Poynton High School
and Performing Arts College

Science Transition Lessons Introduction

In addition to the aims set out on page 4 of this booklet, the PDA Science Transition Unit has been written to achieve five key objectives. These are to:

- Focus on developing pupils' Scientific Investigation Skills.
- Provide a familiar context for pupils to work in (*across year 6 and year 7)* in order for them to settle in quickly to year 7 lessons and to demonstrate the full range of their existing knowledge and understanding.
- Provide a common starting point for all pupils.
- Assist teachers to make early and accurate assessments of pupils' scientific knowledge and skill.
- Help pupils to develop their assessment for learning techniques and specifically to reflect on the work done in the transition period and to set the first of many specific curriculum targets for future development in year 7 and beyond.

We hope that pupils and teachers alike will find participating in the PDA science transition lessons an enjoyable and rewarding experience, and that the approach we have taken will encourage teachers to visit each other's schools to share expertise and to develop a greater understanding of learning across both key stages.

It would be fantastic if you could get students to complete the booklet during this project so they can bring their completed booklet to their first science lesson in September.

If you have any questions about this topic, please do not hesitate to contact me at rjm@phs.cheshire.sch.uk Good luck!

Kindest regards,
R. McDonald
KS3 Science Coordinator

Aims

The PDA Science Transition Unit is intended to:

- Maintain pupils' interest, enthusiasm and positive attitudes/experiences developed through the primary phase and to ensure a positive progression from KS2 to KS3.
- Raise pupils' awareness and understanding of their own progression in science and to encourage them to identify their future development needs and specific curriculum targets.
- Assist teachers to identify pupil's prior learning and to move pupils on from their known starting points, building on this past experiences.
- Ensure that teachers are better informed abut pupils' strengths and areas for development, and that they can use the transition lessons to confirm their assessments and plan future teaching programmes that meet the individual needs of their pupils.
- Develop a shared professional understanding of the content and demands of Year 6 and Year 7 to establish greater continuity and less repetition of work.
- Ensure that there is a consistency in the teaching approach and lesson structure that will help pupils adapt quickly to their new surroundings and to fully demonstrate their scientific knowledge and skills.
- Enable pupils to consolidate their existing skills as well as to monitor their own progress during the transition period.
- Make sure that pupils have something of quality to take to the High School which demonstrates what they know, understand and can do in the context of the work they did in Year 6.
- Help pupils become familiar with High School teaching styles, processes and procedures more quickly than before.

Overview

The transition consists of twelve lessons and an approximate total teaching time of 12 hours:

- 6 sessions taught in primary school of *about* one hours duration whilst completing the booklet

- 4 one-hour lessons taught at the High School.

Lessons concentrate on developing pupils' Scientific Investigation skills and their ability to reflect on their own learning. Accordingly pupils will be asked to identify one specific personal (curriculum) development target at the end of the Year 6 and the Year 7 package.

1 (*of 3*): The context of the work is that …

Each Primary School will be a bubble manufacturer *(eg. 'The Worth Bubble Company')* and,
Each pupil will be a research scientist!

At Primary school pupils will carry out two investigations to establish:

a) Which ***type*** of washing up liquid makes the 'best' bubbles and

b) What ***amount*** of washing up liquid will make the 'best' bubbles?

And in order to ensure that their company produces the 'best' bubbles to sell to children in the district.

In September ….

The secondary school company (a.k.a. '*Poynton Super Bubbles inc')* will take over the primary school companies and introduce new methods of working, including:

- New equipment
- New *expensive* chemicals
- New detailed risk assessments
- The need to maximise profit whilst still producing the very best bubbles!

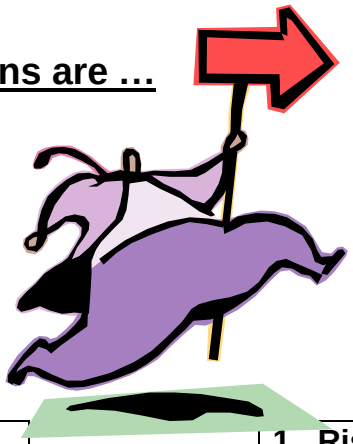
Each pupil will be expected to update the new company with their original results (from Primary school) in order to aid in the search for a new super bubble solution.

