

April 2023



Stoke exemplification for primary science (SEPS)

Key Stage 2 pupil work collection

Compiled by Dr Sarah Earle in collaboration with
the teachers of Stoke on Trent and beyond.

Particular thanks go to the science leads and teachers at:
Burnwood, Gladstone, Hillside, Holy Trinity, Jackfield,
New Ford, Mereside, Milton, St Maria Goretti, Sutherland
and The Willows Primary Schools.

If you would like to share further examples, please contact:
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KEY STAGE 2

Stoke exemplification for primary science (SEPS)

Resource guidance

The [Teacher Assessment Framework](#) (TAF) contains a list of ‘pupil can’ statements to be used for making a statutory judgement at the end of key stage following completion of the [National Curriculum](#) (NC). The TAF splits the ‘expected standard’ for science into ‘working scientifically’ (disciplinary knowledge) and ‘science content’ (substantive knowledge). Working scientifically should be taught through, and clearly related to, the teaching of substantive science content. Both kinds of knowledge will be taught and assessed throughout the key stage.

At the end of the key stage, teachers make a judgement about whether each pupil is meeting the ‘expected standard’ statements based on their own assessments of pupils’ work. This judgement will consider a broad range of evidence and learning experiences, which will come from day-to-day work in the classroom.

To judge that a pupil is working at the expected standard in science, they are expected to meet all of the ‘working scientifically’ statements and all of the ‘science content’ taught in the final year of the key stage. Teachers might draw on assessments made earlier in the key stage, talking to previous class teachers, but there is no requirement to keep evidence from the classroom related to science lessons before the final year of the key stage.

To support teacher assessment, the Science Across the City project worked with teachers across Stoke on Trent in 2021-23 to gather a broad range of new examples. The examples presented in this resource often show the end of the learning journey in each topic, so it is worth noting that other lessons and experiences will have led up to this point. The examples are annotated to explain the context to the reader, but it is not expected that class teachers would annotate pupil work in this way. Objectives are linked to the TAF, unless stated otherwise (e.g. where Y3/4 NC statements). Opening the bookmarks tab on the left will help to navigate to the topic of interest.

These exemplification materials have been created to support moderation discussions, which help to benchmark judgements. Moderation discussions, across year groups or across school(s), also provide a valuable opportunity for teacher professional learning, to develop a shared understanding of progression in primary science. These materials can also be used as a source of ideas for planning learning experiences.

These exemplification materials do not dictate the evidence required, but only show how many of the statements might be met. Other examples of pupil work include the [PLAN](#) pupil work collections, the [TAPS](#) examples and the [STA](#)’s early exemplification materials.

Key Stage 2: Animals including humans

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 3: Animals including humans

Pupils should be taught to:

- identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat
- identify that humans and some other animals have skeletons and muscles for support, protection and movement.

NC Year 4: Animals including humans

- describe the simple functions of the basic parts of the digestive system in humans
- identify the different types of teeth in humans and their simple functions
- construct and interpret a variety of food chains, identifying producers, predators and prey.

NC Year 5: Animals including humans

- describe the changes as humans develop to old age.

NC Year 6: Animals including humans

- identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood
- recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function
- describe the ways in which nutrients and water are transported within animals, including humans.

KS2 TAF expected standard: Science content for animals including humans

The pupil can:

- name and describe the functions of the main parts of the digestive [year 4], musculoskeletal [year 3] and circulatory systems [year 6]; and describe and compare different reproductive processes and life cycles in animals [year 5]
- describe the effects of diet, exercise, drugs and lifestyle on how the body functions [year 6]
- construct and interpret food chains [year 4]

KS2 TAF expected standard: Working scientifically*

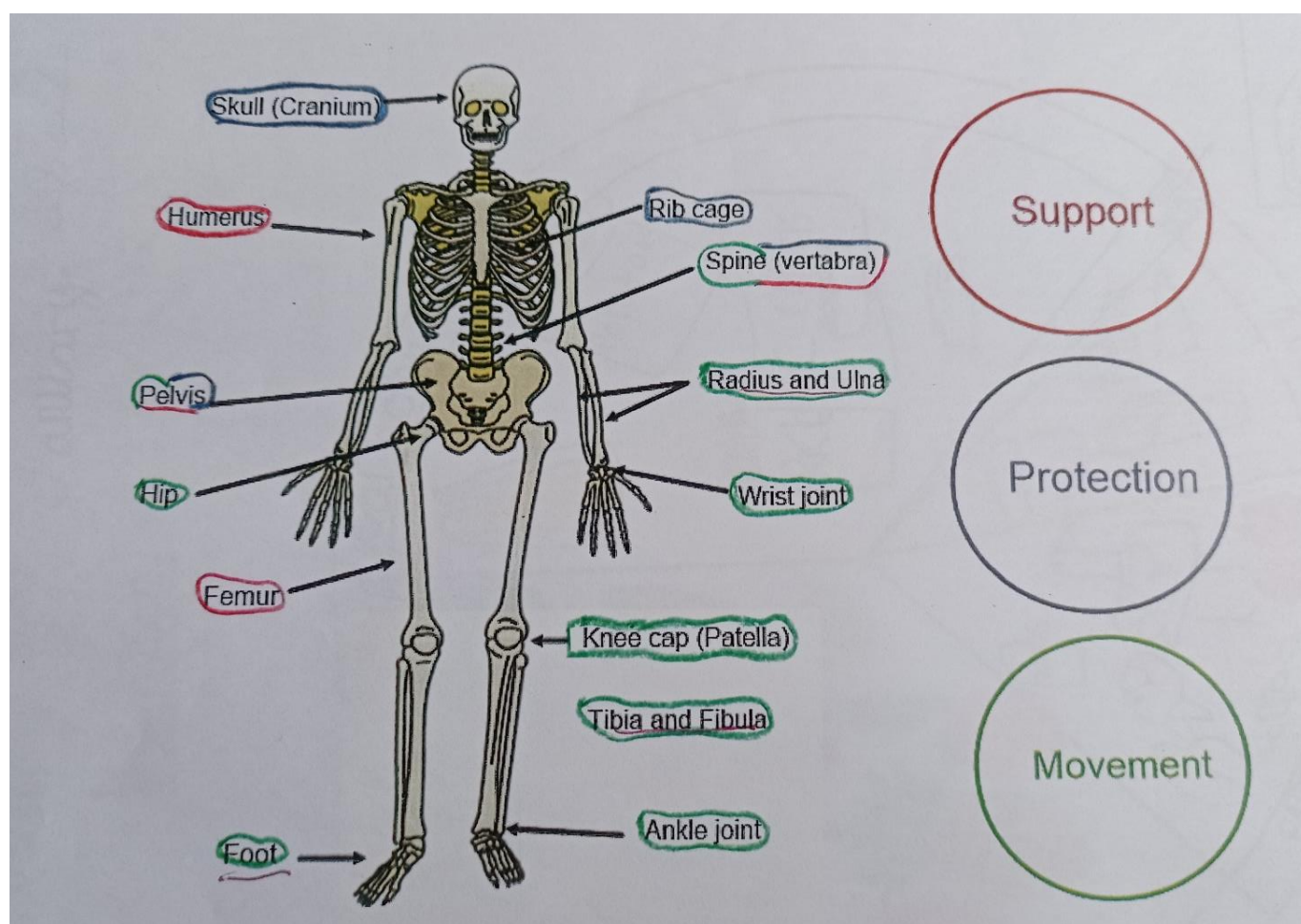
The pupil can, using appropriate scientific language from the national curriculum:

- describe and evaluate their own and others' scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own questions about the scientific phenomena that they are studying, and select the most appropriate ways to answer these questions, recognising and controlling variables where necessary (i.e. observing changes over different periods of time, **noticing patterns**, grouping and classifying things, carrying out comparative and fair tests, and **finding things out using a wide range of secondary sources**)
- use a range of scientific equipment to **take accurate and precise measurements** or readings, with repeat readings where appropriate
- **record data and results** using scientific diagrams and labels, classification keys, **tables**, **scatter graphs**, **bar and line graphs**
- **draw conclusions**, explain and evaluate their methods and findings, communicating these in a variety of ways
- raise further questions that could be investigated, based on their data and observations.

**The working scientifically objectives will be taught in conjunction with science content. Statements exemplified in this topic are in bold.*

Topic: Animals including humans	Year 3 Age 7-8	Title: Skeleton function
Working Scientifically	Science content Y3 NC: identify that humans and some other animals have skeletons and muscles for support, protection and movement (Later KS2 TAF: name and describe the functions of the main parts of the musculoskeletal system)	

After discussing the human skeleton, children were asked to consider the primary purpose of the different bones in their bodies. They circled the bone in red if they thought its most important purpose was for support, in blue for protection and in green for movement. They used a mix of colours to show where they thought a bone had more than one primary purpose.



Children meeting the objective would be able to discuss and recognise core purposes of the skeleton. NB. Can use 'everyday' or scientific names for bones in discussions, but do not need to learn the names of all bones.

Topic: Animals including humans	Year 3 Age 7-8	Title: Nutrition plate
Working Scientifically Review: communicate their findings in a variety of ways (research)	Science content Y3 NC: identify that animals, including humans, need the right types and amount of nutrition and they get nutrition from what they eat (Later KS2 TAF: describe the effects of diet on how the body functions)	

After researching and discussing different types of food, children were asked to identify and categorise the main nutrition present in common food items, using an 'eat well plate' to consider the proportion of these suggested for a balanced diet.

