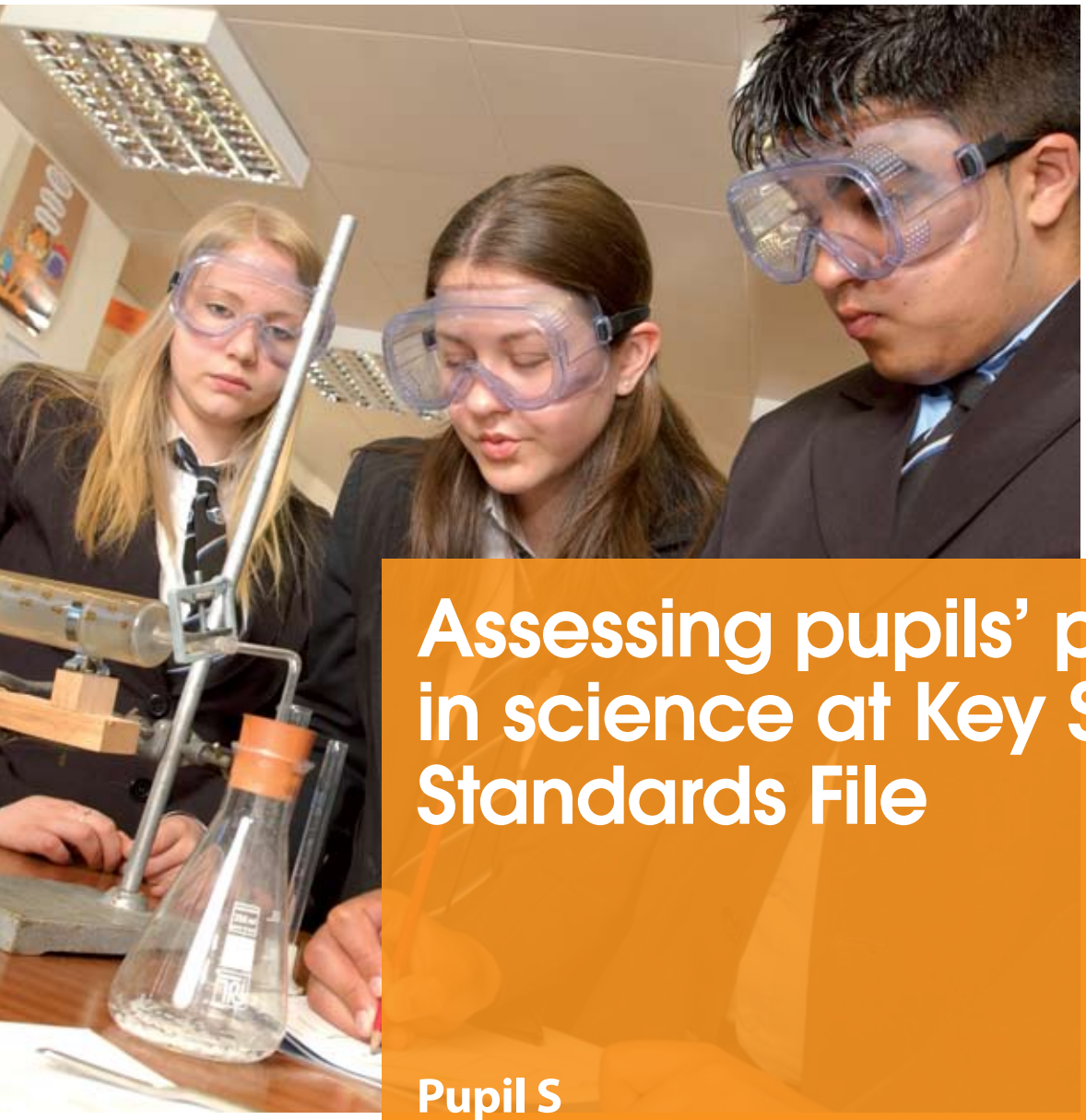
The National Strategies
Secondary



Assessing pupils' progress in science at Key Stage 3: Standards File

Pupil S

department for children, schools and families

QCA Qualifications and Curriculum Authority

Assessing pupils' progress in science at Key Stage 3: Standards File

Pupil S

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Pupil S Year 9 Low level 5 Science Standards File

Pupil profile

Pupil S enjoys work of a more formal nature that requires careful use of conventions. She also likes working with selection and presentation of information, although her ability to interpret such information critically is more limited. Working on collecting and collating her own data can also show variation as she is not yet consistent in her organisation. She has, however, made good progress during Year 9, where she was initially working at high level 3.

The evidence

1. Microbes and disease summary poster
2. Deodorant and breast cancer – assessing the evidence
3. Investigating questions using particle theory
4. Strengths and weaknesses of a model of the ovary
5. Investigating variation
6. Using chemical equations

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1. Microbes and disease summary poster