At the high school pupils will carry out two similar investigations to:

a) Find a new bubble enhancing ***additive*** (using a range of chemical compounds that will be new to pupils)

b) Establish what ***volume*** of Glycerol (in solution) will give the longest lasting bubble and why.

2 (*of 3*): The Lessons are …



Primary Sessions	Secondary Lessons
1. Planning Raise and explore the open question "what makes the *best* bubbles?"	**1. Risk Assessment (*Safety in the lab*)** Pupils introduced to the new company lab and new working practices (Rules). Pupils carry out a full risk assessment of the new lab and working practices
2. Observation Investigate "which ***type*** of washing up liquid makes the *best* bubbles?"	**2. Observation** Pupils investigate "what ***volume*** of Glycerol makes the *best* bubbles?"
3. Observation Investigate "what ***amount*** of washing up liquid makes the *best* bubbles?"	**3. Analysis & Evaluation** Pupils ***present results*** in bar charts and line graphs and use these to ***process conclusions*** and ***evaluate*** the reliability of their experimental method.
4. Analysis Pupils ***present results*** in a variety of ways (including the chance of extended display work)	**4. Reflection and using Bunsen Burners safely** Pupils facilitated in a ***self-assessment*** of the progress they have made across the key stage and any on-going developmental needs.
5. Evaluation Pupils ***interpret*** their results and ***evaluate*** the experimental approach used.	
6. Reflection Pupils facilitated in a ***self-assessment*** of skills gained and areas for improvement	

Pupils will then use their investigative skills to carry out a heating experiment called "*Flaming Bunsens!*" and briefly study other ways of investigating (such as surveys etc); and this will conclude the first of twelve study chapters in year 7.

3 (*of 3*): The Assessment Criteria is …

Throughout the project, the **Pupil Objectives** have been differentiated (on pages 9 – 10) as follows:

***"Some pupils**…"* objectives are aimed at students **working towards** expected standard

***"Most pupils**…"* objectives are aimed at students at **expected standard**

***"A few pupils**…"* objectives are aimed at students with **greater depth** of understanding

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***ALL staff (Primary and Secondary) are asked to discuss these statements with pupils* (*when* appropriate) throughout the series of lessons, in order to:**

- **Encourage pupils to reflect critically and positively on their own performance, and**
- **Assist pupils to think through what specific targets they could adopt to improve their investigative skills.**

At the end of the Primary phase (*lesson 6)* pupils will use an Assessment for Learning grid, *Resource Sheet 3* (shown over leaf), to reflect on their own learning and, *with the help of their teachers,* produce one specific curriculum target to meet a future development need.

Similarly, at the end of the Secondary phase pupils will again reflect on their own learning *(see Secondary lesson 6 for details)* and enter in to an informed dialogue with their teachers in order to: produce another single and specific curriculum target to help improve their scientific enquiries over the first term.

Finally, it is anticipated that the assessment methods used in this transition will help our pupils off to a good start in their studies and enable both pupils and teachers to continue to produce valuable curriculum targets for future development.

Resource Sheet 3

Bubbles

Research Assistant Self-Assessment Sheet

Company Name:		**I did this**	
Research Assistant Name:	**Date:**	**Completely on my own**	**With help**
I could **identify** what to change, keep the same and measure in our 'best' bubble experiment			
I predicted what might happen and **explained** this by talking about the science I know already			
I was able to **make** and **repeat measurements** accurately.			
I was able to **use my results** from the 'amount of detergent experiment' to **draw a line graph**.			
I compared what I had changed with what I had measured and **used evidence** from the experiment to prove what I was saying.			
I was able to **suggest** how I might improve the methods we used to carry out our experiments and **give reasons based upon evidence** from our experiments.			

Summarise your experiment in no more than 2 sentences:	**To improve my investigation skills I need to:**	**Tick**
	Identify what can be changed, kept the same and measured	
	Predict what might happen and why	
	Work on taking measurements accurately	
	Suggest how to improve the experiment and why	
	Create a new experiment to expand on this one	

Pupil Objectives

Objectives are identified as follows:

***"Some pupils**…"* objectives are aimed at students **working towards** expected standard

***"Most pupils**…"* objectives are aimed at students at **expected standard**

***"A few pupils**…"* objectives are aimed at students with **greater depth** of understanding

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a) Deciding on an appropriate approach

***Some pupils**…* decide on an appropriate approach for example using a fair test to answer a question.

***Most pupils**…* when they try to answer a scientific question, identify an appropriate approach.

***A few pupils**…* use scientific knowledge and understanding to identify an appropriate approach.

b) Control of variables

***Some pupils**…* where appropriate, describe, or show in the way they perform their task, how to vary one factor while keeping others the same.