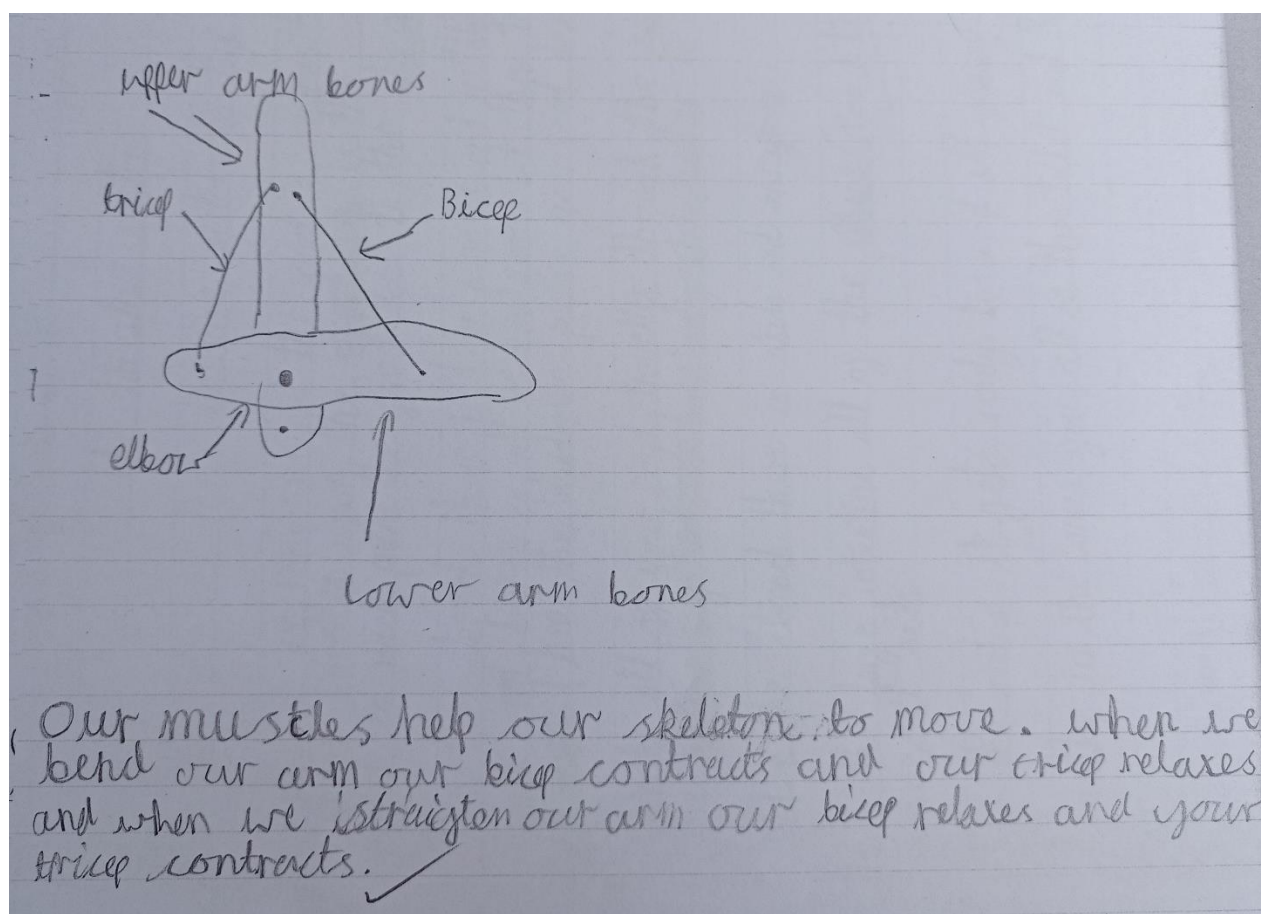


Children meeting the objective would be able to discuss and recognise a variety of sources of nutrition.

NB. The 'dairy' category can be called 'dairy and alternatives' to include a range of diets. The 'carbohydrates' category above, could be described as 'starchy carbohydrates' which are more long-lasting energy sources than the sugary carbohydrates.

Topic: Animals including humans	Year 3 Age 7-8	Title: Arm muscles
Working Scientifically describe and evaluate their own scientific ideas, using evidence from a range of sources (modelling)	Science content Y3 NC: identify that humans and some other animals have skeletons and muscles for support, protection and movement (Later KS2 TAF: name and describe the functions of the main parts of the musculoskeletal system)	

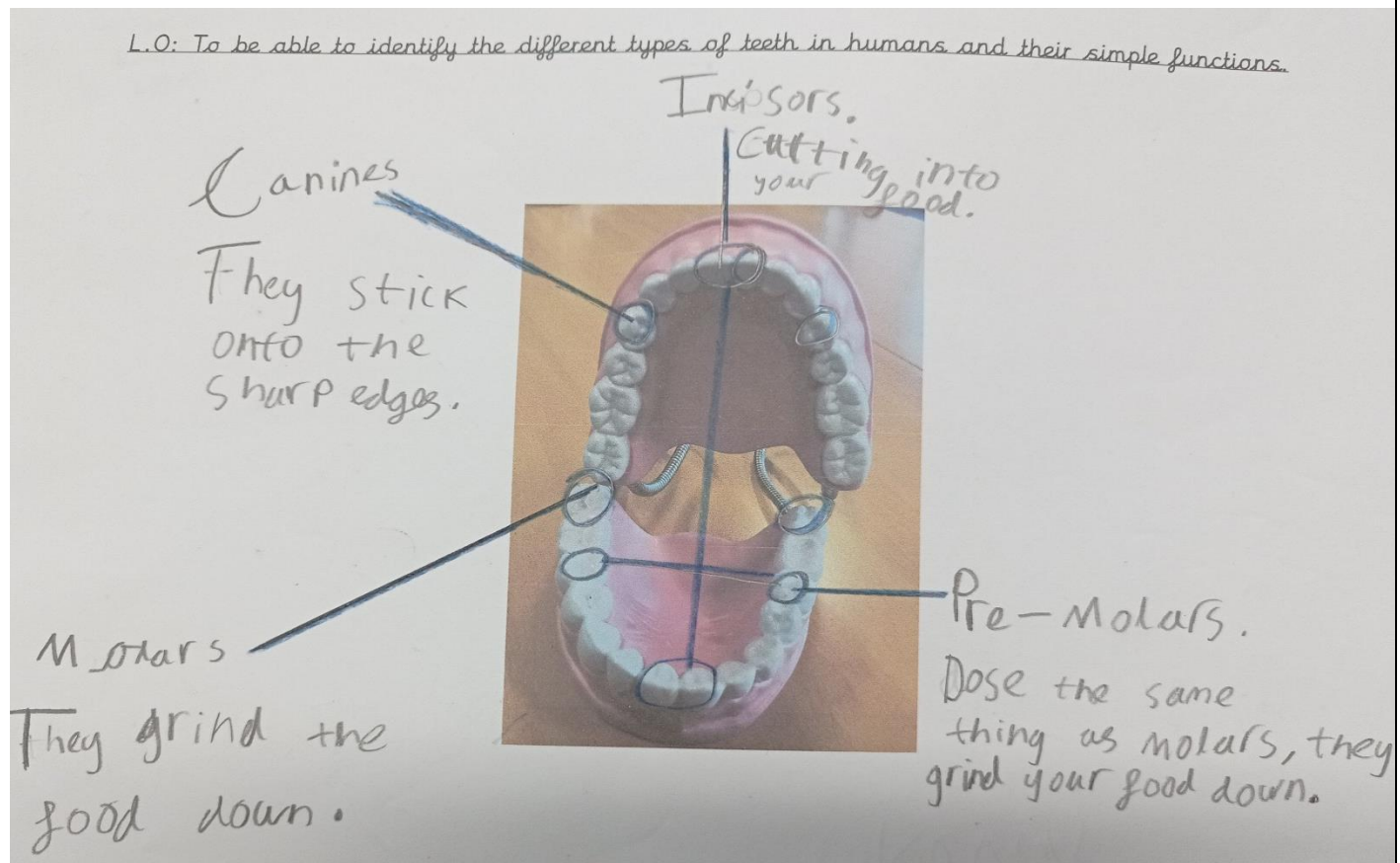
After exploring a model of the muscles in the arm, the children were asked to draw and/or write a short explanation to explain what was happening.



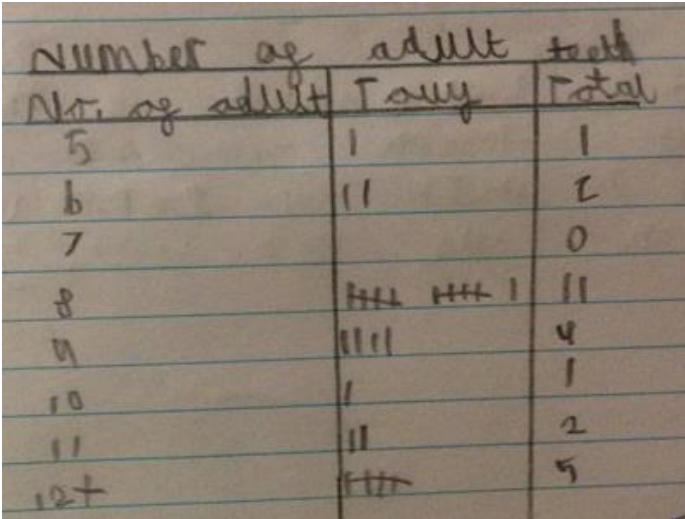

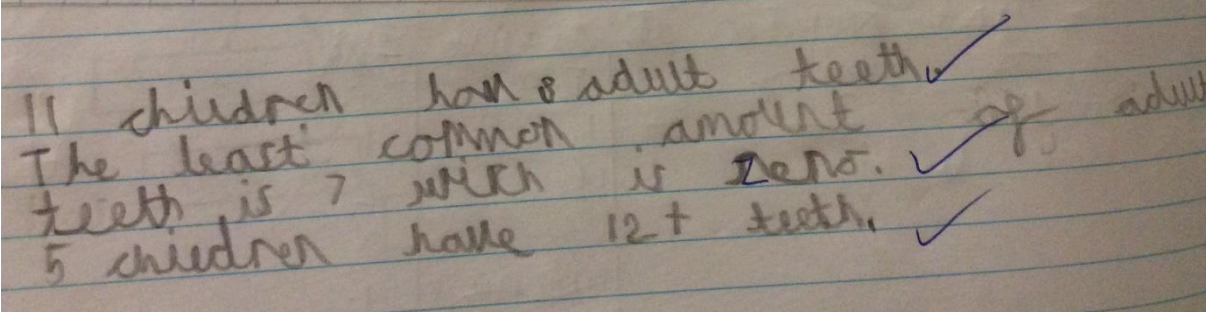
Children meeting the objective would be able to recognise the role of the muscles in movement. (This child has gone further to name the muscles involved).

Topic: Animals including humans	Year 4 Age 8-9	Title: Teeth function
Working Scientifically	Science content Y4 NC: identify the different types of teeth in humans and their simple functions (Later KS2 TAF: name and describe the functions of the main parts of the digestive system)	

After exploring their own teeth and models of teeth, children were asked to label a set of model teeth and explain their functions.

