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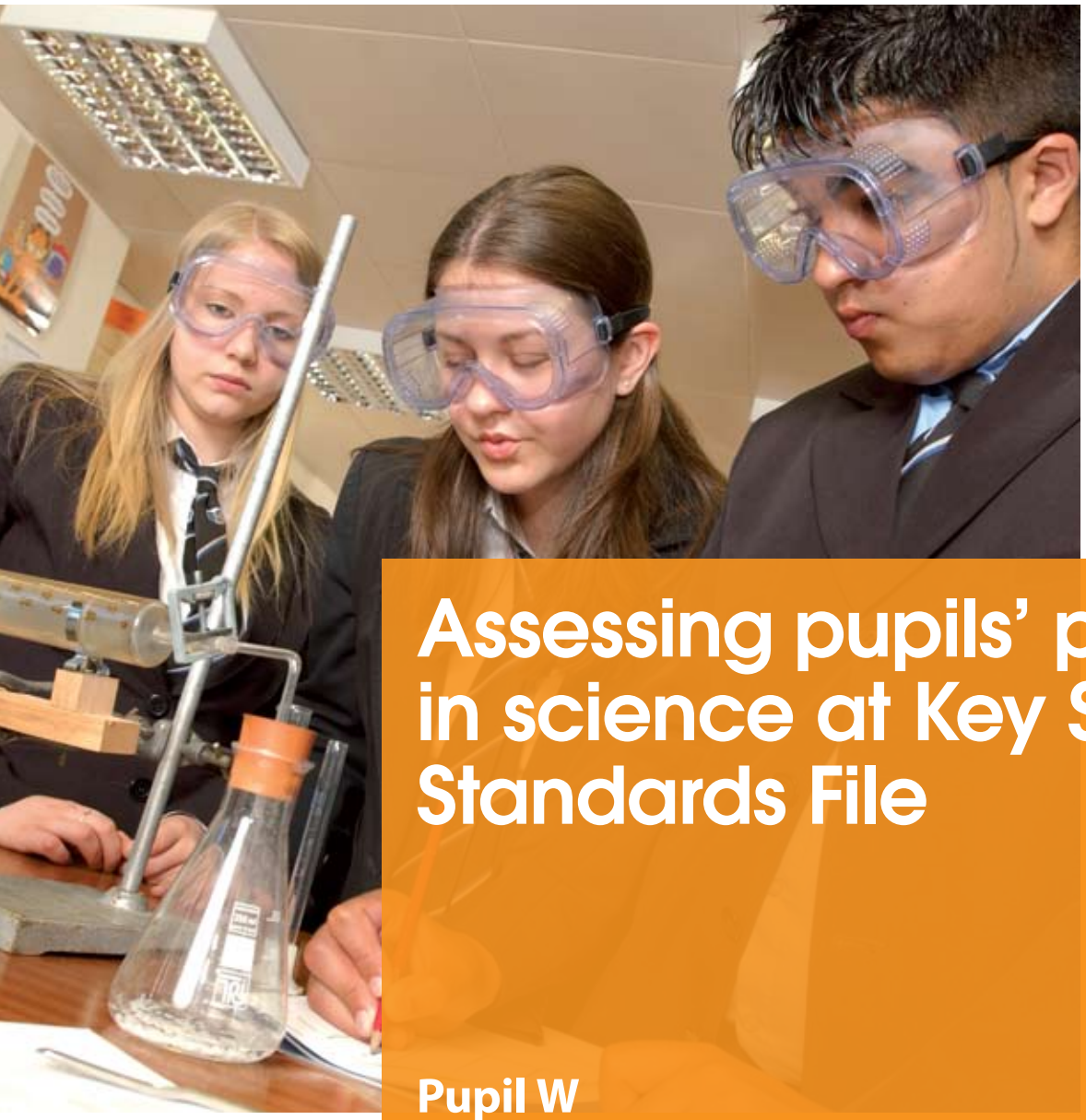

Assessing pupils' progress in science at Key Stage 3: Standards File

Pupil W

department for
children, schools and families

QCA Qualifications and Curriculum Authority

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Pupil W

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Pupil W Year 8 High level 4 Science Standards File

Pupil profile

The evidence here for Pupil W presents an interesting case. For AF2 it shows level 5 work, and there is movement towards level 5 in other areas that is significant but always partial. A case could be made for assessing the work at low level 5, if only the achievements were more consistent and more complete. The evidence as it stands is judged at high level 4.