***Most pupils**…* when the investigation involves a fair test, identify key factors to be considered.

***A few pupils**…* when the investigation involves a fair test, use scientific knowledge and understanding to identify key factors to be considered.

c) Making a prediction

***Some pupils**…* where appropriate, make predictions.

***Most pupils**…* where appropriate, make predictions based on their scientific knowledge and understanding.

***A few pupils**…* where appropriate, make predictions based on their [*detailed*] scientific knowledge and understanding [*and can explain them clearly*].

d) Selecting suitable equipment

Some pupils… select suitable equipment

Most pupils… select apparatus for a range of tasks and plan to use it effectively.

A few pupils… [*use scientific knowledge to*] select [*the most appropriate*] apparatus for the task and plan to use it effectively.

e) Making observations

Some pupils… make a series of observations and measurements that are adequate for the task.

Most pupils… make a series of observations, comparisons or measurements with precision appropriate to the task. They begin to repeat observations and measurements systematically

A few pupils… make enough measurements, comparisons and observations for the task. They measure a variety of quantities with precision, using instruments with fine-scale divisions.

f) Recording & presenting results

Some pupils… record their observations, comparisons and measurements using tables and bar charts. They begin to plot points to form simple graphs

Most pupils… where appropriate, present data as line graphs.

A few pupils… choose scales for graphs and diagrams that enable them to show data and feature effectively.

g) Interpreting data

Some pupils… use these graphs to point out and interpret patterns in their data. They begin to relate their conclusions to these patterns and to scientific knowledge and understanding, and to communicate them with appropriate scientific language.

Most pupils… draw conclusions that are consistent with the evidence and begin to relate these to scientific knowledge and understanding. They use appropriate scientific language and conventions to communicate quantitative and qualitative data.

A few pupils… identify measurements and observations that do not fit the main pattern shown. They draw conclusions that are consistent with the evidence and use scientific knowledge and understanding to explain them. They select and use appropriate methods for communicating qualitative and quantitative data using scientific language and conventions.

h) Evaluating their work

Some pupils… suggest improvements in their work, giving reasons.

Most pupils… make practical suggestions about how their working methods could be improved.

A few pupils… make reasoned suggestions about how their working methods could be improved.

Primary Lessons

June to July

Session / Lesson one – Planning investigation

Learning objectives:	Sug. time	Teaching activities	Resources	Key outcomes
To enable children to: **Describe variables which could be observed or measured.**	10 mins	**Exploration/orientation** Children brainstorm/concept map (on first page of High School Book):  Encourage children to explore what is already known about the topic of bubbles by making as many links as they are able. Teacher to lead a discussion. Teacher to model on the board [Encourage a broad definition E.g.: in chocolate, fizzy drinks, bread…..as well as making bubbles from detergents]	High School Science book	***Some pupils***… • **decide** on an appropriate approach for example using a fair test to answer a question. • **describe** how to vary one factor whilst keeping others the same. • **Make** a prediction.
	5 mins	**Focused exploration** Provide a range of equipment for exploration e.g. detergent solution/commercial bubble mix, wands, straws, bottle tops etc….. Children in small groups (whatever is manageable and appropriate for your class) to explore: **What can you tell us about bubbles?** Children record findings on whiteboards – give a clear time limit feedback to class. **What makes the best bubble?** Children to explore within a clear time limit. Stop the class and discuss how we can define **BEST.**	Range of equipment for making bubbles: plastic trays paper towels safety goggles detergent solution OR Commercial bubble mix, wands, straws, bottle tops etc …..	***Most pupils***… • when they try to answer a scientific question, **identify** an appropriate approach. • **Identify all relevant** key factors to be considered for a fair test. • **Make** a prediction based upon scientific knowledge and understanding.
	5 mins	Teacher to lead the discussion in order to eventually identify **dependent** factors which could be **observed** or **measured** when later investigating bubbles (size of bubble, shape of bubble, colour of bubble, length of time bubble lasts). Record on one shade of sticky note.	Sticky notes of two different colours	