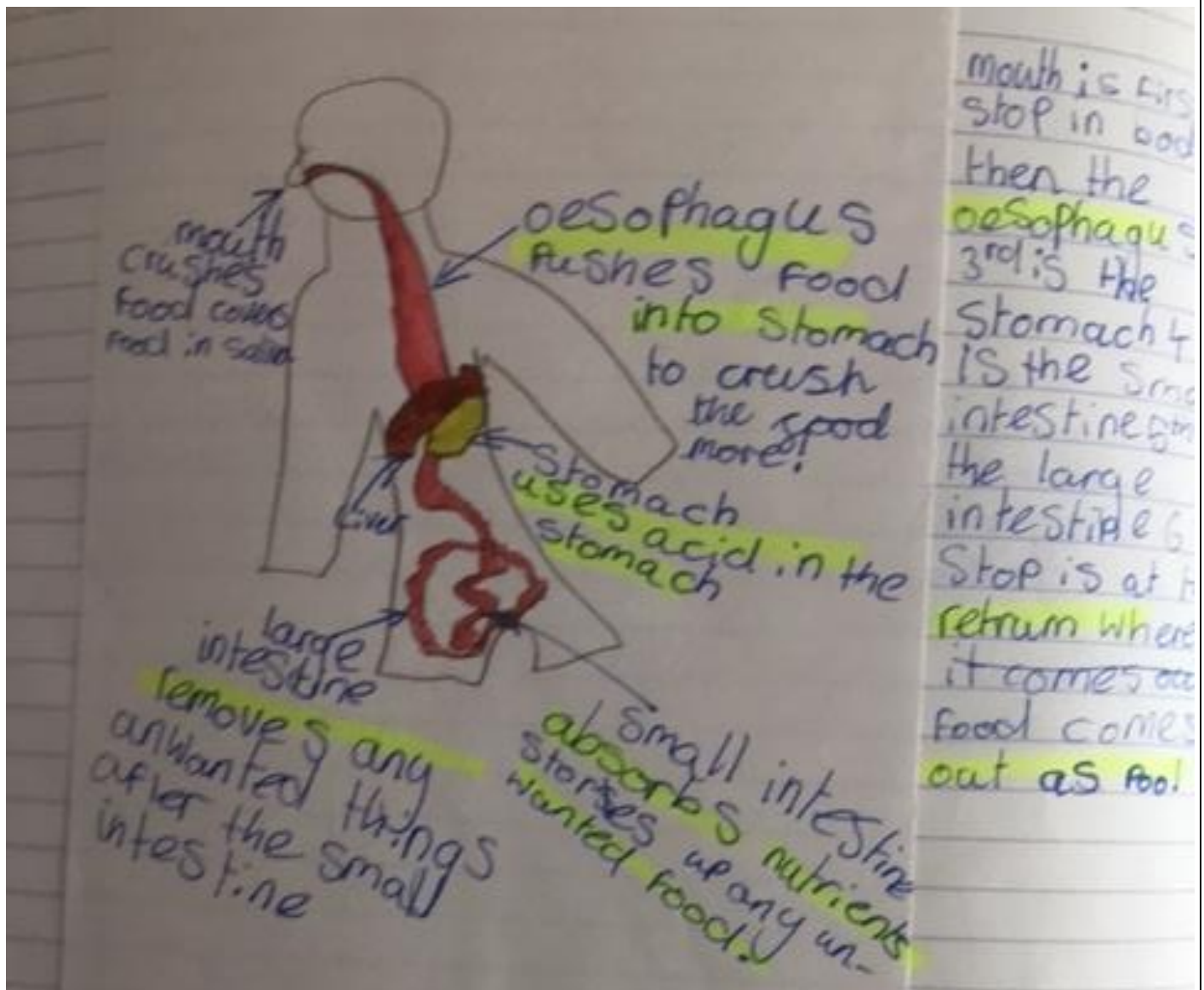


Children meeting the objective would be able to describe the function of teeth as part of the digestive system.

Topic: Animals including humans	Year 4 Age 8-9	Title: Teeth survey
Working Scientifically Do: record data and results using tables and bar graphs (noticing patterns)		Science content (In context of Y4 NC: identify the different types of teeth in humans and their simple functions)
		<p>Children collected and recorded data to find out about the number of adult teeth in their year group.</p> <p>Children meeting the Working Scientifically objective would be able to record their data clearly. This could be in a tally chart and/or a bar graph, depending on their experience in maths (e.g. this bar chart was part of a maths lesson, using the science data).</p>
		

Topic: Animals including humans	Year 4 Age 8-9	Title: Digestive system description
Working Scientifically	Science content name and describe the functions of the main parts of the digestive system	

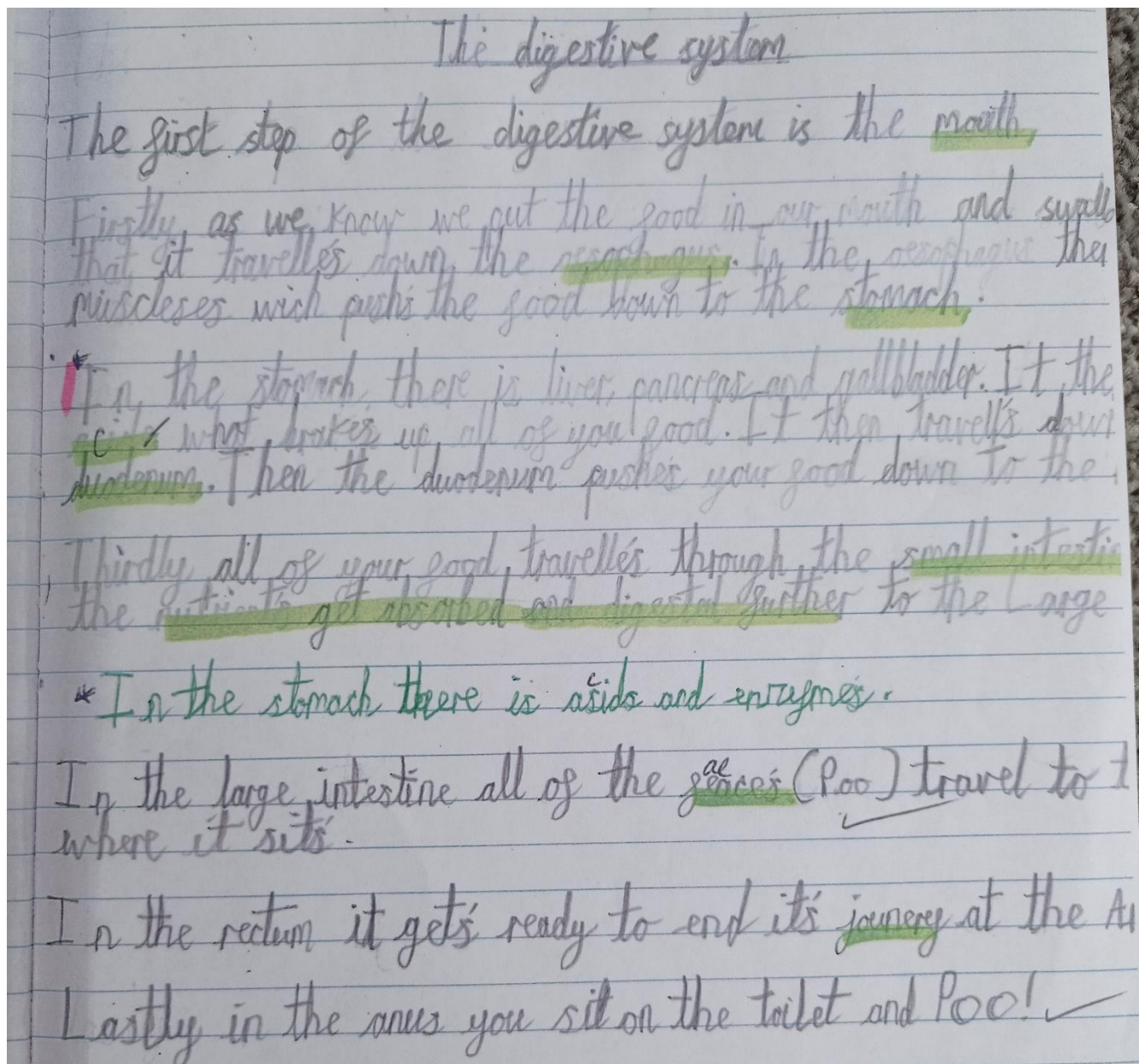
After researching and modelling the digestive system in science, the children were asked to draw and write about where food goes once it has been eaten.



Children meeting the science content objective would be able to describe what happens to food in the main parts of the digestive system, for example, being broken down in the mouth and stomach, then nutrients being absorbed in the intestines.

Topic: Animals including humans	Year 4 Age 8-9	Title: Digestive system report
Working Scientifically	Science content name and describe the functions of the main parts of the digestive system	


After researching and modelling the digestive system in science, the children were asked to utilise this information in **Literacy lessons** to write about where food goes once it has been eaten. Key words for parts of the digestive system were provided on the board.




Children meeting the science content objective would be able to describe what happens to food in the main parts of the digestive system, for example, being broken down in the mouth and stomach, then nutrients being absorbed in the intestines. If linked with Literacy, this could be in writing, but if just in science then a labelled diagram might be more appropriate.

Topic: Animals including humans	Year 5 Age 9-10	Title: Human development
Working Scientifically Review: describe their own scientific ideas using evidence from a range of sources (research)		Science content Y5 NC: describe the changes as humans develop to old age

Children were asked to describe their observations and ideas to compare stages of human life. Some compared a range of stages more briefly (e.g. baby, child, young adult, older adult), whilst others compared a couple of stages in more depth, as in this example.



This baby cannot do anything itself, not even support its own head and feed itself. The clothes it wears are a sure sign of youth, and certainly not chosen by the baby for it to wear. Babies don't have any teeth and annoyingly, only communicate by crying, screaming, strange gurgling noises and goo-goo and gag-gaas, showing severe lack of cognitive ability.



This toddler can walk, albeit, not very well and is holding a bag of raisins. Meaning he can pick up and hold light objects and feed himself. The clothes, despite the tractors imprinted on them, are more like smaller versions of clothes adults and older children wear. He doesn't pick them to wear though. He has grown baby teeth and can now talk, showing increases of intellect.

Children meeting the objective would be able to describe differences between stages in the human life cycle. (The vocabulary used in this example goes beyond KS2 expectations).

Topic: Animals including humans	Year 5 Age 9-10	Title: Growth investigation
Working Scientifically Do: use scientific equipment to take accurate and precise measurements and record results using scientific tables (pattern seeking)		Science content (In the context of Y5 NC: describe the changes as humans develop to old age).

Children in this group recorded data for a growth investigation into whether there is a pattern between height and number of adult teeth. Other groups investigated different potential patterns e.g. height and forearm length.

LO: To investigate ~~patterns~~ what affects adult ~~teeth~~ growth

Does height affect number of adult teeth?

Name	Height	Number of adult teeth
[REDACTED]	125 CM	8
[REDACTED]	128 CM	8
[REDACTED]	130 CM	5
[REDACTED]	140 CM	8
[REDACTED]	142 CM	12
[REDACTED]	142 CM	9
[REDACTED]	144 CM	8
[REDACTED]	145 CM	11
[REDACTED]	145 CM	15
[REDACTED]	146 CM	9
[REDACTED]	146 CM	8
[REDACTED]	148 CM	14
[REDACTED]	149 CM	16
[REDACTED]	149 CM	8

Height has no affect on the number of adult teeth

Children meeting the Working Scientifically objective would be able to take measurements of height with a reasonable degree of accuracy and record results clearly enough for others to be able to read their data.

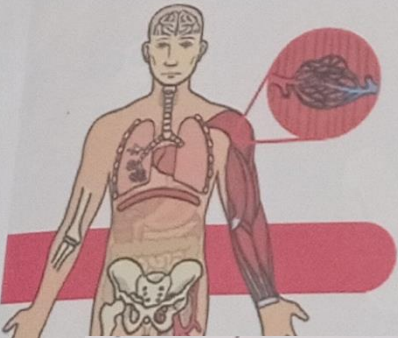
Topic: Animals including humans	Year 6 Age 10-11	Title: Blood purpose
Working Scientifically Review: explain and communicate findings (research)		Science content name and describe the functions of the main parts of the circulatory system

Children were asked to present their research on purpose of blood:

Child A

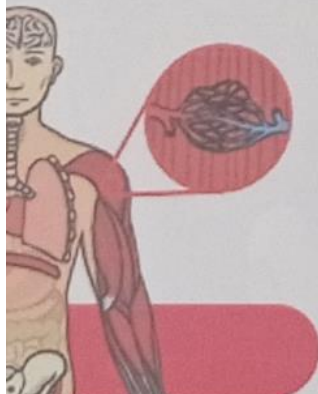
What is blood for?

Thanks to all the components of blood (plasma, red blood cells, white blood cells, and platelets) and their functions, we know that blood:



Blood travels all around the body and carries different things, such as oxygen, nutrients, red blood cells, white blood cells, capillaries and much more to the places where they are needed. Blood help you to stay healthy and alive.

Child B



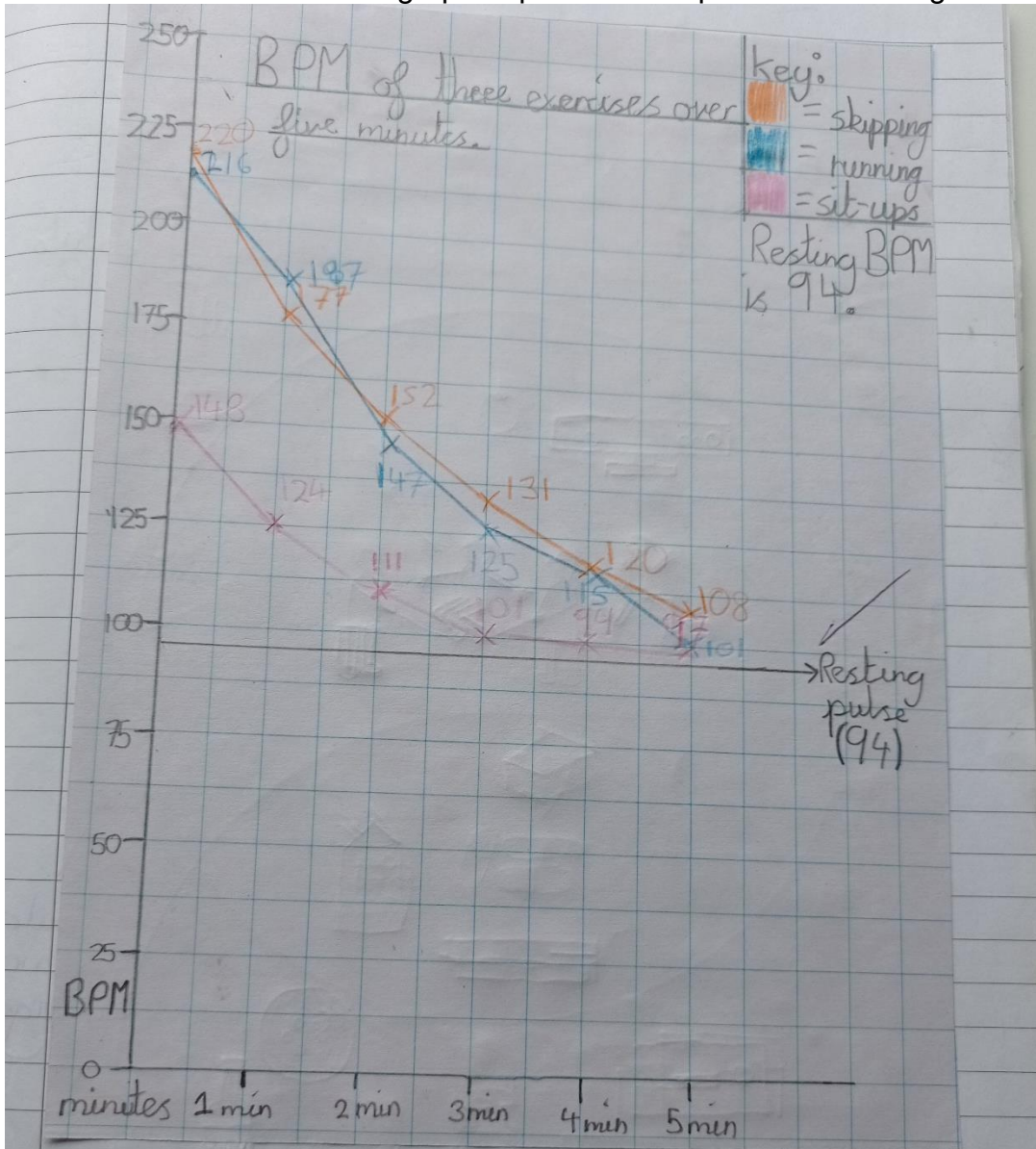
- Blood carries oxygen and Nutrients around the body.
- Blood is carried by veins and looks blue because of light.
- Blood stops infections.

We know that blood is made of 2 parts - liquid and solid. Platelets stop your blood from bleeding. Red blood cells contain oxygen and white blood cells fight bacteria.

Child C

Children meeting the objective would be able to describe functions of the blood (one part of the circulatory system, another lesson might consider the heart etc).

Topic: Animals including humans	Year 6 Age 10-11	Title: Pulse rate graph
Working Scientifically Review: record results using line graphs and draw conclusions (pattern seeking)		Science content describe the effects of exercise
Children were asked to draw a line graph to present their pulse rate investigation results:		



Conclusion:

In conclusion, I found out that the skipping was my highest BPM-raising exercise. My lowest BPM-raising exercise is the sit-ups.

Children meeting the Working Scientifically objective would be able to present results clearly enough for others to be able to interpret their data.

Topic: Animals including humans	Year 6 Age 10-11	Title: Pulse rate conclusions
Working Scientifically Review: draw conclusions (pattern seeking)		Science content describe the effects of exercise

Children were asked to investigate the effect on pulse rate of their own choice of stationary exercises (e.g. headstands, plank, yoga poses etc).

Prediction

I predict that your heart rate will go up. I think this because if you do a headstand all the blood will rush to your head and your heart will have to work extra hard to get blood to your feet.

Pulse rate (10 seconds x 6)	both arms up 1 min	one leg balance 1 min	downward dog 1 min	plank 1 min	bridge 1 min
Resting	66 bpm	66 bpm	66 bpm	66 bpm	66 bpm
After exercise	60 bpm	60 bpm	78 bpm	66 bpm	84 bpm

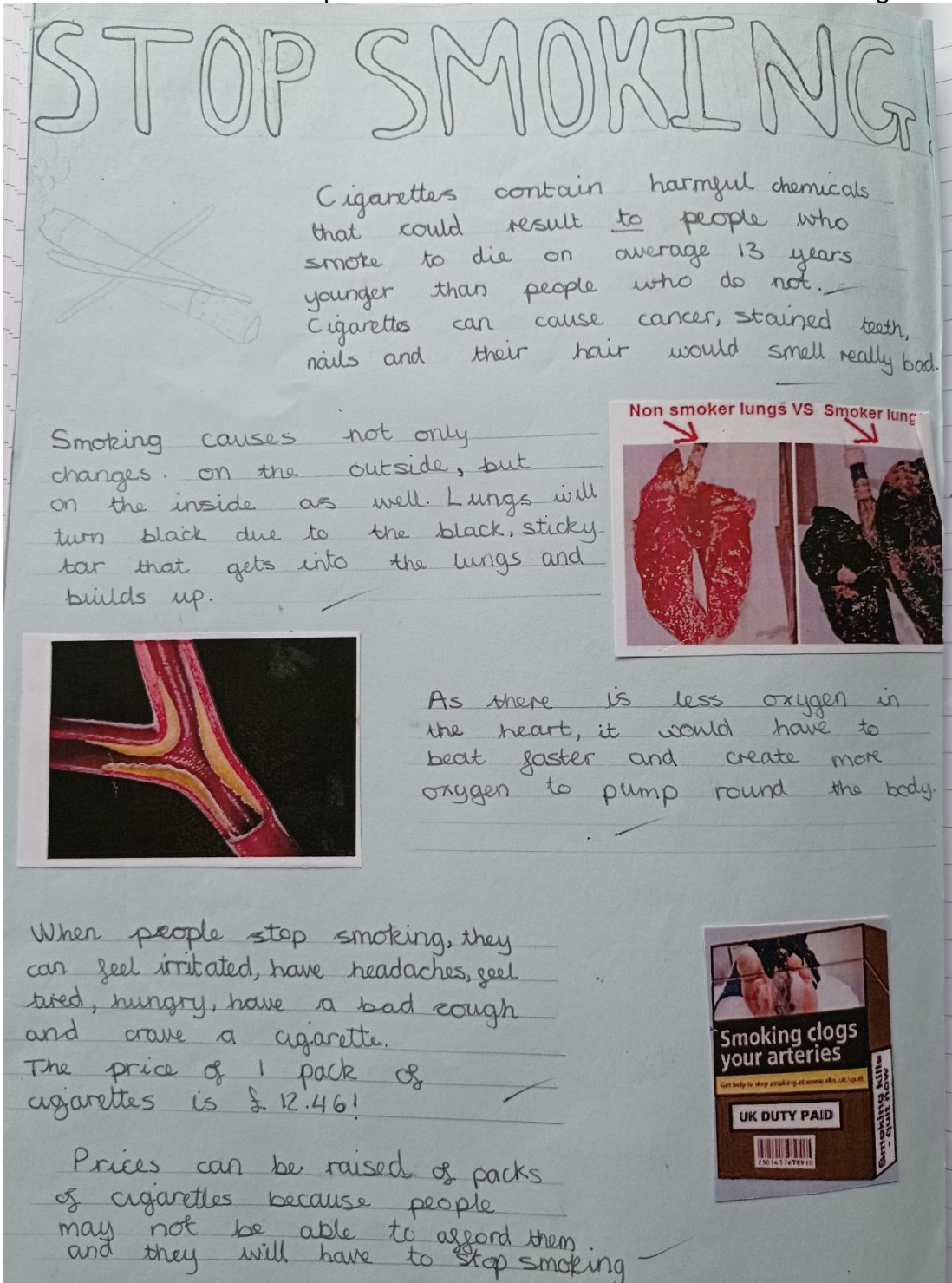
Largest difference - 18 bpm Smallest difference - 6 bpm