Assessment focuses

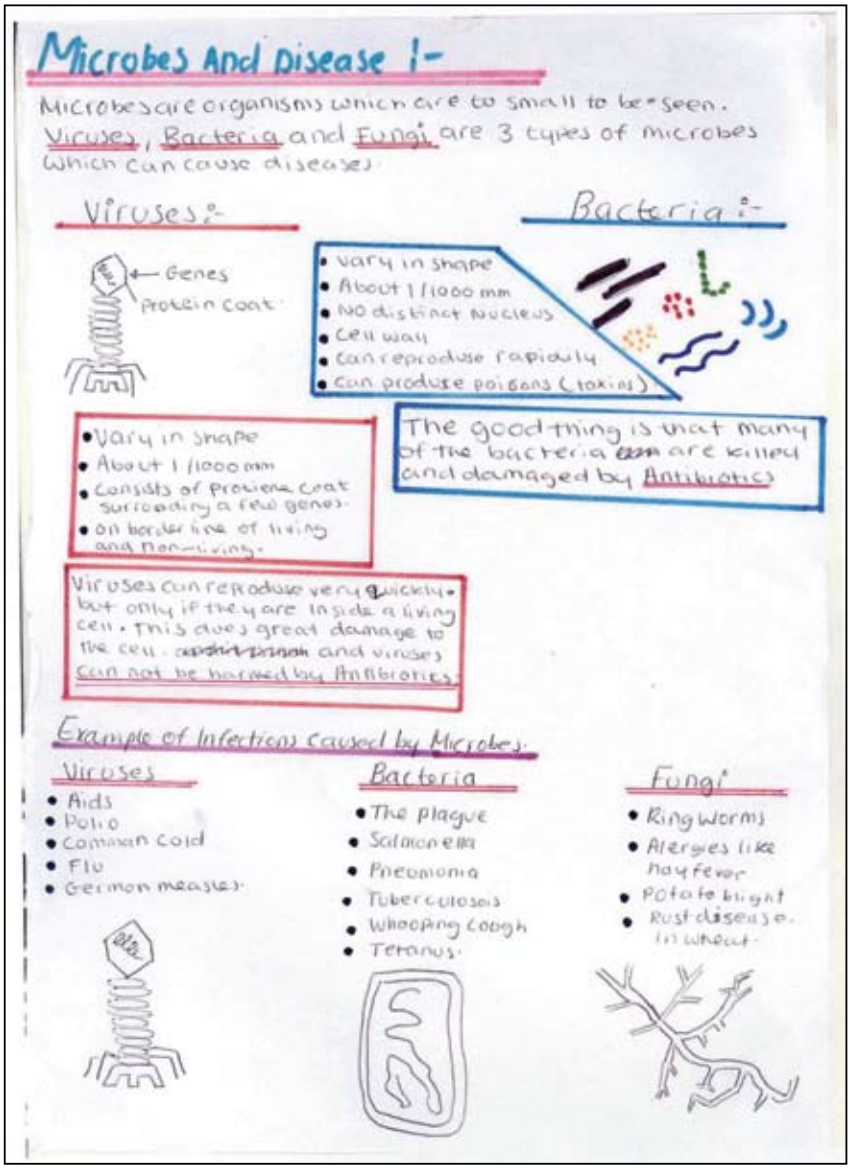
AF1, AF3

Context

The pupils were learning about health and hygiene. The teacher asked the pupils to select some ideas to prepare a summary on their chosen component in the health and hygiene topic. Different pupils summarised different components and displayed their various summaries for the whole class to examine and compare. Through discussion in small groups, pupils decided which summaries they thought had good features that helped them to learn.

Pupil S drew on information from more than one source (a textbook, a revision guide and her own notes), and collated this and presented it in her own words and format.

Pupil S's work



Teacher's notes

AF1

Pupil S explained disease by drawing on abstract ideas, describing microbes, and distinguishing between bacteria and viruses by their susceptibility to antibiotics, but made no indication of the important point of relative scale of different microbes. Her labels gave the sizes of bacteria and viruses as the same. Talking through the work with her, she was able to draw out some significant differences between bacteria and viruses.

AF3

She made use of appropriate forms of scientific language – viruses, bacteria, fungi, nucleus, cell wall, toxins, antibiotics, protein, genes – sometimes with and sometimes without explanation. She presented the information appropriately, but the structural information about fungi was absent.

Next steps

- Production of a scale analogue to compare the sizes of some fungi, plant cells, animal cells, bacteria and viruses.
- Short single response test to confirm understanding of microbes and disease.

Assessment commentary

The re-presentation of information requires some active selection and creation of a suitable layout, although Pupil S uses a fairly narrow range of information sources, seemingly uncritically and with the introduction of small but significant error. She successfully uses appropriate scientific language to communicate information.

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2. Deodorant and breast cancer – assessing the evidence