The evidence

1. Investigating the stretch of elastic bands
2. Investigating woodlice behaviour
3. Describing particles in solids, liquids and gases
4. Identifying a mystery gas
5. Investigating fuels
6. Investigating how humans affect animal populations

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1. Investigating the stretch of elastic bands

Assessment focuses

AF3, AF4, AF5

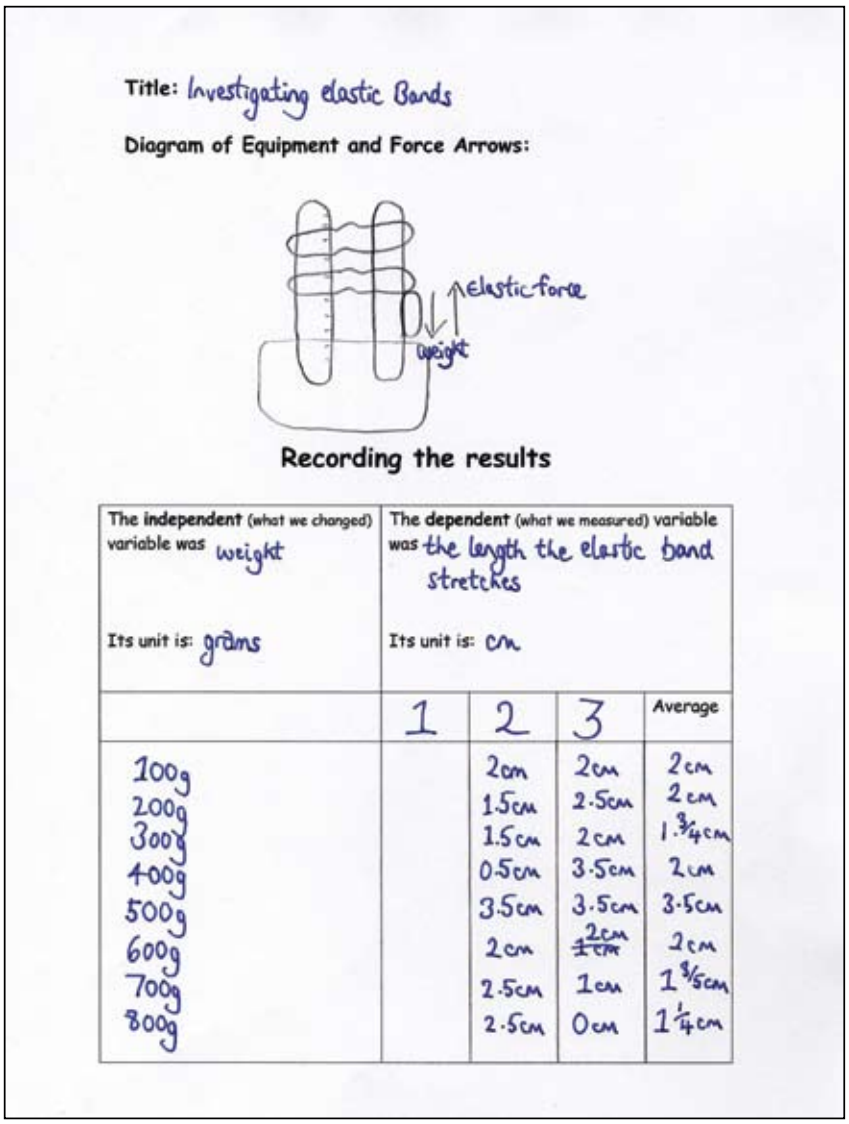
Context

While learning about forces, the teacher set the task of investigating the stretch of elastic bands, making measurements of extension in length under the action of different forces. The teacher gave pupils a list of the equipment and asked them to devise their own procedure to measure how much their band stretched as the number of masses increased.

The teacher asked the pupils to provide diagrams to show how the equipment was set up, and also to show the forces acting on the bottom of the elastic band.

The teacher also gave them a template for their results and told them they were expected to record and then present the data graphically.