In conclusion, I've learned that your heart rate will go up if you are doing a harder yoga pose, but if you are doing an easier one like a one leg balance, it will stay the same or go down.

Children meeting the Working Scientifically objective would be able to use their results to draw conclusions about the effect of different yoga poses on their pulse rate. A next step for this child could be to explain what they think makes the exercise/yoga pose harder or easier for the body.

Topic: Animals including humans	Year 6 Age 10-11	Title: Smoking poster
Working Scientifically Review: explain and communicate findings (research)		Science content describe the effects of drugs and lifestyle on how the body functions

Children were asked to create a poster of their research into the effects of drugs:



Children meeting the objective would be able to include descriptions of effects on the body.

Key Stage 2: Living things, including Plants

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 3: Plants

Pupils should be taught to:

- identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers
- explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant
- investigate the way in which water is transported within plants
- explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.

NC Year 4: Living things and their habitats

- recognise that living things can be grouped in a variety of ways
- explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment
- recognise that environments can change & that this can sometimes pose dangers to living things.

NC Year 5: Living things and their habitats

- describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird
- describe the life process of reproduction in some plants and animals.

NC Year 6: Living things and their habitats

- describe how living things are classified into broad groups according to common observable characteristics & based on similarities & differences, including micro-organisms, plants & animals
- give reasons for classifying plants and animals based on specific characteristics.

KS2 TAF expected standard: Science content for Living Things and Plants

The pupil can:

- name, locate and describe the functions of the main parts of plants, including those involved in reproduction [year 5] and transporting water and nutrients [year 3]
- use the observable features of plants, animals and micro-organisms to group, classify and identify them into broad groups, using keys or other methods [year 6]
- construct and interpret food chains [year 4]
- describe the requirements of plants for life and growth [year 3]; and explain how environmental changes may have an impact on living things [year 4]

KS2 TAF expected standard: Working scientifically*

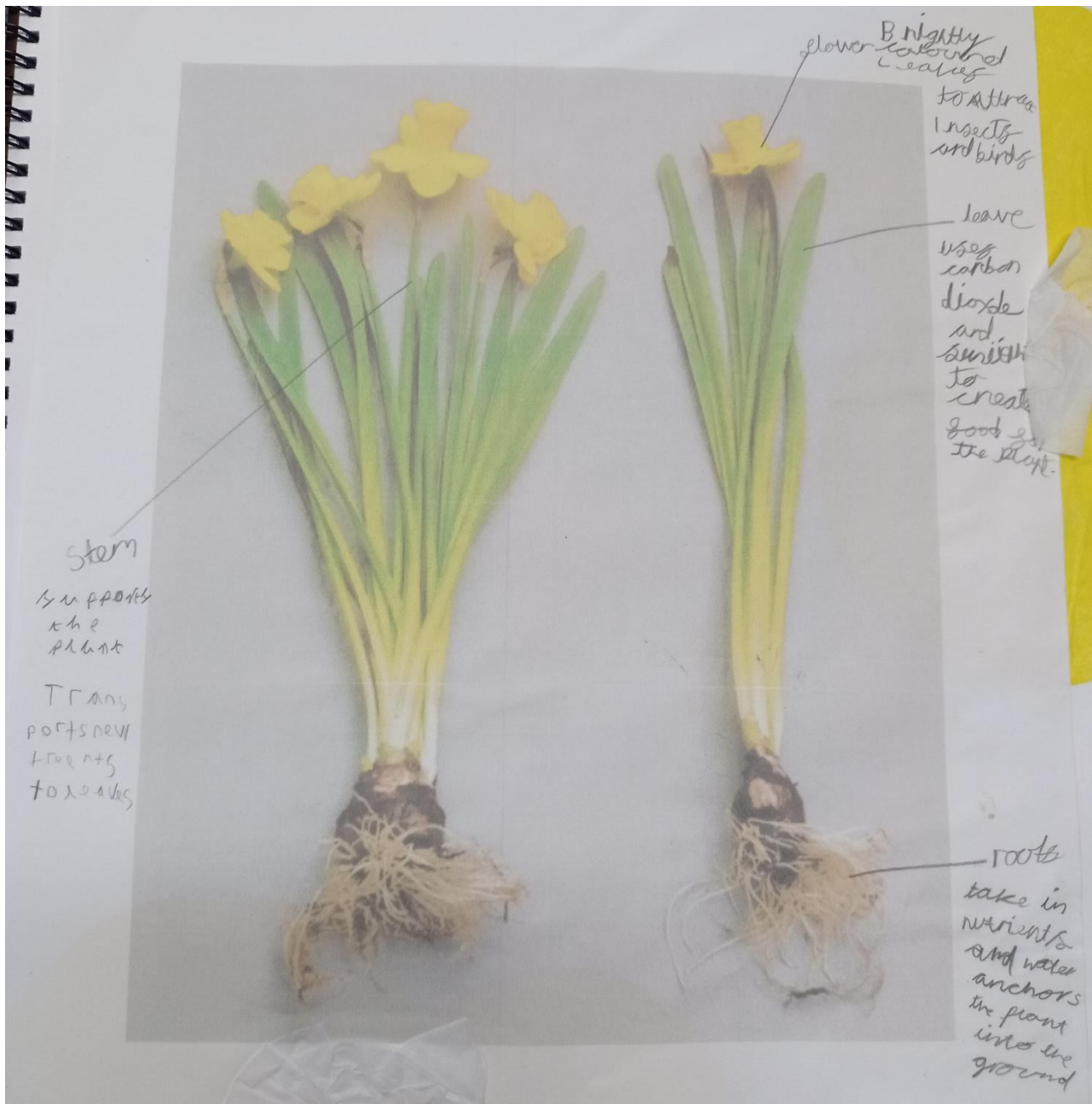
The pupil can, using appropriate scientific language from the national curriculum:

- **describe and evaluate their own and others' scientific ideas** related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own questions about the scientific phenomena that they are studying, and **select the most appropriate ways to answer these questions**, recognising and controlling variables where necessary (i.e. **observing changes over different periods of time**, noticing patterns, **grouping and classifying things**, carrying out comparative and fair tests, and **finding things out using a wide range of secondary sources**)
- use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate
- **record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs**
- draw conclusions, explain and evaluate their methods and findings, **communicating these in a variety of ways**
- raise further questions that could be investigated, based on their data and observations.

**Statements exemplified in this topic are in bold.*

Topic: Plants	Year 3 Age 7-8	Title: Plant parts
Working Scientifically describe and evaluate their own and others' scientific ideas		Science content name, locate and describe the functions of the main parts of plants, including those involved in transporting water and nutrients

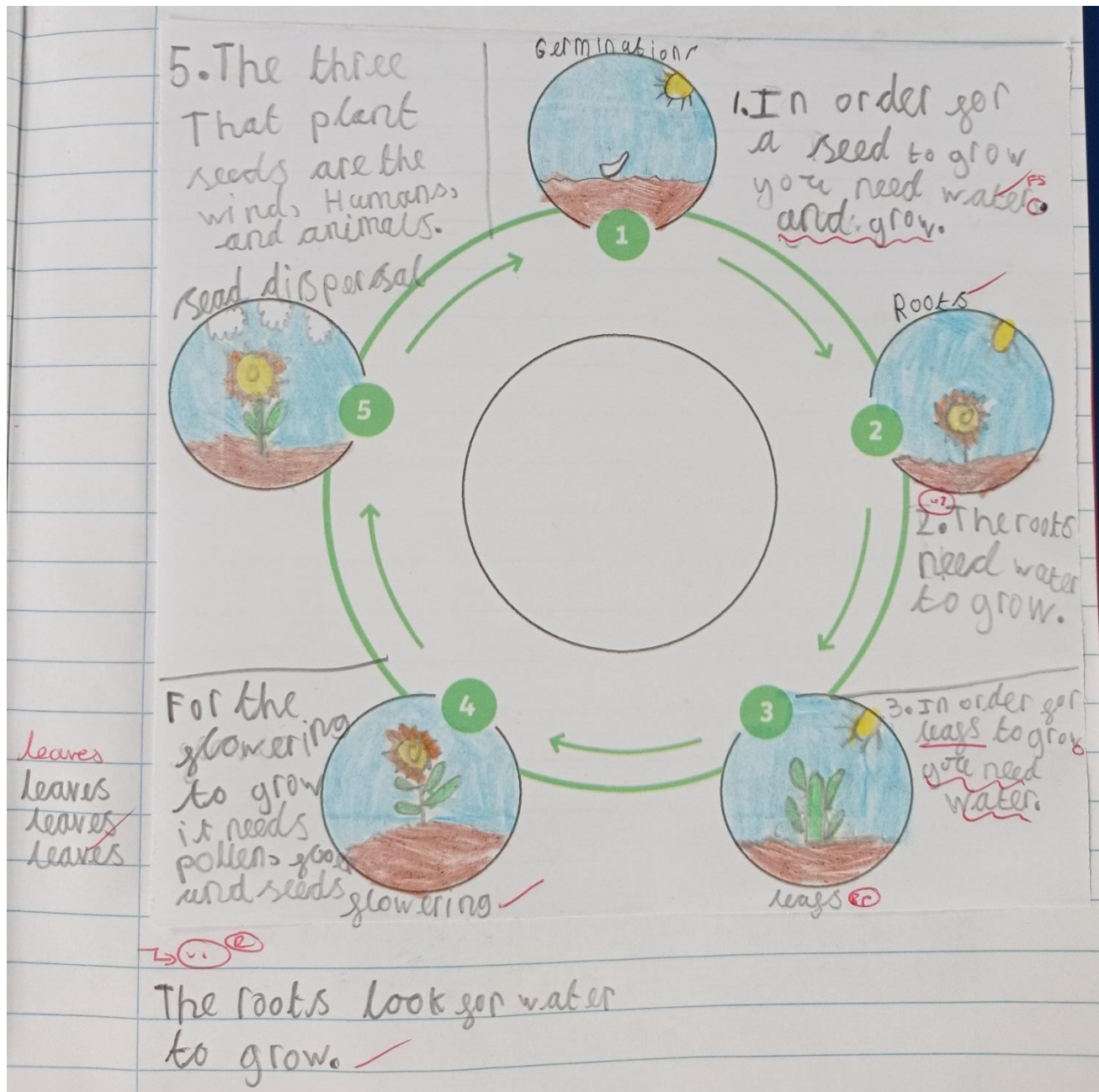
Children explored potted plants and outdoor plants, reviewing the names and functions of key parts such as stem, roots, leaves and flower.