Session / Lesson one – Planning investigation

Learning objectives:	Sug. time	Teaching activities	Resources	
Demonstrate appropriate approach to answer a scientific question	20mins 10mins 5mins	**Introduce context** Establish the context of there being a toy company that wishes you (the class) to research **what makes the best bubble?** **Focussed planning of investigation** Teacher leads a discussion on **Independent** factors which could be changed that affect bubbles drawing on outcomes from the exploratory task earlier [Type of detergent, amount of detergent, size of wand, thickness of wand material, shape of the wand] Prompt for these if not offered. Add each to separate sticky notes (use a different colour to the dependent variables). Using ***Resource Sheet 1*** (enlarged/projected/OHP) Demonstrate how the selection of 1 independent and 1 dependent variable can help frame a **testable question** (do not demonstrate with the variables **type of detergent** and **length of time bubble lasts**). Teacher models moving the sticky notes to model the planning of the investigation using the teacher enlarged ***Resource Sheet 1.*** Ultimately close the question to become: **Which type of detergent gives bubbles that last the longest?** Using children's copy of ***Resource Sheet 1***, children record the agreed question. Discuss how they intend to carry out the experiment. Refer back to variables that must be kept the same. Include a risk assessment of safety issues Independent activity. Individually children will complete ***Resource Sheet 1*** showing how they will carry out investigation ready for next lesson. This sheet will be stuck into next page of book. **Plenary** Children to feed back key variables. **How have we made our test fair?**	Resource sheet 1 (enlarged) Plus 1 copy per child	***A few pupils***… • use scientific knowledge and understanding to **explain** an appropriate approach. • Use scientific knowledge and understanding to **explain** why key factors have been used to construct a fair test. • Make detailed predictions **explained** using scientific knowledge and understanding

Things that might affect bubbles	**Things about bubbles we would observe or measure**

Our question will be:

What happens to _____

When we change _____

We will change: _____

We will measure: _____

Therefore we must keep these things the same: _____

_____

We predict that as we change _____, we will find that

_____**. This will happen**

because _____.

We will carry out our investigation like this:

We will record our results like this:

We changed	We predicted	We measured

Session / Lesson Two – Investigating The Type of Detergent

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
To enable children to: **Make a series of reliable observations/measurements** **Record observations/measurements appropriately**	10 mins. 15 – 20 mins.	**Reviewing and revisiting** Remind children of the context of the toy company researching for the best bubble mix. Recap previous lesson which planned the investigation. Discuss the variables and predictions. Organise children into groups appropriate for the class (2-6). On white boards, children transfer recording table planned from the previous lesson. Have equipment available and organise groups. **SAFETY:** review the possible safety precautions that might/should be taken (safety goggles, transfer from hand to mouth, spillages etc.). **Investigation** Children will carry out investigation whilst recording their results in previously drawn table on whiteboards. **Presenting and Interpreting** After clearing away, refocus children onto their actual findings: **How can we organise and present these results so that they are easier to draw a conclusion from?** Teacher to lead a discussion and model different ways of recording.	Whiteboards and pens 3 – 6 different detergents e.g.: Tesco's own Fairy Tesco Value Eco friendly etc….. Plastic trays/containers Paper towels Safety goggles Standardised wands Stop watches (if nec.) Measuring jugs/syringes	***Some pupils …..*** ▪ Make a series of observations and measurements that are **adequate** for the task. ▪ Record their observations, comparisons and measurements using tables and bar charts. They begin to plot points to form **simple graphs.** ***Most pupils …..*** ▪ Make a series of observations, comparisons with **precision** appropriate to the task. They begin to repeat observations and measurements systematically ▪ Where appropriate, present date as **line graphs.**

Session / Lesson Two – Investigating The Type of Detergent

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
Draw conclusions relevant to the data and relate these to scientific knowledge	10 mins. 10 – 15 mins.	**Independent Activity** Children decide upon their own method and use this to record their findings in next page of High School books. Children must also write underneath this graph their conclusion drawn from their results. **Plenary** Children return to their groups to discuss how they will present their findings and an agreed group conclusion to rest of the company (class). **Lead to Next Lesson** Pose the following questions to class: **Was there anything in the experiment that you felt you would want to do again or differently? Why?** Discuss this briefly then finish with a discussion of the following question: **What could we investigate further with this brand that would help us to continue our search for the BEST bubble?**		***A few pupils …*** ▪ Make enough measurements, comparisons and observations for the task. They measure a **variety of quantities with precision,** using instruments with fine-scale divisions. ▪ **Choose scales** for grahs and diagrams that enable them to show data and feature effectively.

