_____

You're going to make a hydrometer explain how and draw a diagram. State materials required:

_____
_____
_____

Ok, so we just made a hydrometer now it's the best part making sure it works and testing it out.

Materials:

- Permanent markers of different colours
- Graduated cylinders
- Water
- Salt
- Sugar
- Ruler
- Scissors

Method:

1. Place the straw with the mala at the bottom into the beaker/graduated cylinder of distilled water. The straw should float level in the water. (If it sinks, remove some excess mala)

2. Measure the distance from the top of the straw to the water level by using your thumb and index finger just on the water level when taking the straw out and then marking it with a permanent marker.

3. Your hydrometer will show if the liquid it is placed into is more dense, less dense or the same density as pure water.

   Question: If the liquid is denser than water, would the hydrometer float higher or lower in the liquid than in the water?

4. There are five different solutions going to be mixed. Using water in the beaker add the sugar/salt and mix until completely dissolved. The solutions are 20 g/L, 40 g/L, 60 g/L, 80 g/L, 100 g/L

Calculate what will be needed for 100ml instead of a L:

5. Place the hydrometer in the solution. Record the measurement from the top of the straw in the appropriate row and column on the table.

6. Remove the hydrometer, replace the solution with a different one, and repeat step 5 for all five sugar/salt and water solutions.

7. Find the density of each solution in comparison of millimetres and record these in the table.

Take your hydrometer up to the front and place it in the "Unknown Solution."
Record your hydrometer reading: _____

Table of results:

Sugar in grams	10	20	30	40	50	Unknown (Estimate)
Density: How many mm from 1 (water)						

Where your results as expected?

_____
_____
_____

Put your conclusion in to your own words:

_____
_____
_____
_____

Development:
Draw a diagram of what happened:
Is this what you expected to happen?

_____
_____

Single lesson optional: Does difference matter

Will temperature matter when it comes to density? What do you think?

_____
_____

Let's take a look at this: how could we check this out?

_____
_____
_____
_____
_____
_____
_____
_____
_____

What would you expect to happen? Will there be a difference? What will it be?

_____
_____
_____

Draw a diagram of how it works:

Have you ever been in a very warm room on a very cold winter day and opened a door or window leading to the outside for a short period of time? What happens?

Unit 5: What's going on?

Single Lesson 1: What's going on?

Take notes on what the teacher is describing:

What in your opinion is the answer to mystery of the case study described by the teacher? (Hypothesis)

_____

_____

What is a home brewery? Have you any idea how this might work?

_____

_____

_____

How is alcohol made? Any ideas?

_____

_____

_____

Have you heard of fermentation before? If so for what reason?

_____

_____

As described your teacher, the subject in the case study often became intoxicated after eating high glucose food. What is glucose?

_____

_____

_____

Fun Fact: ** this is actually a real disease now**

How would you test for glucose?

_____

_____

Name 3 foods that contain glucose:

1.
2.
3.

With the help of what you have learned, create a word equation for alcohol fermentation.

In pairs working from your hypothesis from the first question and what you have learned: come up with the solution to what the case studies problem is.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Other cases have shown up tend to happen after consuming antibiotics, any idea why this might be the case?

_____

_____

Double lesson: Make your own!

Test to make an alcohol.

Apparatus:

Procedure:

Diagram of apparatus:

*

What change are you making to the suggested guidelines? Why is this important?

_____

_____

Using some previous knowledge how are you going to test for an alcohol?

_____

_____

_____

Business plan:
Take notes on the key points required.

-
-
-
-
-
-
-
-
-
-
-
-

Single lesson: Where it all went wrong.

Today is the day, we test our results each group will check there results against the group who followed the optimum.

How do you use the hydrometer? (recap)

_____

_____

_____

Where would you expect your results to fall on the hydrometer?

_____

_____

What conclusion can be drawn from the experiment that you carried out and its comparison to the optimum settings?

_____

_____

_____

_____

_____

PRESENTATION TIME!!