Children meeting the content objective would be able to name plant parts and describe their function. (NB. This child needs to check flower vocab – petals).

Topic: Plants	Year 3 Age 7-8	Title: Flowering plant life cycle
Working Scientifically	Science content Y3 NC: explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. (KS2 TAF: describe the requirements of plants for life and growth).	

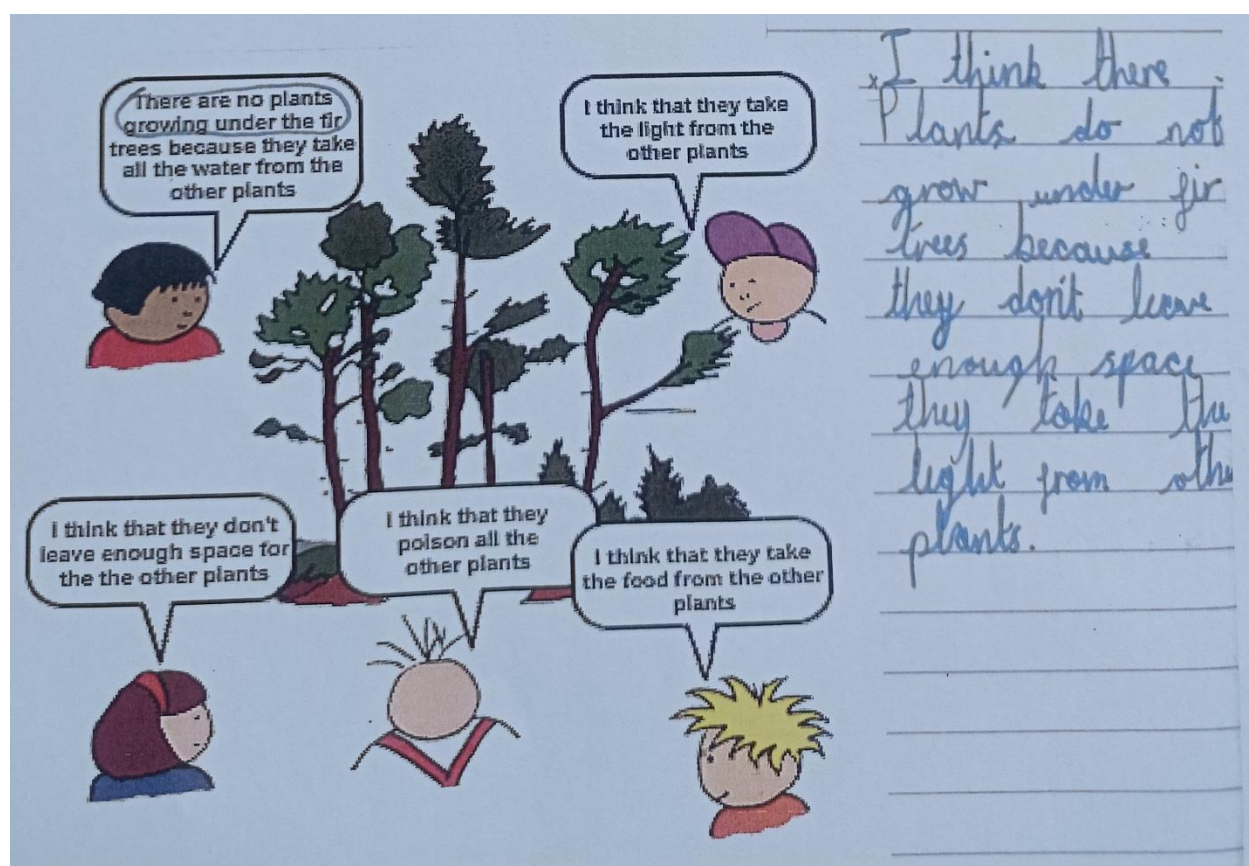
At the end of their work on plants, children were asked to draw and/or write about the life cycle of a flowering plant. They were encouraged to label to show what they had learnt about plants.



Children meeting the Y3 NC objective would be able to note key stages in the life cycle. This child has also noted the importance of water for growth.

Topic: Plants	Year 3 Age 7-8	Title: Requirements for life discussion
Working Scientifically	Science content describe the requirements of plants for life and growth.	

After observing and investigating plant growth, including noting how there was no grass under the school conifer, the class discussed a Concept Cartoon*. This cartoon asked children to consider why the fir trees do not have other plants growing on the ground nearby. After paired and class discussion, children briefly recorded their ideas.

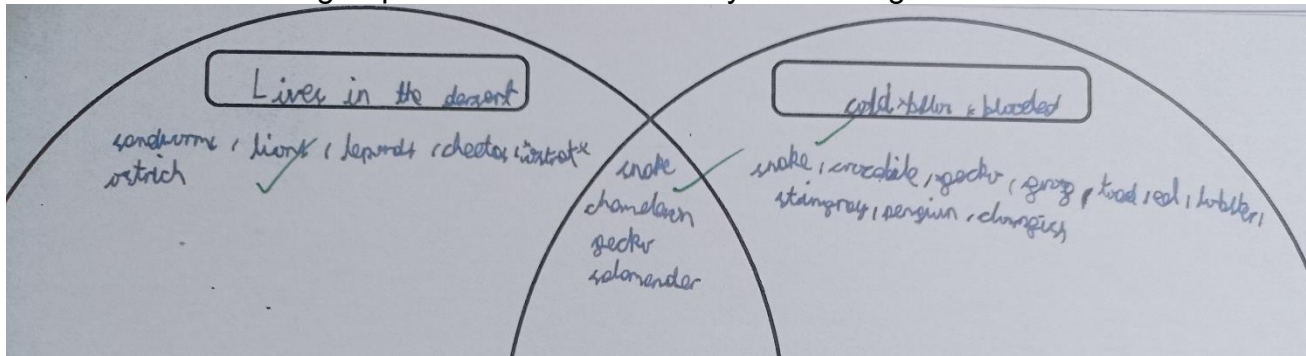


Children meeting the objective would be able to link their explanations to plant requirements for life, e.g. stops light reaching the new plants on the ground, space for roots to be able to spread out to hold the plant up, the roots can't get enough water because the fir trees take in too much, there's no space to grow roots, the fir trees are too thick so don't let the light through, etc.)

(*Concept Cartoon - original concept from Naylor and Keogh, Millgate House Publishers)

Topic: Living things	Year 4 Age 8-9	Title: Grouping animals
Working Scientifically (grouping and classifying)	Science content use the observable features of animals to group, classify and identify them into broad groups	

Children were asked to group animals in different ways according to their features.




Vertebrates

Vertebrates have a spine ✓

Fish are vertebrates.
Mammals are vertebrates.

Some vertebrates have an endoskeleton.




They are also mostly mammals and amphibians ✓

Such as: horses, goats, cows, sheep, pigs, fish and a snake.