Session / Lesson Three – Investigating The Amount of Detergent

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
To enable children to: **Collect reliable data.** **Choose the best method of presenting data.**	10 mins. 20 – 25 mins. 15 mins.	Remind children of the previous lesson Tell the children that the company was pleased with their findings but would like to investigate our chosen detergent further. **Presenting the Investigation** Present children with the following question: **What happens to the length of time a bubble lasts when we change the volume of our chosen detergent?** Display enlarged/OHT/IWB version of ***Resource Sheet 2*** tell the children that the toy company have already planned this investigation for them to carry out. Go through the plan with the children. **Investigation** In small groups (whatever is manageable and appropriate for your class) the children will carry out the investigation. On white boards, children transfer the recording table from ***Resource Sheet 2*** onto their white boards. They will then record their results on here during the experiment. **Independent Activity – Presenting Results** After a quick clear away, the children will transfer the results table into their High School book. Regain children's attention and discuss the best method of presenting this data, ultimately decide on a line graph because of having continuous data.	Enlarged/OHT/IWB version of ***Resource Sheet 2*** Copies of ***Resource Sheet 2*** (1 per group) Samples of chosen detergent Measuring pots/syringes Plastic trays/containers Paper towels Safety goggles Standardised wands Stop watches (if nec.)	***Some pupils …*** ▪ Record their observations, comparisons and measurements using **tables and bar charts.** They begin to plot points to form **simple graphs.** ***Most pupils …*** ▪ Where appropriate, present data as **line graphs.** ***A few pupils …*** ▪ **Choose scales** for graphs and diagras that enable them to show data and feature **effectively.**

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
	5 mins.	Focus on a few points for the children to independently consider when drawing their graph e.g. scale, positioning of variables on x or y axis etc. … do not give them the answers, as this is part of the assessment. Children now independently draw their graph (on graph paper which will then be stuck into their books). **<u>Plenary</u>** Children can compare their finished graphs with the rest of their group deciding on which of their graphs is most successful and why.	Graph paper (1 piece per child)	

Things that might affect bubbles	**Things about bubbles we would observe or measure**
Type of detergent, size of wand, the shape of the wand, strength of blow, amount of detergent, things added to the detergent	The size of the bubble, the length of time the bubble lasts, the colour of the bubble, the shape of the bubble

Our question will be:

What happens to **the length of time the bubble lasts** when we change the amount of detergent that we add to the water?

We will change: the amount of detergent **we add to the water.**

We will measure: the length of time the bubble lasts before it pops.

Therefore we must keep these things the same: Type of detergent, size of wand, the shape of the wand, strength of blow, things added to the detergent.

We predict that as we change the amount of detergent **that we add to the water, we will find that the bubbles will last longer. This will happen because the surface tension of the water has been increased.**

We will carry out our investigation like this:

We will record our results like this:

We changed The amount of detergent (ml)	**We predicted**	**We measured** the length of time the bubble lasts (seconds)

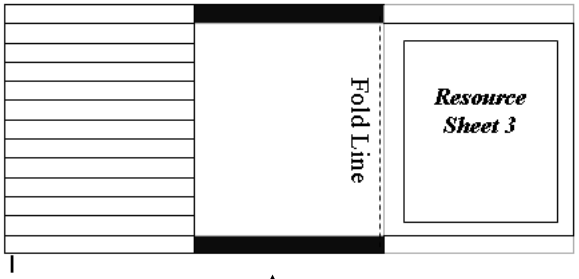
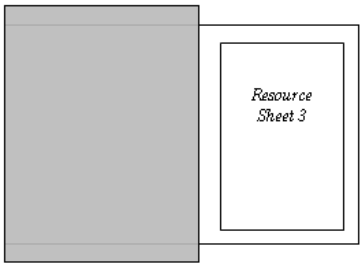
Session / Lesson Four – Drawing Conclusions