Pupil W's work

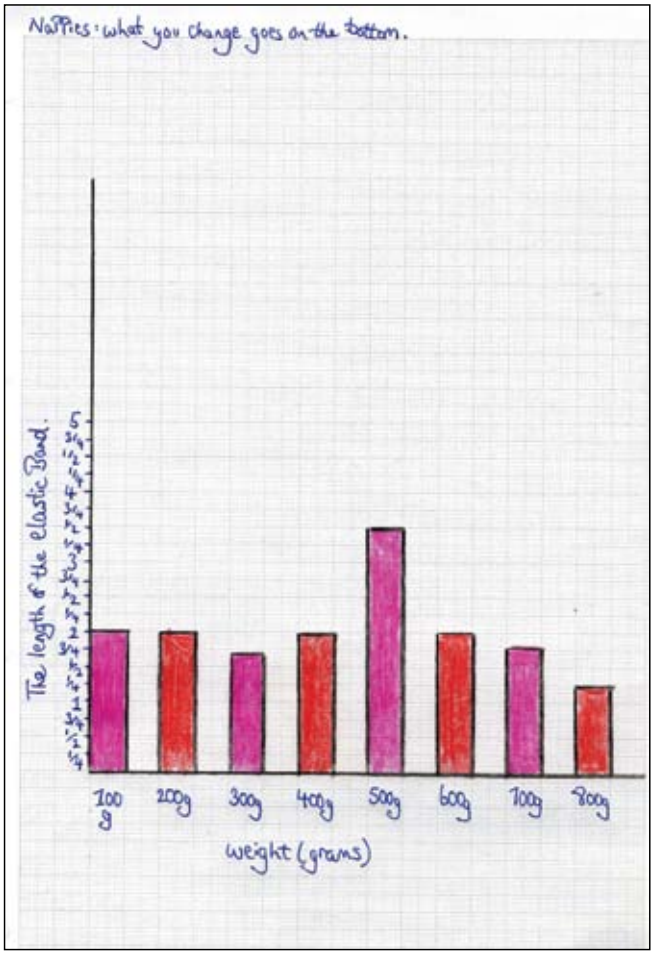


Title: Investigating elastic Bands

Diagram of Equipment and Force Arrows:

Recording the results

The independent (what we changed) variable was weight Its unit is: grams	The dependent (what we measured) variable was the length the elastic band stretches Its unit is: cm			
	1	2	3	Average
100g		2cm	2cm	2cm
200g		1.5cm	2.5cm	2cm
300g		1.5cm	2cm	1 3/4cm
400g		0.5cm	3.5cm	2cm
500g		3.5cm	3.5cm	3.5cm
600g		2cm	~~1cm~~ 2cm	2cm
700g		2.5cm	1cm	1 3/5cm
800g		2.5cm	0cm	1 1/4cm



Teacher's notes

AF3

The diagram is rather small and the experimental apparatus used was not labelled, but correct scientific convention was used in showing arrows of equal length pointing in opposite directions to represent two equal and opposing forces.

Pupil W presented data in a table and as a bar chart, using a mixture of decimal and fraction mathematical conventions. He recognised and used a scientific convention in stating that, "What you change goes along the bottom." His results show successive increases in extension rather than the more usual cumulative extension (and hence the y axis on the bar chart is incorrectly labelled) but no instruction on this was given.

AF4

Results have been repeated, as was encouraged by the template. Pupil W then also made a full set of accurate measurements (albeit with a mix of decimal and fraction notation).

He followed instructions to control obvious risk.

AF5

When asked what his results showed, Pupil W was able to say that the length of the elastic band increased each time more weight was added, but he made no further comment that identified a general pattern in the data or that mentioned the possibility of anomalies.

Next steps

- Practice with representing different kinds of data and deciding the most appropriate way in which to present them.
- Practice at showing different labelled views of objects including experimental apparatus.

Assessment commentary

Data are collected and presented in a table and on a bar chart using the correct choice of axes. The mixed use of decimals and fractions suggest that Pupil W is not yet confident with the use of decimals for scientific measurement, and in this situation a line graph would be a more appropriate format in which to present the data.

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2. Investigating woodlice behaviour