Invertebrates

Invertebrates do not have a spine. ✓

Some invertebrates have an exoskeleton and some have ✓



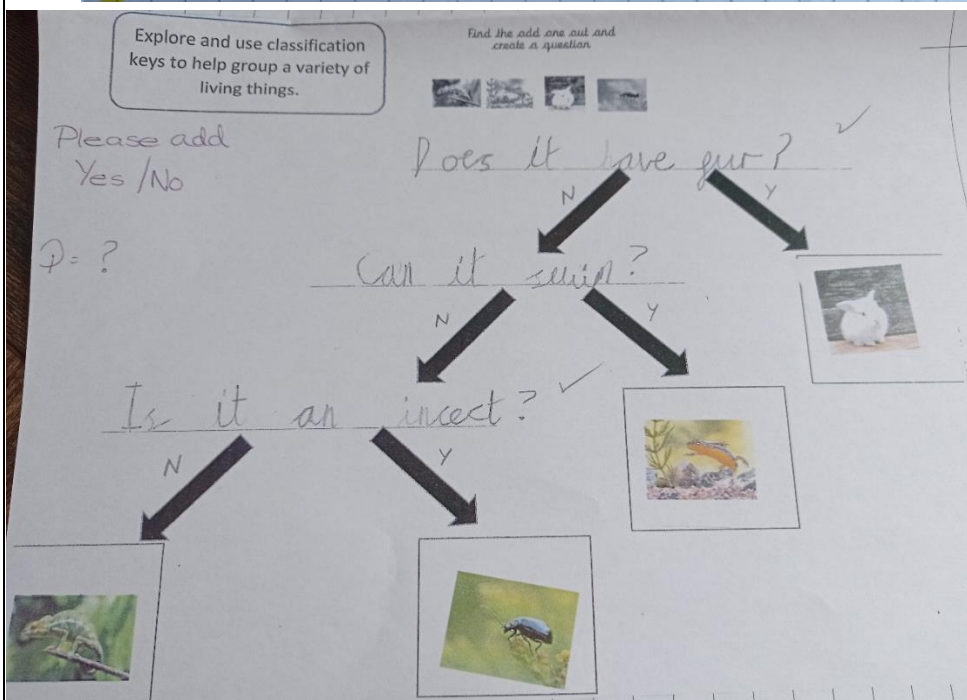
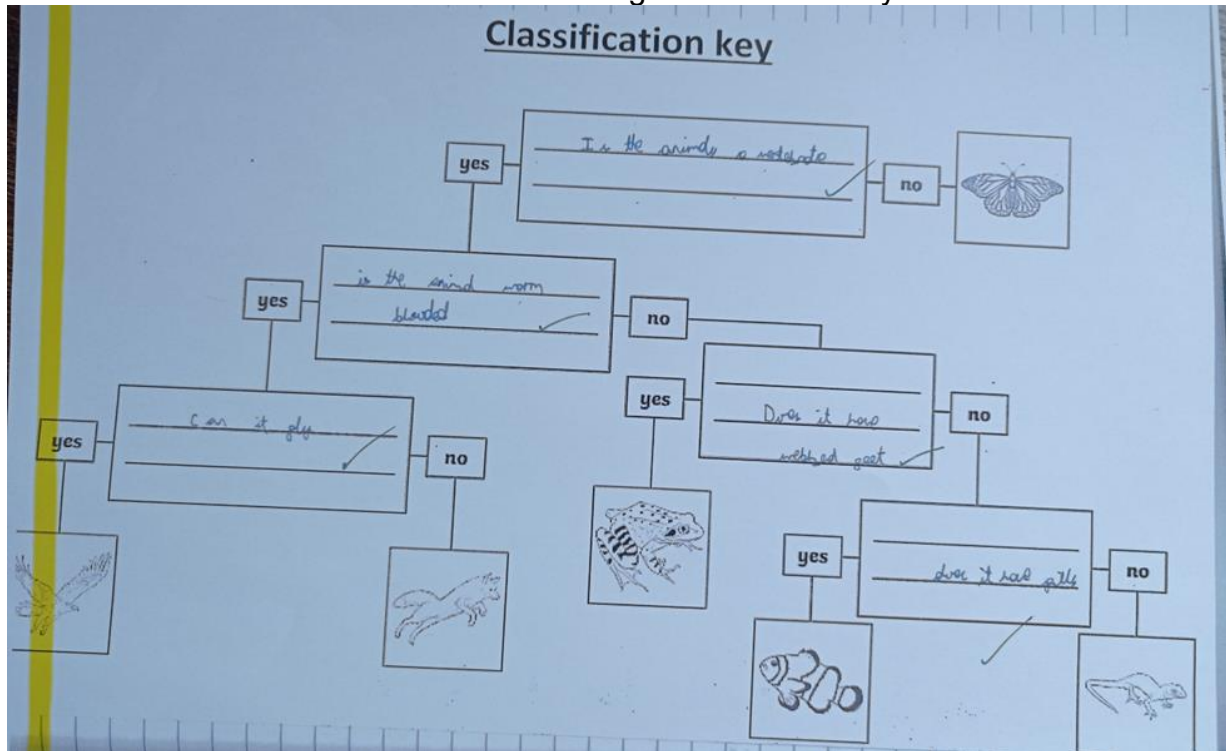
Sometimes they have shells to protect them.

Mostly all the invertebrates

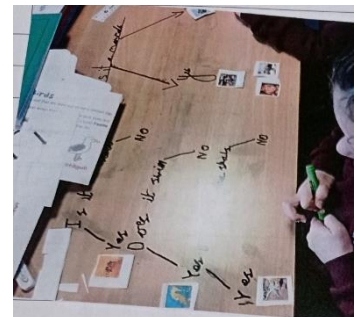
Children meeting the objective (at Y4) would be able to describe some features of broad groups like vertebrates/invertebrates.

Topic: Living things	Year 4 Age 8-9	Title: Making an animal classification key
Working Scientifically Do: record data using classification keys (gp&classify)	Science content Y4 NC: explore and use classification keys to help name a variety of living things in their local and wider environment	

Children were asked to make their own branching classification keys with 4-6 animals.



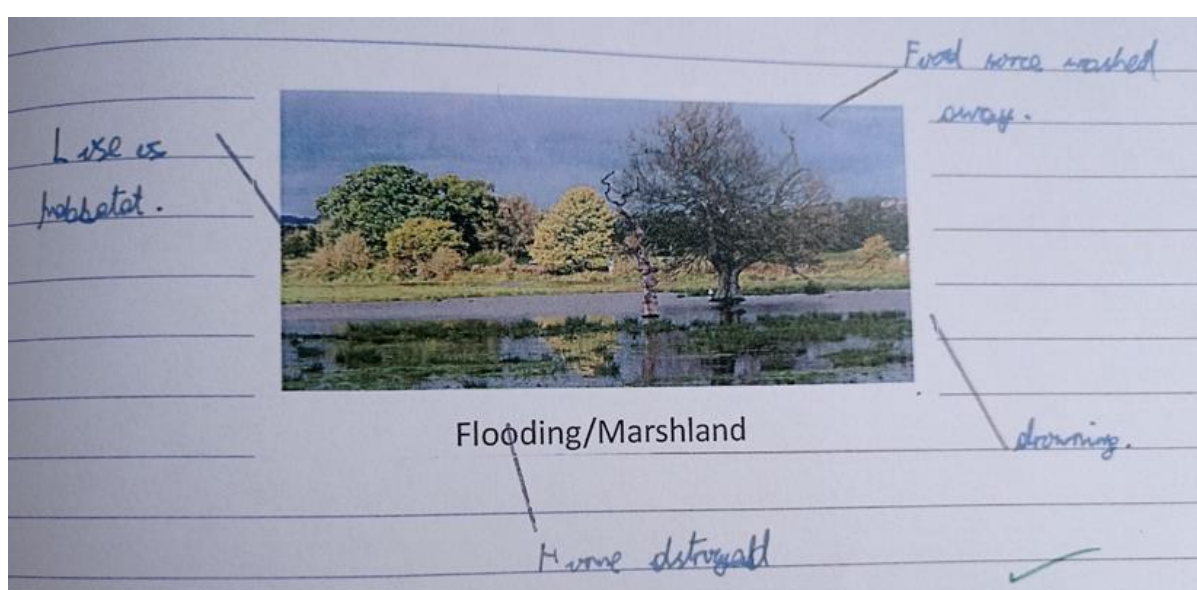
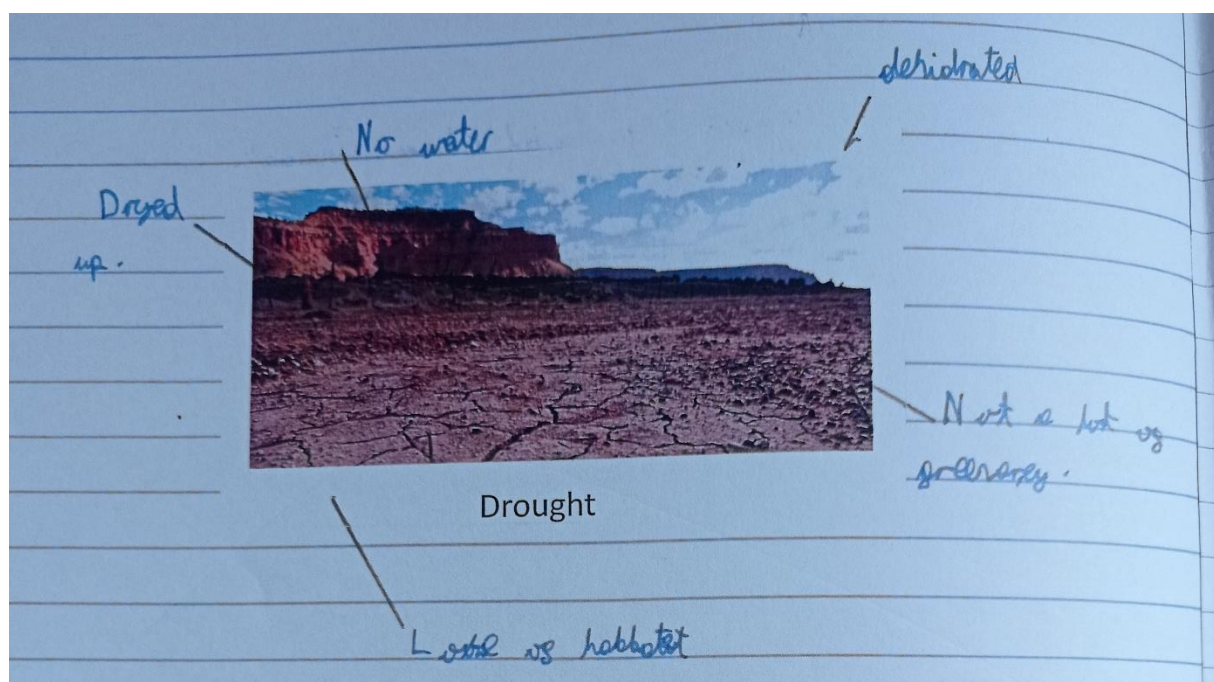
Different schools provided different scaffolds (structure and/or animal photos) to help.



Children meeting the Y4 objective would be able to use the scaffolds to make their own yes/no questions for a classification key that others could use.