Assessment focuses

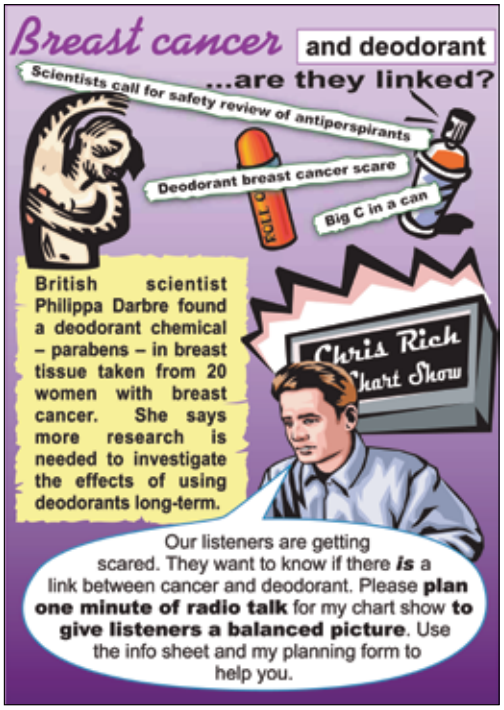
AF1, AF2, AF3, AF5

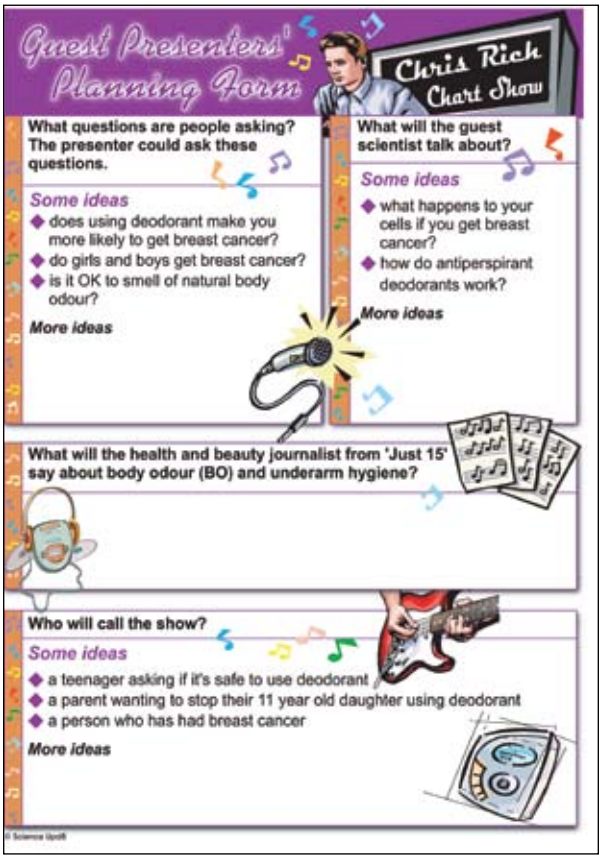
Context

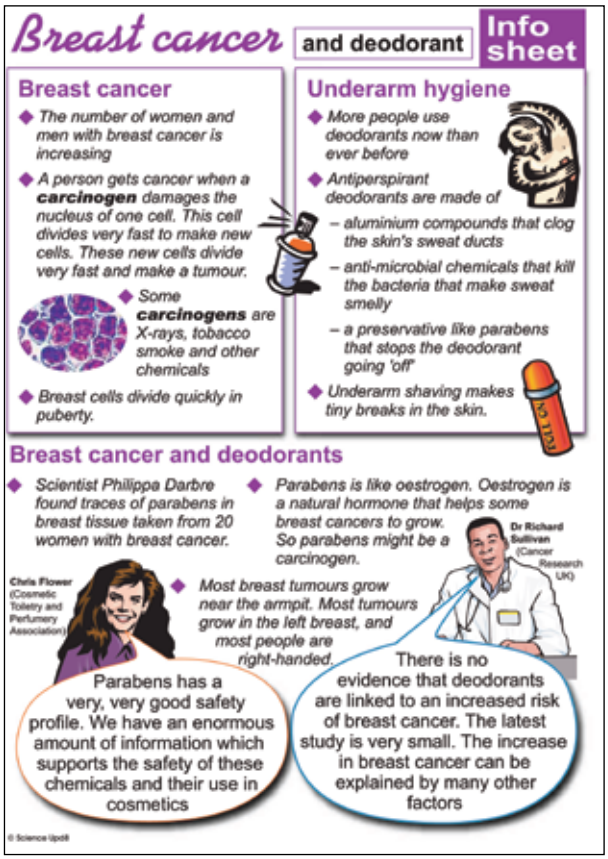
The class was working on ideas about cells, cell specialisation and cell reproduction. They used an 'UPD8' resource (http://www.upd8.org.uk/) to explore the science of a suggested link between deodorant and breast cancer.

Every pupil in the class took part in recorded audio interviews for fictional radio stations, preparing scripts before making the recordings, using the resource sheets as their sources of information. Pupil S played the part of the visiting expert on a radio programme, discussing the possible relationship between deodorant and breast cancer

UPD8 resource







Pupil S's work

Transcript

Radio host:	Hello and welcome to AllSay Radio. Today we'll talk about breast cancer caused by deodorant. I'm joined here today with scientist Professor.
Professor:	Hi.
Radio host:	So you've come today to talk about breast cancer caused by deodorant, not only women but men as well.
Professor:	Well there has been a controversial study which suggests a potential link between a common chemical called parabens that's found in cosmetics and deodorants. Parabens has been detected within tumours. The chemicals have been accumulated in the breast tissue after being absorbed by the skin.
Radio host:	Oh I see. Oh we have a caller on the line. Hello?
Caller:	Hi. I just called in to say…um… that I am a person that tends to use deodorant but I'm worried – should I stop using deodorant?
Professor:	Well I don't think you should worry that much because the research has been only tested on twenty women. Theoretically that's not enough evidence to support this case. But still I would advise you to use deodorant that do not contain parabens.
Caller:	OK thank you. Bye.
Radio host:	Thank you Professor for being here and thank you listener for calling in and sharing your worries. OK I'll see you next time on AllSay Radio. Good night and goodbye.

Teacher's notes

AF1

Pupil S refers to abstract ideas of the absorption and accumulation of the chemical parabens in tissue.

AF2

The work allows consideration of how scientific and technological developments affect different people, and how applications can have both positive and negative impacts.

AF3

She uses appropriate scientific terminology to communicate abstract ideas in an authentic way.

AF5

She makes a valid and important point about the quality of the data, specifying that this is due to the small sample size, and she recognises the uncertainty of any conclusion reached from the data.

Next steps

- Review of science presented through audio and visual media, and whether the communication illustrates the validity of the evidence being used.
- Work on stem cells, providing a context for cell reproduction and cell specialisation.

Assessment commentary

The activity not only motivates pupils but allows a broad coverage of the assessment focuses, and it provides a particularly strong assessment for AF5. A real survey has been used as the basis of the work, and from this Pupil S identifies the limitations due to the sample size. This allows her to show progress towards level 6, which is above her overall level of achievement.

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3. Investigating questions using particle theory