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
To enable children to: **Draw conclusions relevant to the data and relate these to scientific knowledge** **Make practical suggestions about how their working methods could be improved**	10-15 mins 15 mins 20 mins 5 mins	<u>Reviewing</u> ▪ Remind children of previous lesson by reviewing their graphs. ▪ Teacher now displays on OHT own line graph prepared earlier showing different results to what the children will have. ▪ Teacher will discuss and model an interpretation of these results focussing on: - Simple description of what is going on - Description of the relationship between both variables using comparative language. - Answering the original question based on conclusions drawn. <u>Independent activity</u> ▪ In High School books, children draw their own conclusions based on teacher's model. <u>Evaluation of Investigation</u> ▪ Teacher models an evaluation of the practical activity discussing things that could be improved and why. This could be based around an anomaly (rogue result) on the graph. Suggest reasons for this anomaly and how it could be avoided. ▪ Children write their own evaluation independently. <u>Plenary</u> ▪ Children to share and compare their conclusions and evaluations with the rest of their group.	OHT of teacher prepared graph (with an anomaly)	*Some pupils …* ▪ **use graphs** to point to and interpret patterns in their data. They begin to relate their conclusions to these patterns and to scientific knowledge and understanding and to communicate them with appropriate scientific language. ▪ **suggest** improvements in their work, giving reasons. *Most pupils …* ▪ **draw conclusions** that are consistent with the evidence and begin to relate these to scientific knowledge and understanding. They use appropriate scientific language and conventions to communicate quantitative and qualitative data. ▪ **make practical suggestions** about how their working methods could be improved. *A few pupils …* ▪ **identify** measurements and observations that do not fit the main pattern shown. They draw conclusions that are consistent with the evidence and use scientific knowledge and understanding to explain them. They select and use appropriate methods for communicating qualitative and quantitative data using scientific language and conventions. ▪ **Make reasoned suggestions** about how their working methods could be improved.

Session / Lesson Five – Presenting Findings

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
To enable children to: **Present their findings in a formal presentation.**	Dependent on chosen format of presentation	Revisiting Context. • Remind children that they are carrying out these investigations on behalf of a toy company. • Tell the children that the company would like to be presented with all their findings. • Discuss the important information that must be included and the different ways that the findings could be presented e.g. a poster, leaflet, power point etc… **N.B.** The presentation format could be left open ended for the children to decide or the teacher could choose the format for the whole class, it is up to the individual teacher. Producing chosen format • Children (working in groups or independently) produce their presentation. The rest of this lesson is left up to the individual teacher.	Dependent on chosen format of presentation	

Session / Lesson Six – Self Evaluation

Learning objectives	Suggested time	Teaching activities	Resources	Key outcomes
To enable children to: Recognise their strengths and weaknesses, and to identify their own target areas in which they want to improve.	Allow a full lesson for this task	**Self-evaluation** • Work through the self-evaluation sheet on ***Resource Sheet 3*** step by step with the children. Making sure the children are clear on what is meant by each question. Let the children look back through their books as they are doing so. • Next attach ***Resource Sheet 3*** onto a sheet of A3 then into the back of the children's book in the following way:  Inside back cover of High School science book with A3 sheet of paper glued on.  This arrangement will allow the evaluation sheet to be viewed at all times or folded away. Therefore, the High School staff can be aware of the children's targets as they are marking their work.	Enough A3 sheets of paper and copies of ***Resource Sheet 3*** for every child A3 sheet of paper with ***Resource Sheet 3*** for every child	***Some pupils …*** • Suggest improvements in their work, giving reasons. ***Most pupils …*** • Make practical suggestions about how their working methods could be improved. ***A few pupils …*** • Make reasoned suggestions about how their working methods could be improved.

Resource Sheet 3

Bubbles
Research assistant self-assessment sheet

Company Name:		I did this	
Research assistant name:	Date:	Completely on my own	With help
I would **identify** what to change, keep the same and measure in our 'best' bubble experiment.			
I **predicted** what might happen and **explained** this by talking about the science I know already.			
I was able to **make** and **repeat measurements** accurately.			
I was able to **use my results** from the 'amount of detergent' experiment to **draw a line graph**.			
I **compared** what I had changed with what I had measured and **used evidence** from the experiment to prove what I was saying.			
I was able to **suggest** how I might improve the methods we used to carry out our experiments and **give reasons based upon evidence** from our experiments.			

Summarise your experiment in no more than 2 sentences:	**To improve my investigation skills I need to:**	**Tick**
	Identify what can be changed, kept the same and measured	
	Predict what might happen and why	
	Work on taking measurements accurately	
	Suggest how to improve the experiment and why	
	Create a new experiment to expand on this one	