Unit 6: Food for thought

Single lesson: elephant toothpaste

Draw a diagram of what the teacher just carried out:

What could be the difference in the two graduated cylinder?

_____

_____

What is the liver added for?

_____

_____

What happened the glowing splint?

What does that mean?

_____

_____

Can you begin to make an equation for the reaction?

Let's introduce the word denaturation – can you hazard a guess at what this might mean?

_____

_____

What effect would denaturation have on the human body?

_____

_____

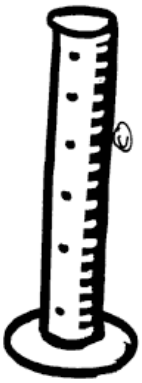
_____

Draw a diagram to explain denaturation.

If you had 3 sources of catalase how would you test them?

Double lesson: It's foaming up!

Recap on previous lesson what materials did we need to carry out the demonstration? Draw these out.



How did I carry out the procedure?

_____

_____

_____

Today ye will be working with 3 sources of catalase, explain what catalase is.

_____

_____

_____

Fun Fact:

Enzymes have a special pocket on their surface called an "active site." The molecule that they are supposed to react with fits neatly right into that pocket. The molecule or substance that the enzyme reacts with is called the "substrate."

Experiment Results:

Temp °C						
Initial volume (cm^3)						
Final volume (cm^3)						
Foam produced (cm^3)						

- Graph your results:

Which was the most effective catalyst for this reaction? Why?

Which substance (catalyst) had the least effect on this reaction.

What is a control? And how would you have a control in this experiment?

What product was observable that allowed you to conclude that a reaction had occurred?

What test could you carry out to test if the gas was oxygen?

Why were the reaction rates between the different sources?

Fun Fact:

Enzymes don't get used up after they do their job. They can be used over and over

Single lesson optional: What works best?

Debate time: what is more beneficial to you?

Raw or cooked food.

Teacher will assign your group.

Work in small groups to come up with at least 10 arguments. Then join and unite against the other team. The more arguments you have the less the other team can attack you.

Teacher will give you one source of information to use based on enzymes.

Try think of more information on enzymes. You can also have 3-4 on other relevant reasons.

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Fun Fact:

Many drugs and poisons act as inhibitors to enzymes. Some snake venoms are inhibitors.

Unit 7: Move that Body!

Single lesson: Man versus Woman

Draw a diagram of the set up for the demonstration:

What do you expect to happen when you hear man V woman task?
Try it out! What is happening?

_____

_____

_____

_____

What do you know about this topic from junior certificate?

-
-
-
-

Let's move on and try something else that both men and woman will be equally able; Draw a diagram of what the teacher is asking you to do:

Try it out is it harder than it looks? Explain.

_____

_____

_____

Double lesson: It's a circus!

This is a practical lesson so get ready to bust some moves! This is going to be one of the hardest and frustrating labs you have ever had… the question is are u ready?

Teacher is going to give you 5 different activities to trial, you and your pair can have 2-3 goes on each one (you will want more wait and see).

Write down how you got on and try give the explanation behind it using your previous knowledge: draw diagrams to indicate where your centre of gravity is.

Trial 1:

Trial 2:

Trial 3:

Trial 4:

Trial 5:

Discussion: Does your centre of gravity change as you become pregnant or as you get older? Think about this write down your views and we will discuss it in a few moments.

When else does your centre of gravity change?

Sports and centre of gravity, does it have an effect or is it irrelevant?

Explain why you think this way.

Single lesson optional: Sports galore

Have you ever watched how a runner begins a sprinting event such as the 100 meter dash? What is the first thing they do? And why. (Hint use what you know)

_____

_____

_____

_____

_____

_____

_____

Why do people jump over the high jump backwards? What does it do to their centre of gravity have you ever tried?

_____

_____

What topic are you covering? _____

Draw the different positions of where you think the centre of gravity might be.