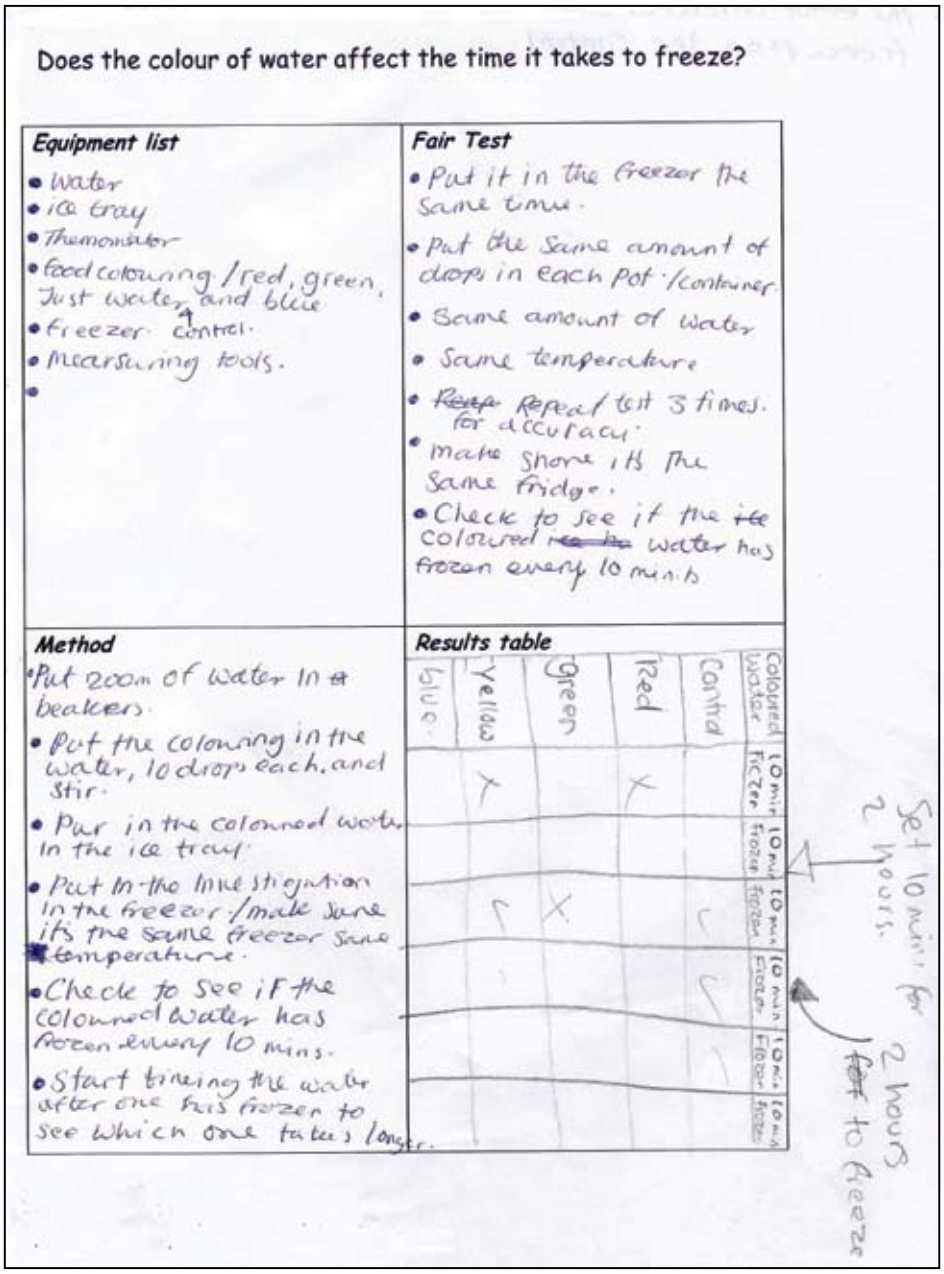
Assessment focuses

AF1, AF3, AF4, AF5

Context

The teacher gave the pupils some questions to investigate about work being carried out on particle theory. The teacher asked pupil S to investigate whether the colour of water affects the time it takes to freeze. The teacher then asked pupils to write a prediction based on their understanding of particles. The investigation reviewed ideas of fair testing, developing an appropriate method to test a prediction, recording results, and making and justifying a valid conclusion.

Pupil S's work



Does the colour of water affect the time it takes to freeze?

Equipment list
- Water
- ice tray
- Thermometer
- food colouring / red, green, blue and
- freezer. Just water as control.
- Measuring tools.
-

Fair Test
- Put it in the freezer the same time.
- Put the same amount of drops in each pot / container
- Same amount of water
- Same temperature
- ~~Keep~~ Repeat / test 3 times. for accuracy
- make shore it is the same fridge.
- Check to see if the ~~ice~~ coloured ~~water~~ water has frozen every 10 mins

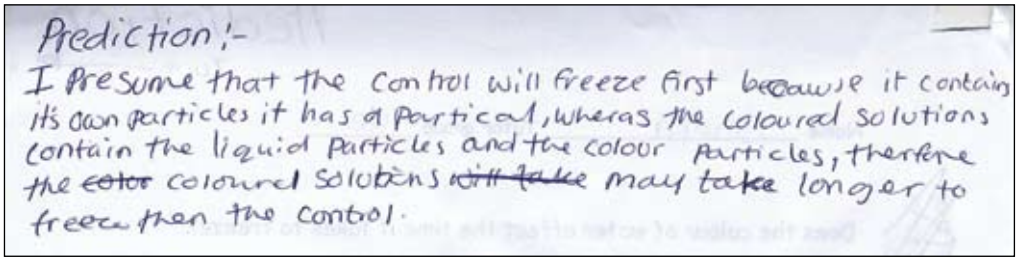
Method
- Put 200ml of water in 5 beakers.
- Put the colouring in the water, 10 drops each, and stir.
- Pur in the coloured water in the ice tray
- Put in the investigation in the freezer / make sure it's the same freezer same temperature.
- Check to see if the coloured water has frozen every 10 mins.
- Start timing the water after one has frozen to see which one takes longer.

Results table

Coloured water	10 min	10 min	10 min	10 min	10 min	10 min
blue						
Yellow	X					
Green						
Red	X					
Control						

Set 10 mins for 2 hours

~~for~~ to freeze


Prediction:-
I presume that the control will freeze first because it contains its own particles it has a partical, whereas the coloured solutions contain the liquid particles and the colour particles, therfore the ~~color~~ coloured solutions ~~will take~~ may take longer to freeze than the control.

Teacher's notes

AF1

The prediction is a reasonable one, presented tentatively as is appropriate. The recognition that coloured solutions contain liquid particles and 'colour' particles makes some use of an abstract model.

AF3

Pupil S recorded her results in a table, but did not provide a full explanation, for the benefit of the reader, and the table is unclear.

AF4

She made a suggestion that measurements should be repeated three times 'for accuracy' and, given the difficulty in judging the time taken for the water samples to freeze, this is a valid suggestion, although it was not carried out.

She was able to work safely by controlling obvious risk, without guidance, to remind her of standard laboratory expectations.

AF5

Pupil S did not provide a conclusion for this work.

Next steps

- Small group presentations to determine whether their conclusions match their particle-based predictions.
- Further work on the production and interpretation of data tables.

Assessment commentary

Pupil S makes some use of abstract particle ideas in generating an initial prediction. She carries out a fair test in her investigation, selecting appropriate equipment to make a set of observations, and requiring independent decisions on what to observe and record. Her presentation of data would be improved by better planning and greater clarity.

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4. Strengths and weaknesses of a model of the ovary

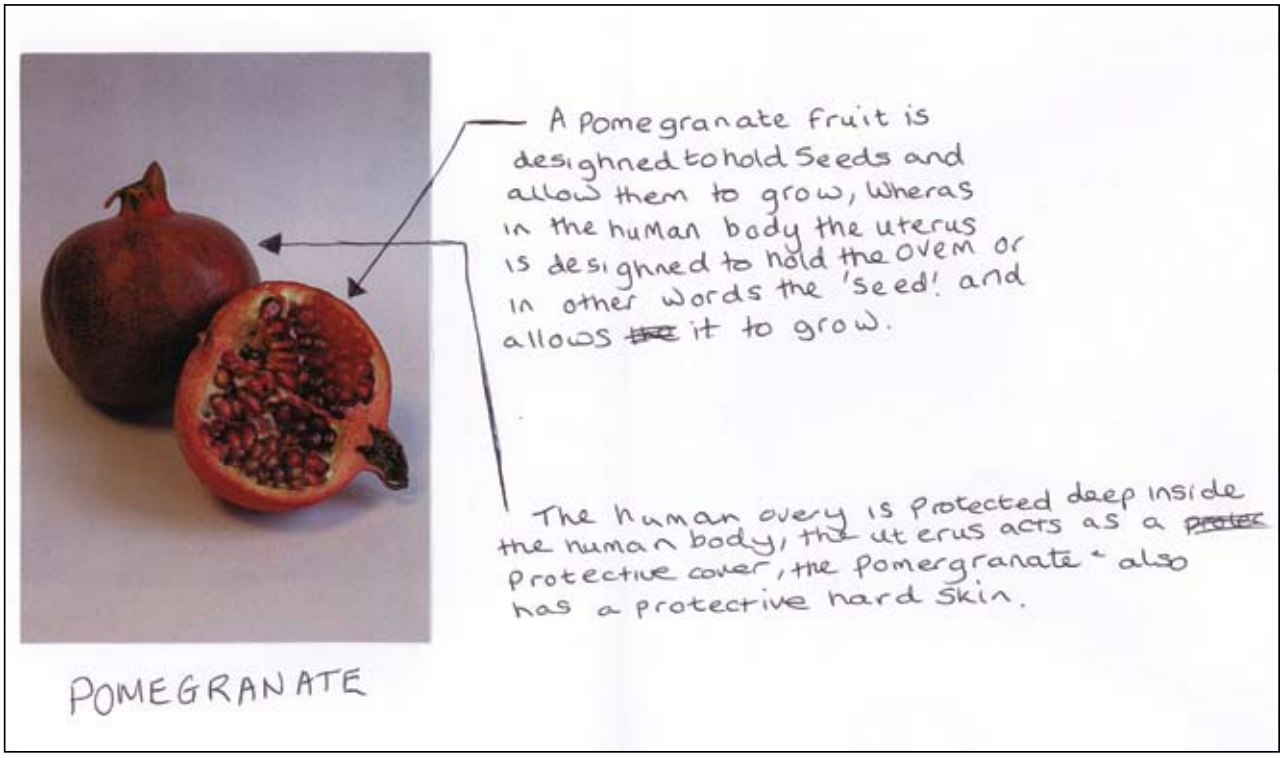
Assessment focus

AF1

Context

This preliminary activity was carried out prior to an 'upd8' (http://www.upd8.org.uk/) exercise that describes the use of a pomegranate as a model of a human ovary. Pupil S's task was to find out information about a pomegranate and assess its value as a model by making comparisons with an ovary.

Pupil S's work



Teacher's notes

AF1

Pupil S has referred to the ovary and the uterus in making an assessment of the pomegranate model. She has identified similarities and used a simple model to describe abstract ideas.

Next steps

- Further exercise to allow a full critique of the pomegranate model.
- Exercise to assess the strengths and weaknesses of some other models, such as jelly cells.

Assessment commentary

Pupil S uses a simple model and seeks out similarities with reality. She limits her assessment of the pomegranate model to these similarities, and does not address the differences, and so there has been little attempt to identify specific strengths and weaknesses.

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5. Investigating variation

Assessment focuses

AF3, AF4, AF5

Context

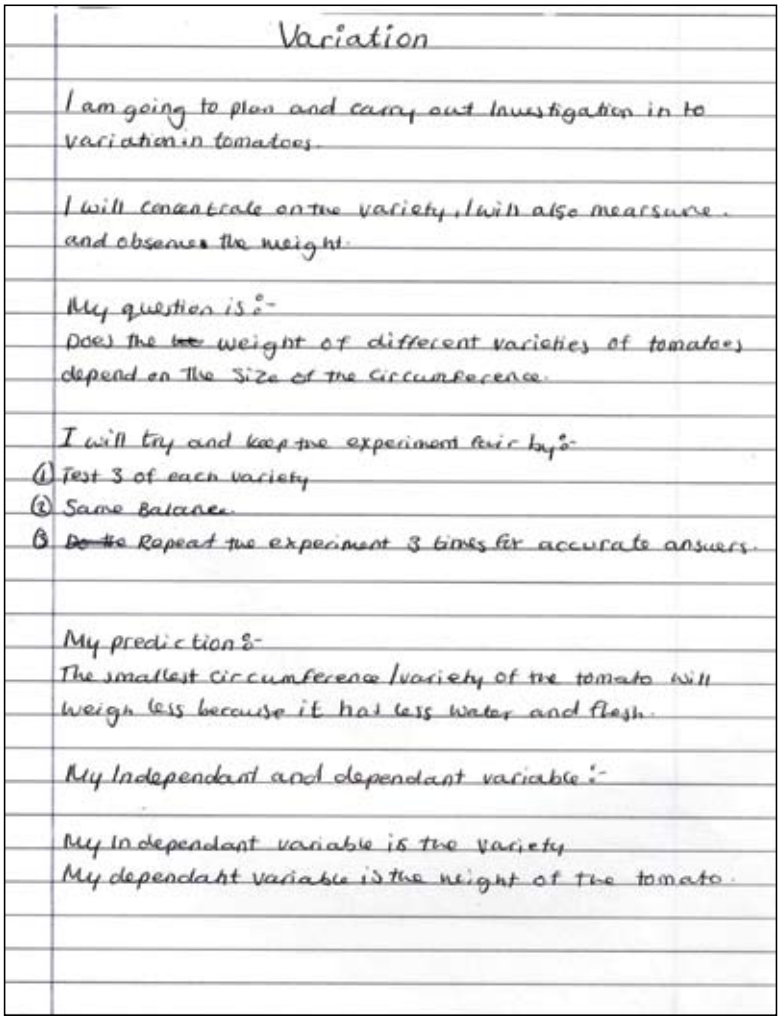
The teacher asked pupils to carry out an investigation on the variation in fruit or vegetables from a local market stall.

The teacher asked them to provide:

- a plan, including the question being tested, the steps to ensure a fair test, a prediction, and an identification of independent and dependent variables;
- a table of their data;
- a graph;
- a conclusion.

Pupil S, working independently, chose to investigate variation in tomatoes.

Pupil S's work



Variation

I am going to plan and carry out Investigation in to variation in tomatoes.

I will concentrate on the variety. I will also measure and observe the weight.

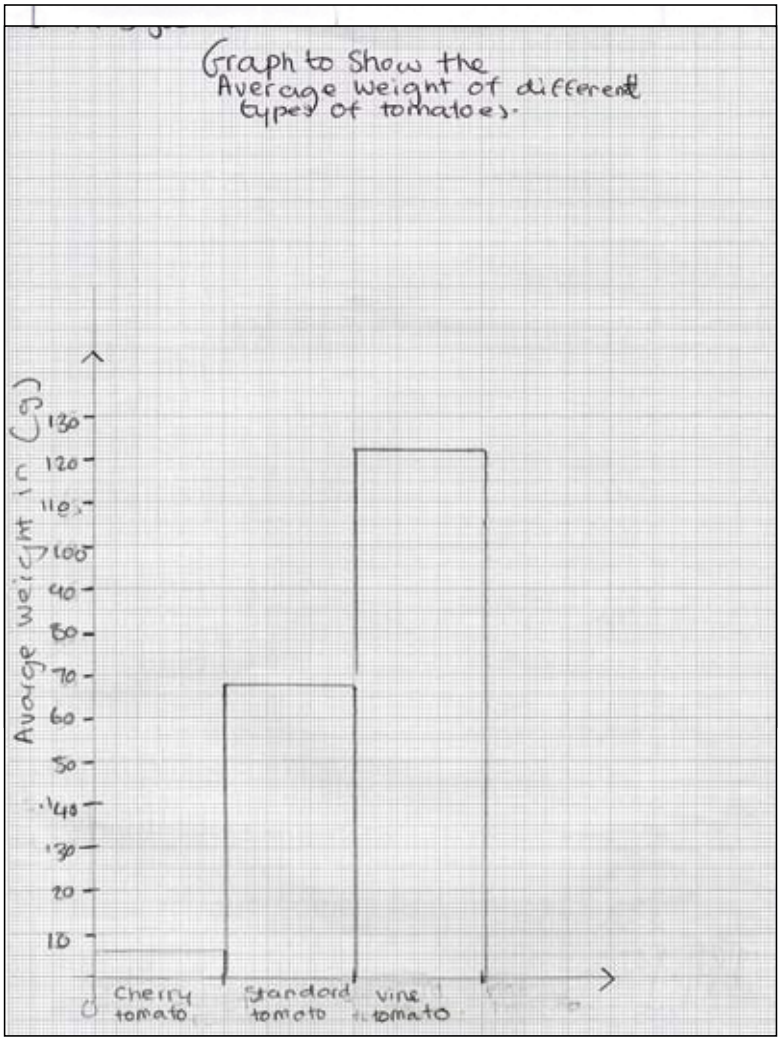
My question is :-
Does the ~~the~~ weight of different varieties of tomatoes depend on the size of the circumference.

I will try and keep the experiment fair by :-
1. Test 3 of each variety
2. Same Balance.
3. ~~Do the~~ Repeat the experiment 3 times for accurate answers.

My prediction :-
The smallest circumference / variety of the tomato will weigh less because it has less water and flesh.

My Independant and dependant variable :-

My Independant variable is the variety
My dependant variable is the weight of the tomato.



Conclusion.

When I changed the variety of tomato I noticed that the weight increased, this is similar to my prediction. because different varieties of tomatoes have different genes. Genes code for different characteristics in the Cherry tomato the size is small that probably has a lot of flavour. The standard tomato is large and has a lot of flesh. The vine tomato is very large and deep red in colour, these characteristics are drown to the genes. So that each variety looks different and weighs different amounts. if I was to experiment again I would like to see if the tomato ~~if the tomatoes~~ had different sweetness. I could do this by taste test, or I could test for Ph levels to see how acidic they are. I could test fo ph using Ph paper and universal indicator solution.

Teacher's notes

AF3

Pupil S recorded her results in a complete and clear table with appropriate units. She then chose to draw a bar chart that showed her results clearly and accurately, and has therefore presented her set of scientific data in different formats.

Her use of technical terms (such as variation, circumference, genes, characteristics) is accurate through all of her work here and involves some abstract concepts, although she did not provide further explanations.

AF4

She made measurements with precision appropriate to the task.

She identified three variables, but her question ("Does the weight of different varieties of tomatoes depend on the size of the circumference?") is not consistent with her stated choice of dependent and independent variables and with her actual measurements.

She correctly measured small but significant and workable samples of tomatoes of each variety, making appropriate repetition and correctly calculating averages.

AF5

The initial point that the different varieties have different weights was an obvious one, but in her continuing discussion she provided valid scientific background, linking genes and characteristics. She also made a suggestion for further investigation.

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Next steps

- Exercise in choosing continuous independent and dependent variables in order to produce line graphs.
- Work on the role of variation in artificial and natural selection.

Assessment commentary

Pupil S's investigation shows work at different levels. Her use of scientific vocabulary and her clear table, with very appropriate repetition and calculation of averages, are strong points. The work could be improved by more thoughtful planning, based on an investigation that is consistent with the named variables.

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6. Using chemical equations

Assessment focus

AF3

Context

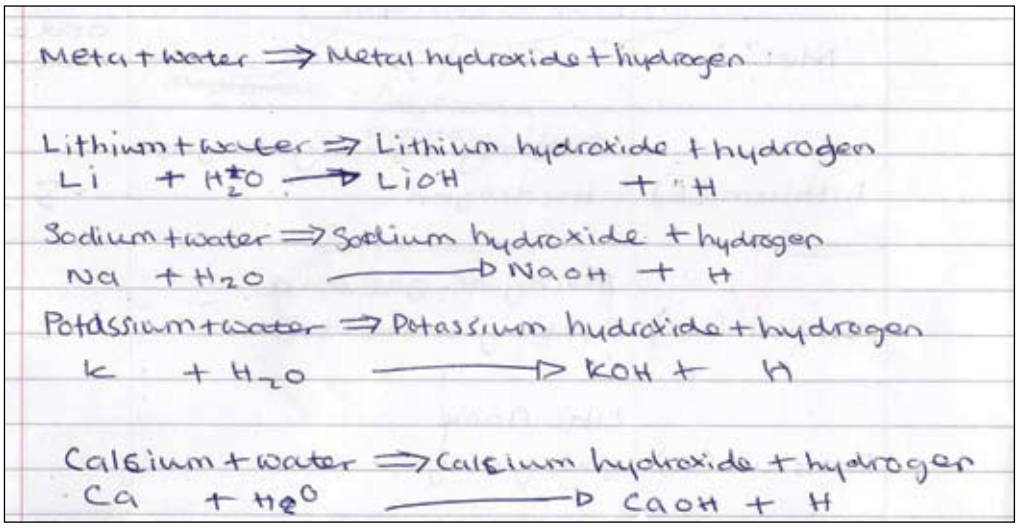
Pupils were working on metals, their reactions and the reactivity series. They carried out or observed a number of practical experiments and recorded their observations using chemical names and formulae, with some sample equations to assist them.

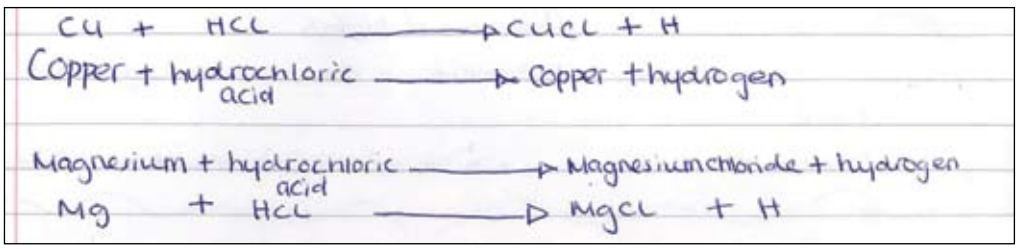
They were then given some word equations for reactions of metals with:

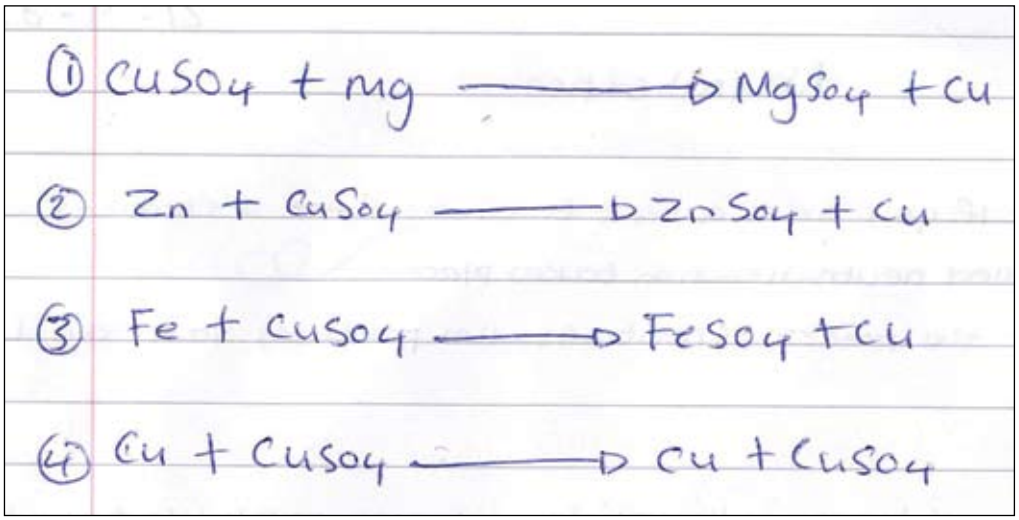
- water;
- hydrochloric acid;
- copper sulphate.