Assessment focuses

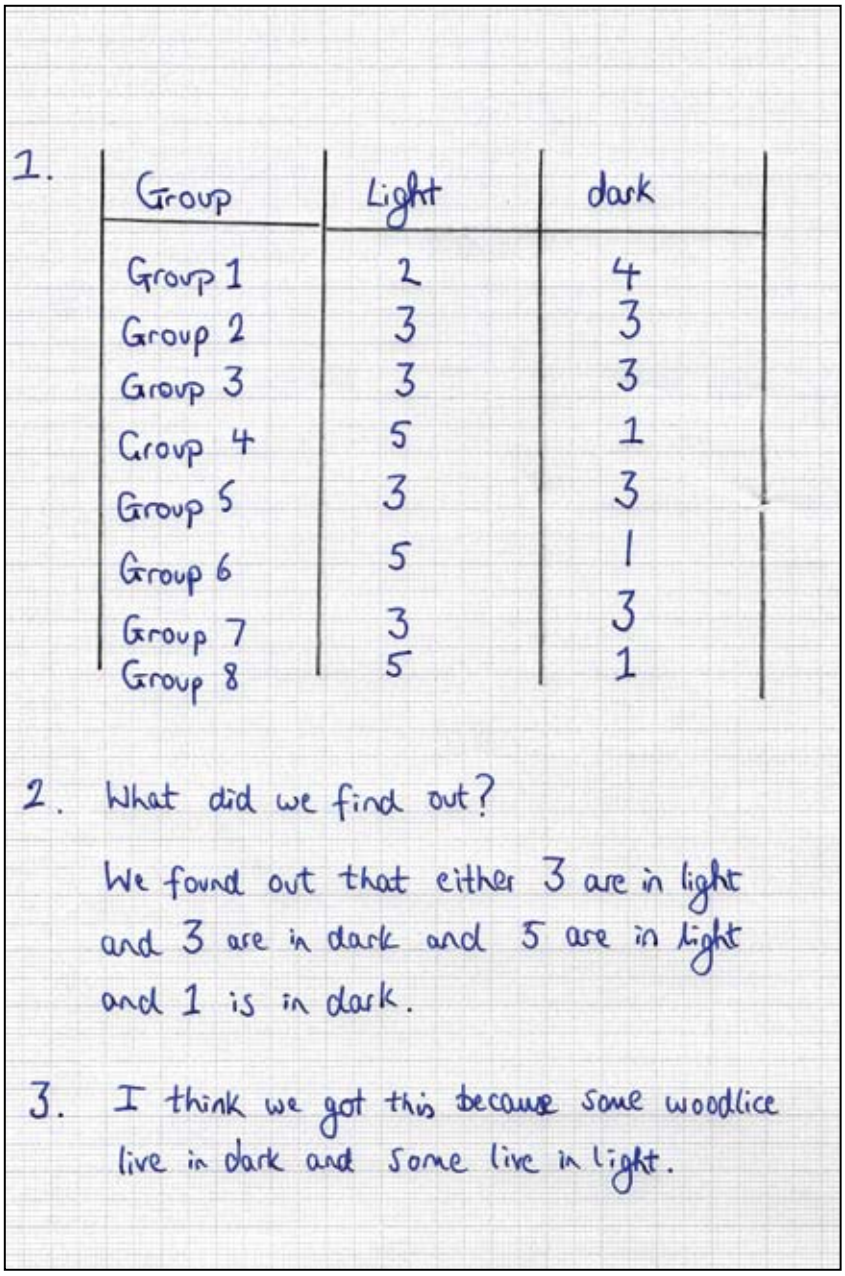
AF3, AF5

Context

Pupils were studying living things and their environments, with a focus on diversity and adaptation. Pupils were considering whether living things can choose their own environments.

As part of this work, pupils gathered data on woodlice in a choice chamber. They set up eight choice chambers and Pupil W made observations over the course of a lesson in order to minimise disturbance to the woodlice.

Pupil W's work



1.

Group	Light	dark
Group 1	2	4
Group 2	3	3
Group 3	3	3
Group 4	5	1
Group 5	3	3
Group 6	5	1
Group 7	3	3
Group 8	5	1

2. What did we find out?

We found out that either 3 are in light and 3 are in dark and 5 are in light and 1 is in dark.

3. I think we got this because some woodlice live in dark and some live in light.

Teacher's notes

AF3

Pupil W produced his own results table, thus selecting an appropriate way of presenting simple scientific data.

AF5

The particular set of results gathered here provides a challenge in that the pattern is not an obvious one compared with the class results as a whole. The pupil's summary that the numbers are either (3 + 3) or (5 + 1) does not apply to group 1, but his conclusion that some prefer one condition and some prefer the other is an entirely reasonable, straightforward conclusion in the light of these results.

Next steps

- Consideration of how collaborative approaches to investigations may improve the evidence collected.

Assessment commentary

The positive achievements here are the recording of results in a clear table, and the development of a straightforward conclusion which deals in a valid way with ambiguous results. Pupil W analyses each result individually, rather than considering overall patterns such as total numbers of woodlice in the light and in the dark, and a more mathematical approach to data analysis would be of benefit.

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3. Describing particles in solids, liquids and gases

Assessment focus

AF1

Context

As a starter activity in the later stages of work on solids, liquids and gases, the teacher gave pupils statements about the states of matter and asked them to link the statement with the appropriate state.

Pupil W's work

Particles in solids, liquids and gases

Choose from this list of phrases to fill in the table below.