Then go home and look it up to check how accurate you were. Draw the real image beside it.

Unit 8: Bubble Trouble:

Single lesson: Jumping pepper

In this lesson you are going to carry out a short demonstration in your groups. The teacher will go through the instructions with you before you begin.

Remember take not of what you see observation is key!

Firstly can you think of a reason why the pepper floats on the top of the water?

_____

_____

_____

Draw a diagram of what happened on both occasions:

Can you explain how soap works? If not give it a guess.

_____

_____

_____

Next let's see if it effects the way water responds to paper? What will happen if I have two cups with water and place washing up liquid in one, then adding a ball of paper?

_____

_____

_____

What is the benefit of it for cleaning?

_____

_____

What will happen in the glass with the washing up liquid?

_____

_____

Bubbles? How can they be made if soap and water act the way they do?

_____

_____

_____

Homework:

Will all products have the same effect?

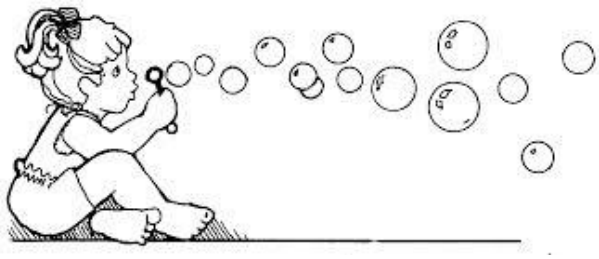
Write down the name of a household item you want to trial. Is it effective?

_____

_____

_____

Double Lesson: Burst your bubble



If I asked you to make bubbles for me now how would you do it?

_____

_____

_____

Explain a step by step procedure on how to make a bubble in your own words. (This is known as a task analysis don't leave any step out)

_____

_____

_____

_____

_____

_____

_____

Fun Fact:

The largest free floating soap bubble has a volume of 20.65 m^3 (729.25 ft^3) and was made using a wand. It was produced by Megan Colby Parker (USA) at Forges Field Recreational Park, Plymouth, Massachusetts, United States, on 27 April 2013.

Note the different ingredients you use when trialling different bubble recipes.

- **Water from the tap**
- **Deionised water**
- **Dishwashing liquid**
- **Sugar**
- **Laundry detergent**
- **Glycerine**
- **Corn syrup**
- **Beaker for mixing**

Method for measuring:

1. Place a piece of paper on the wall. Get a student blow the bubble at the piece of paper. The diameter of the bubble can then be taken using a ruler. (coloured paper might work better)
2. Blow a bubble and time how long it lasts. If it comes in to contact with something does it burst.
3. Finally try join two bubbles together and note what happens.

Recipe Book: Best bubbles around

Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6
How effective was the bubble recipe? (did it work? Did it last long? Was the bubble produced big? How could you improve it?)					

Fun Fact:

The most people inside a soap bubble is 214 and was achieved by Milka Bubbly and Matěj Kodeš (both Czech Republic) at Trade Fair Palace, Prague, Czech Republic, on 1 March 2014.

What was the most effective recipe and did it shock you?

_____

_____

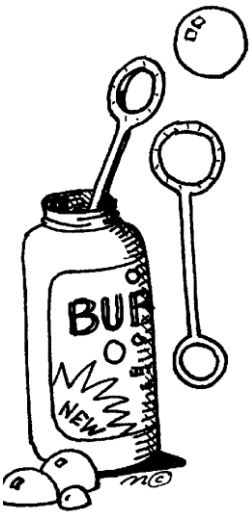
Summerize what happen during your investigations:

_____

_____

_____

Single lesson (optional): World Record



It's your turn to set a world record:

When doing this they will have to-

- Decide on a title for the world record

  _____

- Decide a place where this can be carried out

  _____

- Think of the equipment that they will need for this to work

  _____

- What will be the best recipe for the bubbles

  _____

- How will it be advertised – posters, Facebook page, slogans, etc.
  Use space below: