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Self-marked grade: 24/30

A chemistry topic suitable for scientific investigation has been identified and the stimulus for that topic has been explained. A range of scientific terms appropriate to the topic are used and explained in an appropriate context.
5/5

Enjoyable experiences of science have been described (either as emerging from or contrasting with aspects of the documented investigation) and characteristics of enjoyable science explained.
4/5

Opportunities for further investigations which would advance knowledge in this field have been discussed with reference to the Nature of Science strand **3/5**

Journal has appropriate structure and headings as a 'science journal' describing a scientific method of investigation which is appropriate to the topic and conducted in accordance with scientific conventions and utilises relevant equipment **4/5**

Appropriate data is collected, numerical transformations are applied if appropriate, and representations of data gathered are suitable to the topic and nature of the data **4/5**

Logical conclusions (findings) have been drawn with reference to the data collected **4/5**

Material World Journal:

19/7/2014

Today I attended my niece's 1st birthday party. There were bubbles. I love bubbles, and so did all of the kids there. They raced to pop the bubbles before they floated away. The bubbles were large in shape and numerous. The children were using a store bought bubble mixture – we started talking about making bubbles at home. My sister in law said she had had tried to make bubble mixture at home, but the bubbles are always small in size and didn't really float away from the wand. I wonder why that is? I think this investigation will enable me to gain confidence in my chemistry knowledge, and will solve the problem of creating vs purchasing bubble mixture.

Question: What is in the store bought bubble mixture that makes it successful?

20/7/2014

My first question was what are the ingredients in store bought bubble mixtures?

Purchased bubble mixtures contain:

- Detergent (Water soluble cleansing agent)
- Distilled water (Water with its impurities removed via distillation)
- Glycerine (a substance similar to sugar – commonly purchased as Glycerol a simple polyol (sugar alcohol))
- A polymer (A compound that has large molecules – it is often a starch or simple plastic)

The detergent mixed with water creates the bubble, the Glycerine or Polymer acts as a glue to keep the bubble in its formed shape for a greater length of time than without this added ingredient.
(<http://soapbubble.wikia.com/wiki/Ingredients>)

After obtaining this information I have decided to conduct a fair test: This seems like the only way to be sure that the different solutions can be compared.

I will create two sets of mixtures each set with one variable. Testing the effect of sugars the other the effect of polymers.

Alternatives to Glycerine:

Glucose (Commonly known as Corn Syrup)

Sucrose (White Sugar this will be made into solution)

Honey (Sugars: Fructose and Glucose)

Alternatives to Polymer:

Guar Gum

Xanthan Gum

PVA (Polyvinyl Acetate) glue

Hypothesis: By adding a Polymer or Glycerine to my detergent water mix I will have a mixture that will create as many bubbles as a commercial made bubble mixture.

27/7/2014

Today I am going to make some of the ingredients necessary for my mixtures.

Sucrose Solution:

A solution is when one solvent has been dissolved to make a solution. e.g. salt water or Raro. I made a 50% solution. This is when you mix the same weight water with the same weight of product. Sucrose is an organic compound typically known as White sugar or cane sugar. I used Chelsea Castor Sugar, and weighed 50grams into a bowl and dissolved (incorporated a solid into a liquid) in 50grams of boiled water. I used a metal spoon to check all the grains of sugar had dissolved into the solution. I will store this in an airtight container in the fridge until I will be ready to use it in my bubble mixture.

Making Distilled Water:

- Large Pot
 - rounded lid for the pot
 - glass bowl that floats inside the pot
 - ice cubes
1. Fill the large pot partly full of water.
 2. Set the collection bowl in the pot. The plan is to collect water dripping from the centre of the inverted pot lid, (I nwws to make sure distilled water won't just drip back into the main pot.
 3. Set the pot lid upside down on the pot. When you heat the water, water vapour (gas) will rise up to the lid, condense (turn back into water) to form droplets, and fall into the bowl.
 4. Turn on the heat for the pot. The water needs to get very hot, but it's okay if it doesn't boil.
 5. Put ice cubes on top of the lid of the pot. The cold will help to condense steam in the pot into liquid water.
 6. Turn off the heat and use care to remove the bowl of distilled water.

<http://chemistry.about.com/od/waterchemistry/fl/How-To-Make-Distilled-Water.htm>

Characteristics of Chemistry that are enjoyable:

Making potions, mixtures and solutions: Mixing things and seeing what happens is really fun. It's the element of suspense, what could happen, will it explode, will it bubble up, will it change? As a child who mixed things together to see what would happen, it was a natural progression for me to explore mixtures and solutions.

Hands on activities that require observation: Distilling the water was enjoyable and frustrating. It took a long time, and I am impatient. But the process and watching water vapour appear and then condense again was interesting. I could see this being a problem for children – experiments with slow rates of reaction are 'boring'. When things happen fast it can be very exciting – however sometimes they happen so fast you can miss exactly what is happening.

Making Sucrose Solution was fun – measuring and weighing each ingredient to see how long it would take to dissolve – I could see children really exploring viscosity and dissolving rates with different percentage solutions.

3/8/2014 Test day:

Equipment:

- 5 x Wine glasses (instead of beakers)
- Bubble Wand (I used a wand from a store purchased bottle of bubble mix)
- Measuring equipment (1/2 Cup Measure, 1tablespoon measure, scales)
- Video recorder (I used my iPad)
- Glycerol BP 100% (Home Essentials)
- Glucose Syrup (Queen)
- Sucrose Syrup 50% solution I made last weekend
- Xanthan Gum (Powder form BinInn)
- Detergent (I used Warehouse Brand – Shotz)
- Warm Water



Method

First I made my five mixtures:

I used wine glasses that had been cleaned in the dishwasher to make my mixtures so that no contaminants would affect the mixture. I used warm tap water (as I couldn't make enough distilled water to complete my experiment)

I measured $\frac{1}{2}$ a cup of warm water into each glass, and then added the detergent. I used 15mls of detergent per 125mls (half cup) of water. I made all the glasses the same and then added each additive (variable).

I used 15mls of each additive. This was a little hard to measure as the detergent, glucose and glycerine were all highly viscose and acted like a non-Newtonian fluid - a liquid that changes its flow rate depending on the stress upon it.

(<http://goo.gl/rWMbh>)

I made sure I had warmed the measuring spoon with hot water before pouring in the additive so it was sure to flow off the spoon. (Heat and force are things that stress a non-Newtonian fluid into flowing)

See the below table for ingredients of each mixture.

Ingredient/Amount	Mixture 1	Mixture 2	Mixture 3	Mixture 4	Mixture 5
Water	125mls	125mls	125mls	125mls	125mls
Detergent	15mls	15mls	15mls	15mls	15mls
Glucose	~	15mls	~	~	~
Sucrose	~	~	15mls	~	~
Glycerine	~	~	~	15mls	~
Xanthan gum	~	~	~	~	15mls

Once I had my mixtures created I blew bubbles – I blew three times for each mixture and video recorded the experiment so I could count the number of bubbles each mixture created as it is really hard to count the bubbles whilst blowing bubbles. I knew I would have trouble keeping my tests all the same with the force of my breath. A better way to do this would have been to use a bubble machine.

I used the fair test method of investigating my hypothesis because I had a series of variables. I could not see how observation or modelling would work without the fair test element. I did observe and count how many bubbles I made, but I still had to test the products to create the observation.



<http://youtu.be/nXu81iOcD7s> - More photos of my experiments.



The video is here: http://youtu.be/_UwQxq9bddU



RESULTS:

Additive/Number of bubbles	Detergent	Glucose	Sucrose	Glycerine	Xanthan Gum
Test 1	1 large, 1 extra large	3 formed, but popped before release	2 extra-large formed	Extra-large formed but popped before release	0
Test 2	1 Extra large	1 large, but popped before release	1 formed but popped before release	3 formed but popped before release. 1 miniature	0
Test 3	4 Large	5 formed but popped before release	1 large formed but popped before release	Blew to fast – but 3-5 formed but popped before release	0



Characteristics of Chemistry that are enjoyable: Again making up the mixtures and ensuring they had mixed correctly was fun. I took several photos of the state of the mixtures. I found that the viscous products created interesting whirling shapes in the detergent mixture which were fun to watch swirl around. I could see children really interested in the mixing part. It was enjoyable because it required me to be hands-on and actually handle the materials. It wasn't just looking, there was a practical element. I enjoyed playing with the viscosity of the additives. Glucose and Glycerine were thick and gloopy. The Xanthan gum was really interesting and I could see children either really loving this or really hating it. It was such a fine powder and the way it instantly created a gloopy mess really interested me. For students it's the element of the unknown

that can make something fun. I had no idea how the Xanthan gum would react, and seeing it turn quickly into a gelatinous substance really had me curious and ask questions. I guess I find asking questions fun, some students find this frustrating – so could go either way.



Glycerine added to detergent base



Xanthan Gum powder added to detergent mix

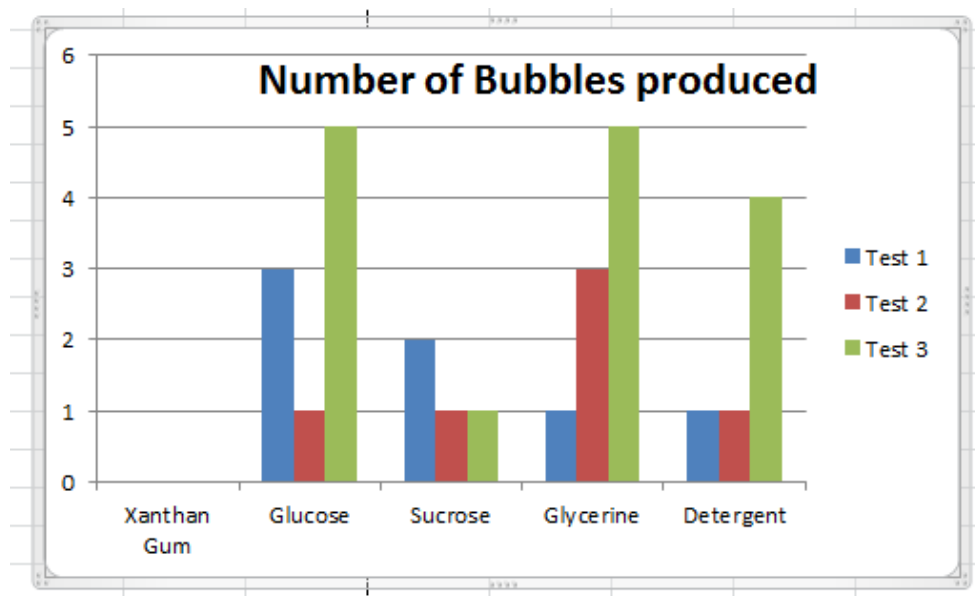
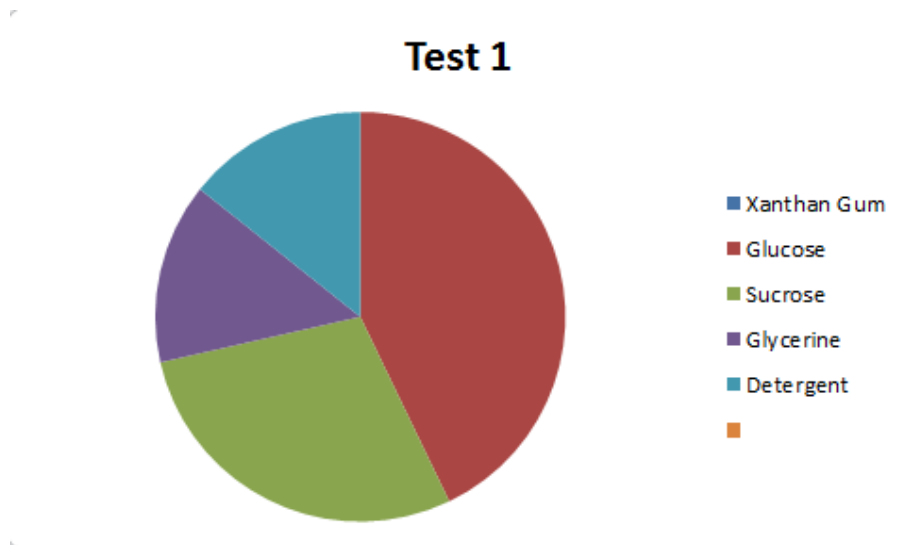
The result of the mix –a gloopy mess that could, in no way, be blown into bubbles. I should have investigated the properties of this polymer a little more before starting my experiment.

I really enjoy Chemistry as a subject and specifically cannot remember ever not enjoying the subject. (Except for possibly writing chemical equations and solving what chemical change had occurred?) Hands on experiments have always been interesting to me and I have always wondered about how things work and why things happen. To me Chemistry seeks to explain things.

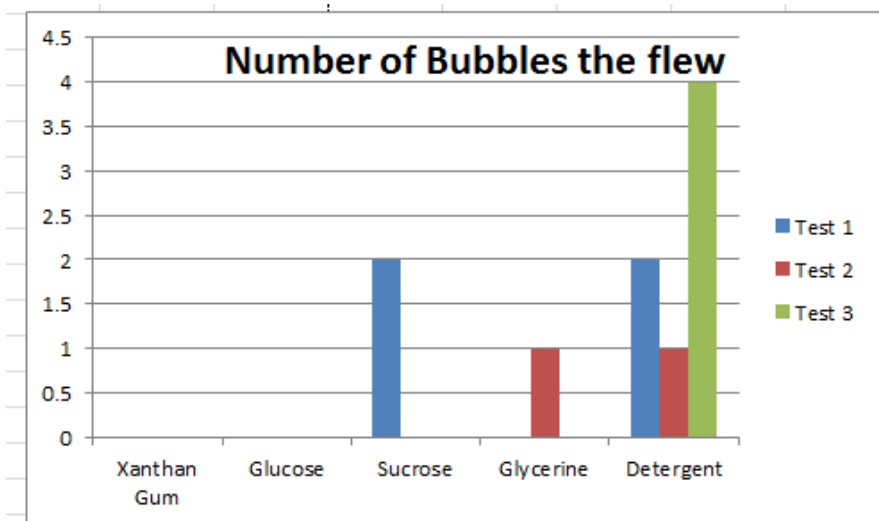
Compared to my living world investigation I have had much more fun. This is something I could see myself sharing with students and seeing them enjoy. The fun was definitely in the hands on experimenting. Creating a mess, and seeing my question and wondering being answered.

10/8/2014

Data Analysis:



In the above graphs I included the bubbles that did not form fully and fly away from the wand. They show that adding glucose or glycerine creates more bubbles than none additive.



The above graph shows the number of bubbles that formed and flew away from the wand. Detergent shows consistent results.

Conclusion:

Adding extra ingredients to homemade bubble mixture is very expensive both on time and financially. It is cheaper to purchase bubble mixture for \$2 rather than make your own with detergent and add expensive additives.

Adding sucrose (white sugar) syrup will create larger bubbles, but won't create a number similar to commercial bubble mix. I would suggest busy Mum's who want to make bubble mixture with the children just use detergent and a little bit of warm water to create bubbles for their children. Alternatively just ask Aunts who love science to purchase bubble mixtures for their niece!

Suggestions for Experimental Improvement: Consider the ratios of the products: Xanthan gum was not the correct ratio. I had kept the ratio the same as the other ingredients, but hadn't considered the viscosity of the liquid it would create. I would also consider using a bubble machine or reliable source of airflow so that my bubble blowing could be considered consistent. I should have probably added more tests – 3 was minimum 7 would have been ideal.

Characteristics of Chemistry that are enjoyable:

Choosing a subject or topic you are interested in also results in fun. I love bubbles I find them fascinating – how they are formed, and what mixture makes best bubbles naturally resulted in my enjoyment of the activity. I can see how not having an interest in the topic could totally take away the fun factor.

Turning my results table into a graph enabled me to really understand what data I had collected. I thought I had made a conclusion by looking at my data and when I had turned it into a pie graph, then flicked into a bar graph I was able to see my data in a mathematical way. As a person who never found maths enjoyable I have noticed that I find maths fun when it comes from some real life investigation or question. I could see students in my class really enjoying this part of science – especially when they don't even realise they are doing maths as well. The enjoyable part is getting an answer to your question.

So What, Now What?

Now that I know adding different polymer or sugary substances to detergent has an effect on the bubble making

- I wonder if the ratios of mixtures would have improved the bubble quantity. I know I used way too much xanthan gum. I wonder if I had created a xanthan solution before adding it to my detergent if that would have changed the mixture into a bubble blowing possibility. I would do multiple tests creating multiple ratios of each product to see if more detergent, or more additive has an effect on the quality and quantity of bubbles produced.

- I also wonder if the viscosity of the additives and the viscosity of the bubble mixture have some effect on the quality of the bubble mixture. I could investigate this by testing the viscosity of the mixture, and comparing it to the amount of bubbles that mixture created. I think this would really help me understand about science – forming scientific knowledge, and explanations for the world around. Observing and explaining what you see is a part of Understanding About Science.
- I noticed that my bubbles had a rainbow colour when blowing them. I wonder if I could change the colour of bubbles by adding either a food colouring or different coloured detergents. I would have to observe the bubbles using different colours. Video or photo evidence would help for closer inspection of the bubbles.
- I noticed that some bubbles formed, and landed on the ground but didn't pop straight away. I wonder if the surface of the ground changes the speed at which bubbles pop.
- Another thing I would like to investigate would be the effect of alcohol on bubbles. I know that Glycerine is a sugar alcohol – I wonder if other alcohols would work. Would Vodka, or syrupy liqueurs work in the same way? Glycerine is a sugar alcohol – I wonder if bubbles could be made by adding detergent to sugary alcohol drinks.

Nature of Science Level 3 Investigating in Science asks me to ask questions, and find evidence for my questions by exploring and carrying out appropriate investigations. I could show my understanding about science, by working with another citizen scientist to provide evidence that support my ideas behind my questions. I have noticed this time around I am happier communicating in science, as my scientific vocabulary has improved over Term 2 teaching Material World, and I have a better grasp of the subject than previously – Last trimester I hadn't undertaken a Living World investigation since I was at high school. I think the idea of communicating scientifically is very important.

Bibliography:

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