Pupils were asked to rewrite the equations using chemical formulae but were not expected to construct balanced equations.

Pupil S's work







Teacher's notes

AF3

Pupil S quickly understood the principles of constructing equations and of displacement, and used appropriate scientific conventions to communicate these ideas.

Next steps

- Counting atoms exercise to illustrate the concept of an unbalanced equation, in preparation for balancing equations.

Assessment commentary

Pupil S uses scientific conventions, in the form of unbalanced equations, to communicate the abstract changes at the atomic level in chemical reactions.

Assessment summary

AF1 Thinking scientifically

Pupil S uses abstract ideas as well as simple models when describing processes and phenomena. She is making progress for AF1 at low level 5.

AF2 Understanding the applications and implications of science

She works on an issue that relates an example of scientific research with aspects of our lives, and in doing so she works on positive and negative consequences of a particular development and begins to consider how these affect different people. Therefore, she just begins to address some points from level 5, and achieves a balanced high level 4 for AF2.

AF3 Communicating and collaborating in science

Pupil S can use scientific conventions and terminology to communicate abstract ideas, but the range of formats for the presentation of scientific data from which she selects is not wide. Thus she is working at level 5 in some aspects, but remains at level 4 in others, and for AF3 can be judged to be moving towards a low level 5.

AF4 Using investigative approaches

In her investigative work, Pupil S again shows some inconsistency of performance. She can work independently, selecting her own method, controlling risk and repeating sets of observations appropriately. She is not always clear, however, about selecting and identifying variables. She is thus beginning to make progress at level 5.

AF5 Working critically with evidence

Pupil S can identify patterns in data and draw straightforward conclusions. She can calculate averages correctly and appropriately, thus manipulating data and using it to contribute to conclusions. Again, she has clearly consolidated at level 4 and is making some, albeit not yet consistent, progress into level 5.

Overall assessment judgement

Pupil S shows a wide range of achievements, including some excursions into level 6. Her ability to use and work with models and conventions is relatively strong, and is at level 5. However, her investigative work is variable, and shows good achievement at level 4 with modest but significant progress into level 5.

The overall judgement of her work is that she has progressed to low level 5.

APP science assessment guidelines: levels 4 and 5

Name…S……

	AF1 – Thinking scientifically	AF2 – Understanding the applications and implications of science	AF3 – Communicating and collaborating in science	AF4 – Using investigative approaches	AF5 – Working critically with evidence
Level 5	**Across a range of contexts and practical situations pupils:** ● Use abstract ideas or models or more than one step when describing processes or phenomena ● Explain processes or phenomena, suggest solutions to problems or answer questions by drawing on abstract ideas or models ● Recognise scientific questions that do not yet have definitive answers ● Identify the use of evidence and creative thinking by scientists in the development of scientific ideas ☑	**Across a range of contexts and practical situations pupils:** ● Describe different viewpoints a range of people may have about scientific or technological developments ● Indicate how scientific or technological developments may affect different groups of people in different ways ● Identify ethical or moral issues linked to scientific or technological developments ● Link applications of science or technology to their underpinning scientific ideas ☐	**Across a range of contexts and practical situations pupils:** ● Distinguish between opinion and scientific evidence in contexts related to science, and use evidence rather than opinion to support or challenge scientific arguments ● Decide on the most appropriate formats to present sets of scientific data, such as using line graphs for continuous variables ● Use appropriate scientific and mathematical conventions and terminology to communicate abstract ideas ● Suggest how collaborative approaches to specific experiments or investigations may improve the evidence collected ☑	**Across a range of contexts and practical situations pupils:** ● Recognise significant variables in investigations, selecting the most suitable to investigate ● Explain why particular pieces of equipment or information sources are appropriate for the questions or ideas under investigation ● Repeat sets of observations or measurements where appropriate, selecting suitable ranges and intervals ● Make, and act on, suggestions to control obvious risks to themselves and others ☑	**Across a range of contexts and practical situations pupils:** ● Interpret data in a variety of formats, recognising obvious inconsistencies ● Provide straightforward explanations for differences in repeated observations or measurements ● Draw valid conclusions that utilise more than one piece of supporting evidence, including numerical data and line graphs ● Evaluate the effectiveness of their working methods, making practical suggestions for improving them ☐
Level 4	**Across a range of contexts and practical situations pupils:** ● Use scientific ideas when describing simple processes or phenomena ● Use simple models to describe scientific ideas ● Identify scientific evidence that is being used to support or refute ideas or arguments ☐	**Across a range of contexts and practical situations pupils:** ● Describe some simple positive and negative consequences of scientific and technological developments ● Recognise applications of specific scientific ideas ● Identify aspects of science used within particular jobs or roles ☑	**Across a range of contexts and practical situations pupils:** ● Select appropriate ways of presenting scientific data ● Use appropriate scientific forms of language to communicate scientific ideas, processes or phenomena ● Use scientific and mathematical conventions when communicating information or ideas ☐	**Across a range of contexts and practical situations pupils:** ● Decide when it is appropriate to carry out fair tests in investigations ● Select appropriate equipment or information sources to address specific questions or ideas under investigation ● Make sets of observations or measurements, identifying the ranges and intervals used ● Identify possible risks to themselves and others ☐	**Across a range of contexts and practical situations pupils:** ● Identify patterns in data presented in various formats, including line graphs ● Draw straightforward conclusions from data presented in various formats ● Identify scientific evidence they have used in drawing conclusions ● Suggest improvements to their working methods, giving reasons ☑
BL	☐	☐	☐	☐	☐
IE	☐	☐	☐	☐	☐

Key: BL-Below Level IE-Insufficient Evidence

Overall assessment (tick one box only) Low 4 ☐ Secure 4 ☐ High 4 ☐ Low 5 ☑ Secure 5 ☐ High 5 ☐

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