- are easily compressed
- fill any container
- keep their volume
- particles attracted to each other
- particles change position
- particles move freely
- particles very close together
- particles vibrate about fixed positions
- particles relatively far apart

solids	liquids	gases
Keep their volume particles closely packed particles attracted to each other. Particles vibrate about fixed positions	are easily compressed ~~fill any~~ particles move freely. particles relatively far apart particles attracted to each other take the shape of the container	are easily compressed fill any container particles move freely particles change Position relative to each other.

Teacher's notes

AF1

Pupil W began to explain phenomena (solids keep their volume, liquids take the shapes of their containers, gases are easily compressed) by drawing on abstract ideas of particles. There was, however, some uncertainty in understanding the behaviour of particles in liquids (since inter-particle distance in liquids is similar to that in solids).

Next steps

- Use of simulation software to illustrate particle behaviour.
- Observation of melting ice, in particular of the very small change in volume, to challenge the misconception that particle spacing in liquids is intermediate between that in solids and gases.

Assessment commentary

Pupil W uses abstract ideas that lie behind explanations of phenomena, but with a template that provides quite close guidance by limiting the choices available. Thus, on this point, the work suggests that he is just starting to move beyond level 4.

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4. Identifying a mystery gas

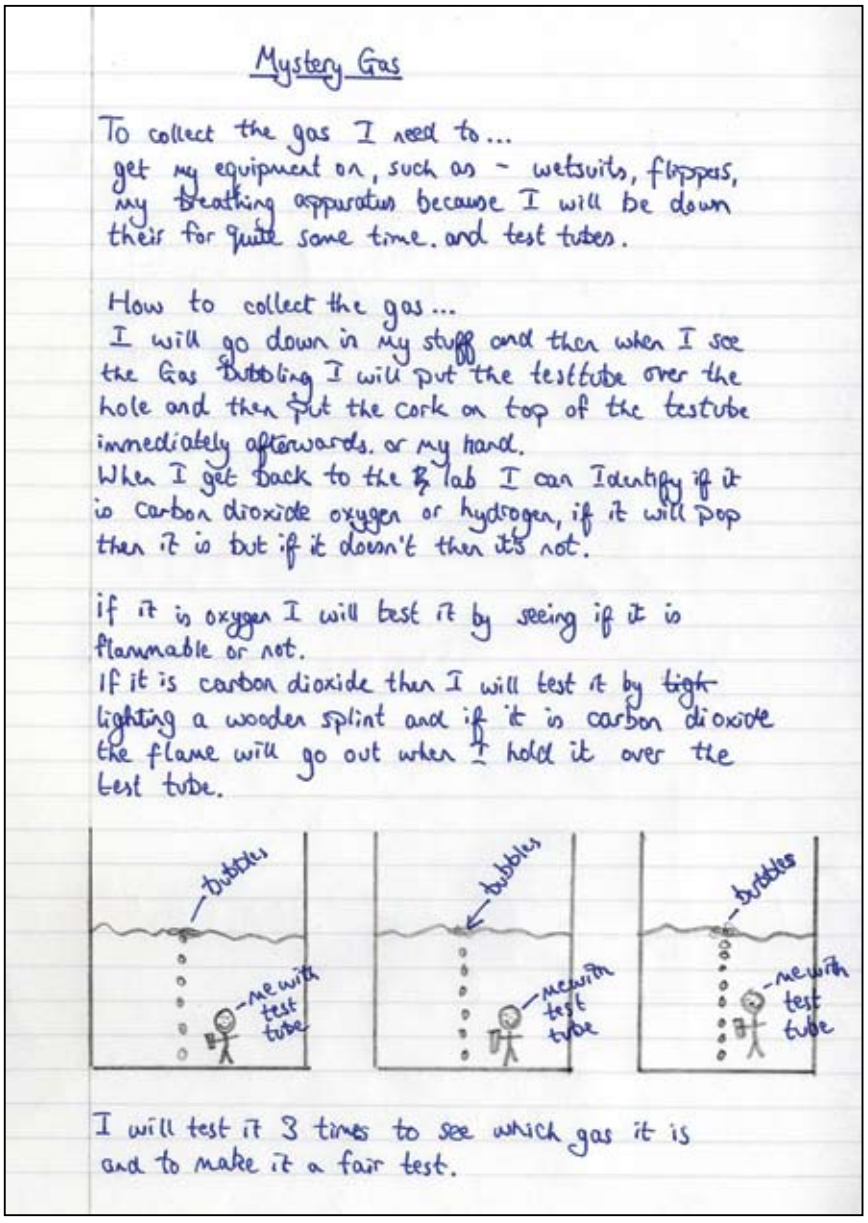
Assessment focuses

AF1, AF3

Context

During work on the atmosphere and gases, and following practical activities on the combustion of gases, the teacher presented pupils with a scenario in which bubbles of a mystery gas were rising from a sea bed. They were asked to describe how they would collect samples of this gas and what tests they would carry out to find out whether the gas is carbon dioxide, hydrogen or oxygen. The teacher asked them to write this up informally.

Pupil W's work



Mystery Gas

To collect the gas I need to...
get my equipment on, such as - wetsuits, flippers, my breathing apparatus because I will be down their for quite some time. and test tubes.

How to collect the gas...
I will go down in my stuff and then when I see the Gas bubbling I will put the testtube over the hole and then put the cork on top of the testtube immediately afterwards. or my hand.
When I get back to the lab I can Identify if it is carbon dioxide oxygen or hydrogen, if it will pop then it is but if it doesn't then it's not.

if it is oxygen I will test it by seeing if it is flammable or not.
If it is carbon dioxide then I will test it by ~~light~~ lighting a wooden splint and if it is carbon dioxide the flame will go out when I hold it over the test tube.

I will test it 3 times to see which gas it is and to make it a fair test.

Teacher's notes

AF1

Pupil W worked with the simple scientific idea that the three gases behave in three different ways and that these allow identifications to be made. He stated these three ways, but made an error in describing the test for oxygen, describing it as flammable.

AF3

He used appropriate forms of scientific language and a simple but meaningful use of pictures to communicate a point.

Next steps

- Visual representation of the constituent particles of these three gases, and development of ideas about atoms, molecules, elements and compounds.

Assessment commentary

Pupil W displays knowledge and understanding of basic gas tests, and has described the tests in clear steps, using scientific ideas and appropriate forms of scientific language when describing processes.

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5. Investigating fuels

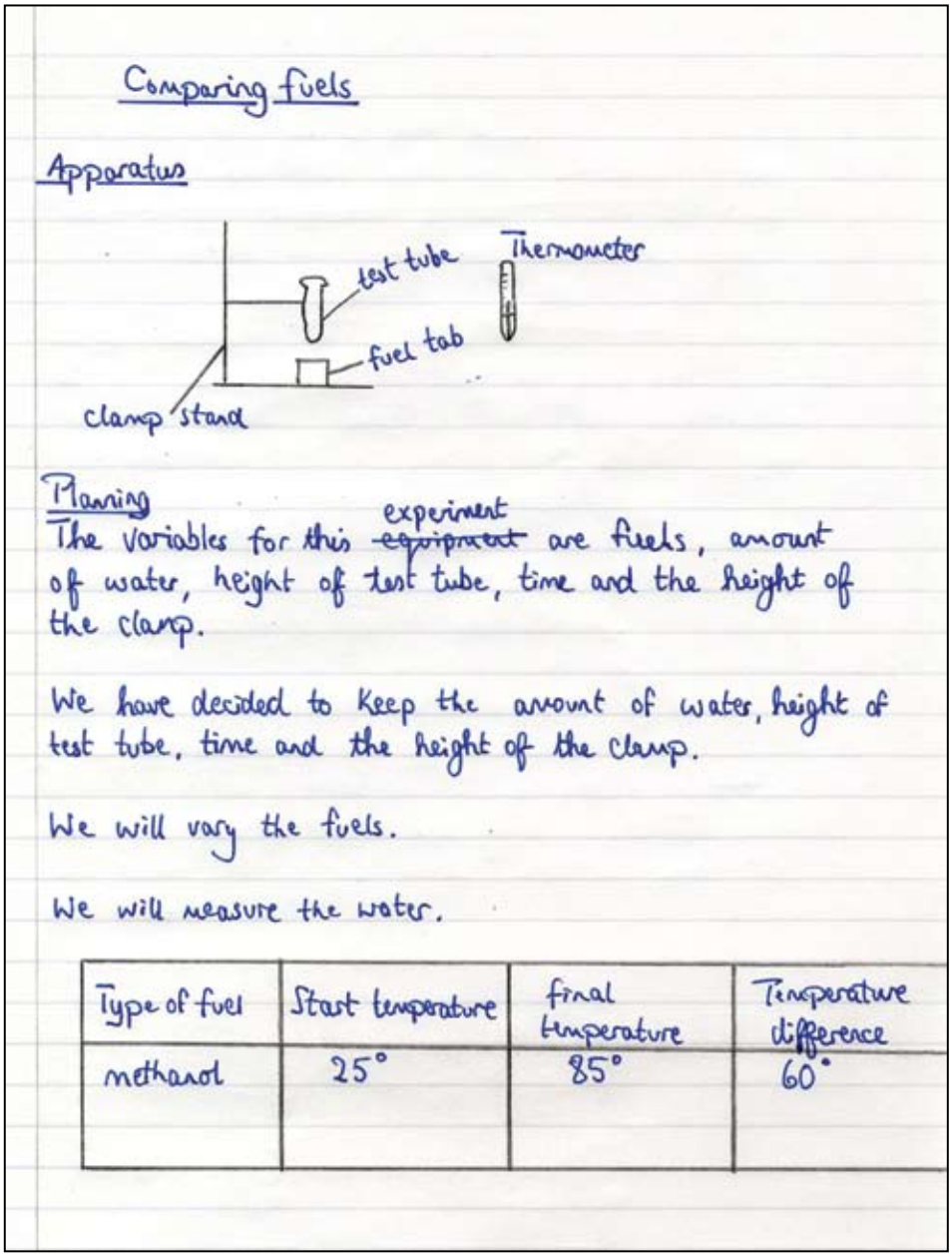
Assessment focuses

AF3, AF4

Context

The teacher asked pupils to work in pairs and plan an investigation to look at the heating effects of different fuels. Following a safety check by the teacher, they took measurements, and choose how to present their results.

Pupil W's work



Comparing fuels

Apparatus

Planning

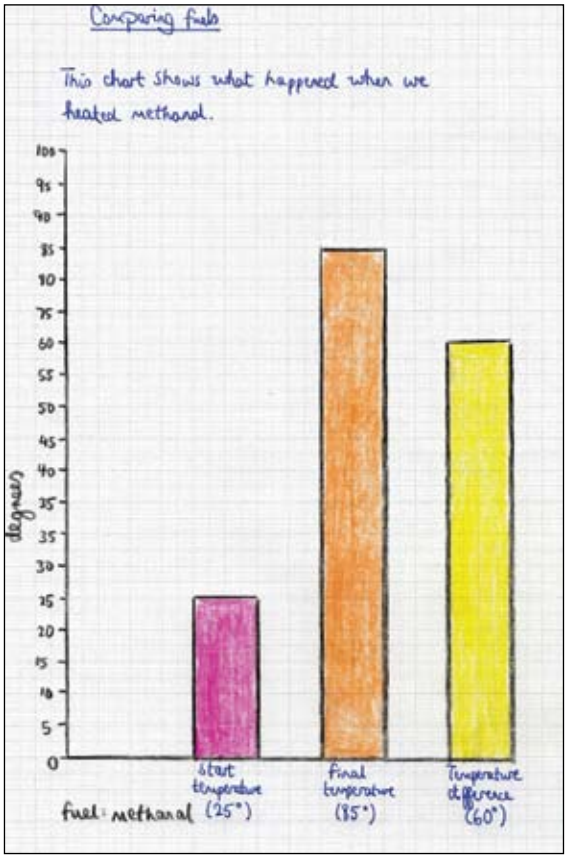
The variables for this experiment are fuels, amount of water, height of test tube, time and the height of the clamp.

We have decided to keep the amount of water, height of test tube, time and the height of the clamp.

We will vary the fuels.

We will measure the water.

Type of fuel	Start temperature	final temperature	Temperature difference
methanol	25°	85°	60°



Teacher's notes

AF3

Pupil W presented data in a table and as a bar chart The bar chart has been clearly drawn, but there is some miscounting on the y-axis.

AF4

Pupil W has considered the variables and has made it clear which ones will be varied, which will be measured, and which will be controlled.

Next steps

- Practice in using larger data sets to construct bar charts.
- Consideration of the factors that make a good fuel.

Assessment commentary

Pupil W uses appropriate forms of scientific language and presents his own results in a table and as a bar chart, although errors of counting on the y-axis result in incorrect relative sizes of the bars.

Valid assessment of the variables is made, although measurements have been made for only one fuel, so the purpose of the investigation is not achieved.

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6. Investigating how humans affect animal populations

Assessment focus

AF2, AF3

Context

During work on habitats and adaptation, the class looked at how humans were affecting a range of habitats and the animals that live in them.

There are two parts of the assessment work provided here.

Part A – a visual presentation of ideas and vocabulary

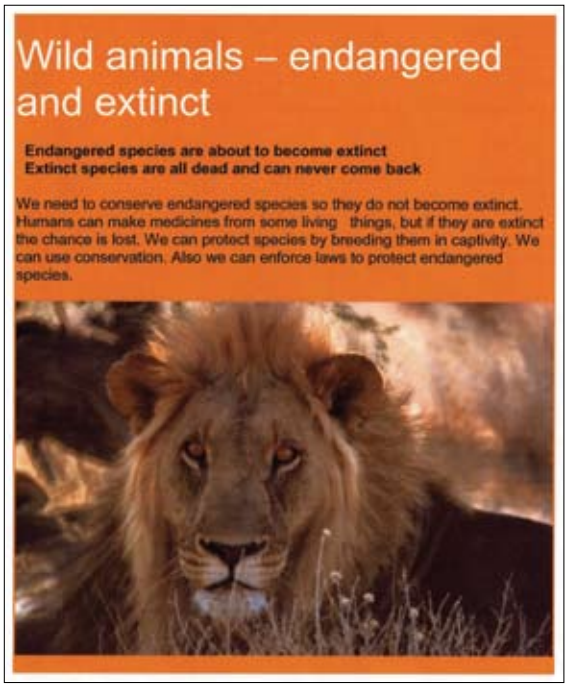
This activity was based on a selection of key words provided to the class. Pupils each chose one or more key words and found information and images from the internet to help them to present their meanings. Pupil W chose to explain 'endangered' and 'extinct', and produced a simple word-processed presentation.

Part B – a role play to consider alternative viewpoints

In pairs, each pupil took the role of either a campaigner trying to protect the animal population or a campaigner claiming that human interests have priority. The teacher provided pupils with resource sheets for further information. A small selection of pairs then performed their role plays to the rest of the class.

Pupil W's work

Part A – visual presentation



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Part B – teacher commentary on role play

Pupil W discussed the effect of shipping on communication between whales. Pupil W played the role of a campaigner claiming that human interests have priority.

He identified economic arguments for shipping, mentioning the need for international trade, including import and export of food. Acting in role, he presented demand for consumer goods as important and ethically acceptable. He also argued that human well-being is independent of changes to the size of whale populations, and even of extinctions.

Teacher's notes

AF2

Pupil W recognised applications of scientific ideas, relating ideas of endangerment, extinction and conservation, and recognising medicines as a positive benefit of maintaining wildlife populations.

He was able to express a particular viewpoint on an issue with a scientific foundation, and, although without identifying them explicitly as such, he presented both economic and ethical arguments.

AF3

Pupil W provided appropriate explanation of some key vocabulary, both through the visual representation and the role play.

Next steps

- Distinguishing between opinion and scientific evidence in relation to scientific arguments involving various interest groups.

Assessment commentary

The role play allowed Pupil W to express relatively sophisticated ideas and to show strong progress for AF2, identifying ethical and moral issues, and demonstrating a particular viewpoint.

His use of scientific language is appropriate for communication of the scientific ideas of endangerment and extinction.

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Assessment summary

AF1 Thinking scientifically

Pupil W can use scientific ideas to explain simple processes. With guidance, he can complete a sorting exercise using an abstract model. This suggests that he is beginning to move towards level 5, but the evidence is not enough to justify a level 5 judgement for AF1. He can be assessed as high level 4.

AF2 Understanding the applications and implications of science

The work on the effect of humans on animal populations demonstrates good progress. There is identification of arguments of different kinds and an understanding of particular viewpoints. For AF2 Pupil W has already progressed to level 5.

AF3 Communicating and collaborating in science

Evidence for AF3 is variable. There is clear use of appropriate language, and good definitions are provided for some key words. Pupil W is beginning to use force diagrams, a scientific convention relating to abstract ideas. He selects appropriate ways of presenting data, although the execution contains errors. His work for AF3 as shown by this file is at high level 4.

AF4 Using investigative approaches

Pupil W begins to recognise significant variables in investigations, and makes sets of measurements. He follows instructions to control risk. A balanced judgement places his AF4 work at high level 4.

AF5 Working critically with evidence

Pupil W makes a straightforward conclusion from the woodlice investigation. There is some identification of a pattern in the data on the elastic band, in the recognition that there is an increase in length with each addition to the applied force. The work here suggests secure level 4.

Overall assessment judgement

Pupil W's work shows partial satisfaction of several criteria at level 5. Except for AF2, the word partial is very significant. Movement towards level 5 exists, but is tentative for AF1, AF3 and AF4, and has no supporting evidence for AF5. The present collection of evidence suggests that he has progressed to high level 4.

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APP science assessment guidelines: levels 4 and 5

Name…W……

	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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