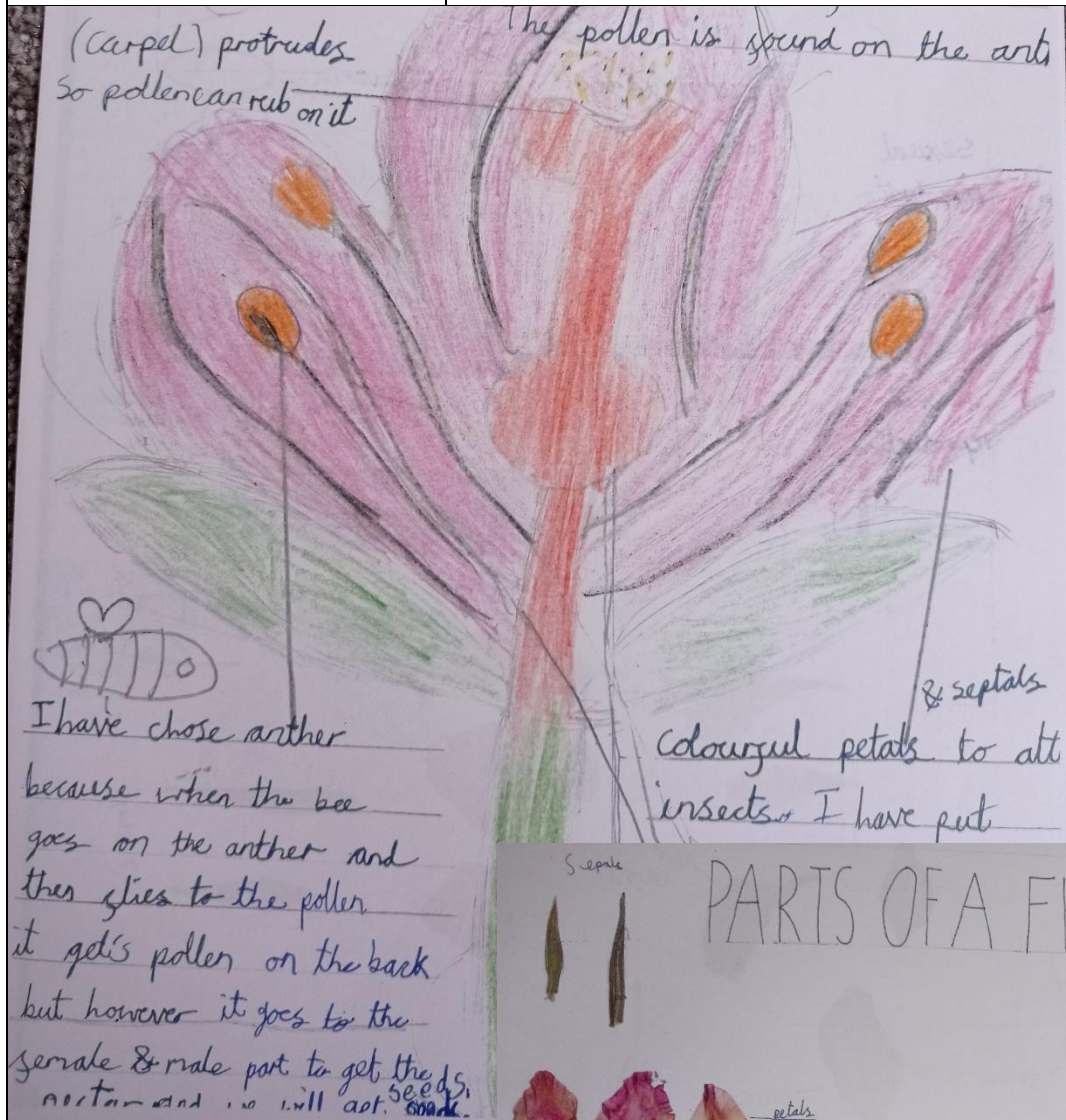
Topic: Living things	Year 4 Age 8-9	Title: Environmental changes
Working Scientifically describe and evaluate their own and others' scientific ideas	Science content explain how environmental changes may have an impact on living things	

Children were asked to consider the impact of environmental events such as droughts, floods, bushfires, deforestation and pollution.



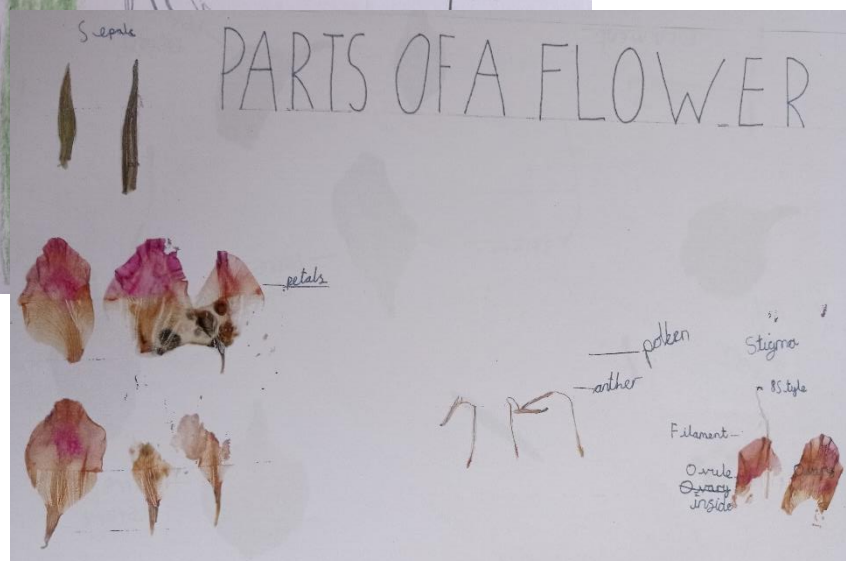
Children meeting the objective would be able to consider the impact on habitats and living things.

Topic: Living things	Year 5 Age 9-10	Title: Parts of a flower
Working Scientifically (close observation)	Science content name, locate and describe the functions of the main parts of plants, including those involved in reproduction	



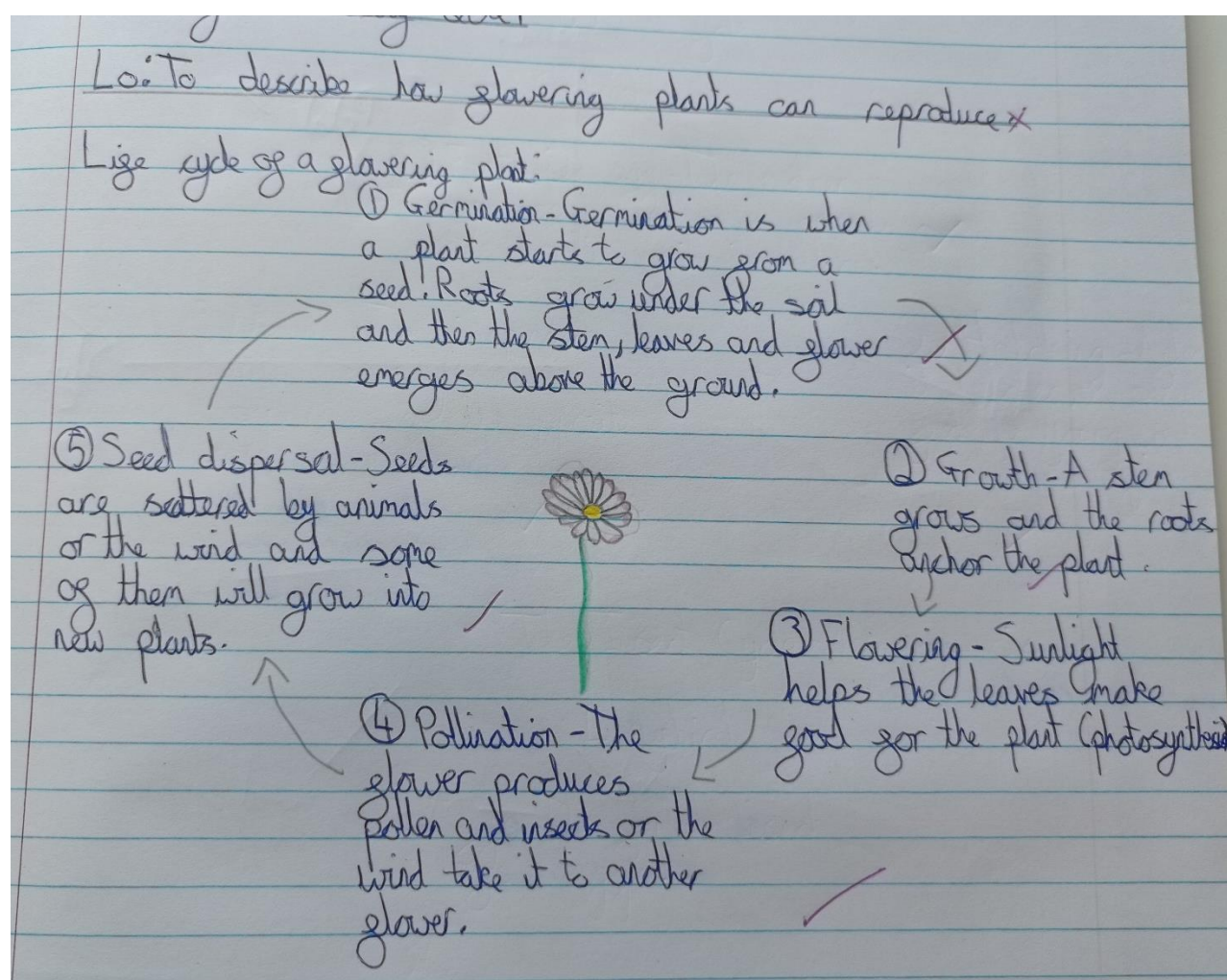
Children explored real flowers, naming the parts and identifying the male and female parts. They then drew their own flower and explained how the parts helped it to reproduce.

Children meeting the objective would be able to describe the function for parts of the flower, e.g. why the petals might be brightly coloured or the anther/stigma might protrude.



Topic: Living things	Year 5 Age 9-10	Title: Plant life cycle
Working Scientifically	Science content NC: describe the life process of reproduction in some plants TAF: describe the functions of the main parts of plants, including those involved in reproduction	

Children were asked to review their knowledge of plants by describing the main stages of reproduction in the life cycle of a flowering plant.



Children meeting the objective would be able to describe the main reproductive stages in the plant's life cycle.

Topic: Living things	Year 5 Age 9-10	Title: Animal life cycles
Working Scientifically Review: describe their own scientific ideas using evidence from a range of sources (research)		Science content describe and compare different reproductive processes and life cycles in animals

The Insect Cycle - No metamorphosis
Bee

1) Reproduction - The female lays eggs. Eggs can be laid in water sometimes.

2) Egg hatches - The egg hatches into a nymph. It looks like a small adult.

3) The nymph grows into an adult. It can sometimes shed skin. The female will then lay eggs.

The Amphibian Cycle
Toad

1) Fertilised egg - The female lays eggs. These are fertilised by the male.

2) Hatching - The tadpole hatches after 2-25 days.

3) Learns to swim - It breathes through gills, swims and eats plants.

4) Body begins to develop - The tadpole grows gills, a stronger tail, lungs and hind legs.

5) Explores life on land - It grows front legs and a shorter tail. It goes on to land.

6) Adult - The tail disappears and it takes 2-4 years to grow and lay eggs.

Children were asked to research and describe the life cycles of two different kinds of animal (e.g. mammal, amphibian, insect or bird).

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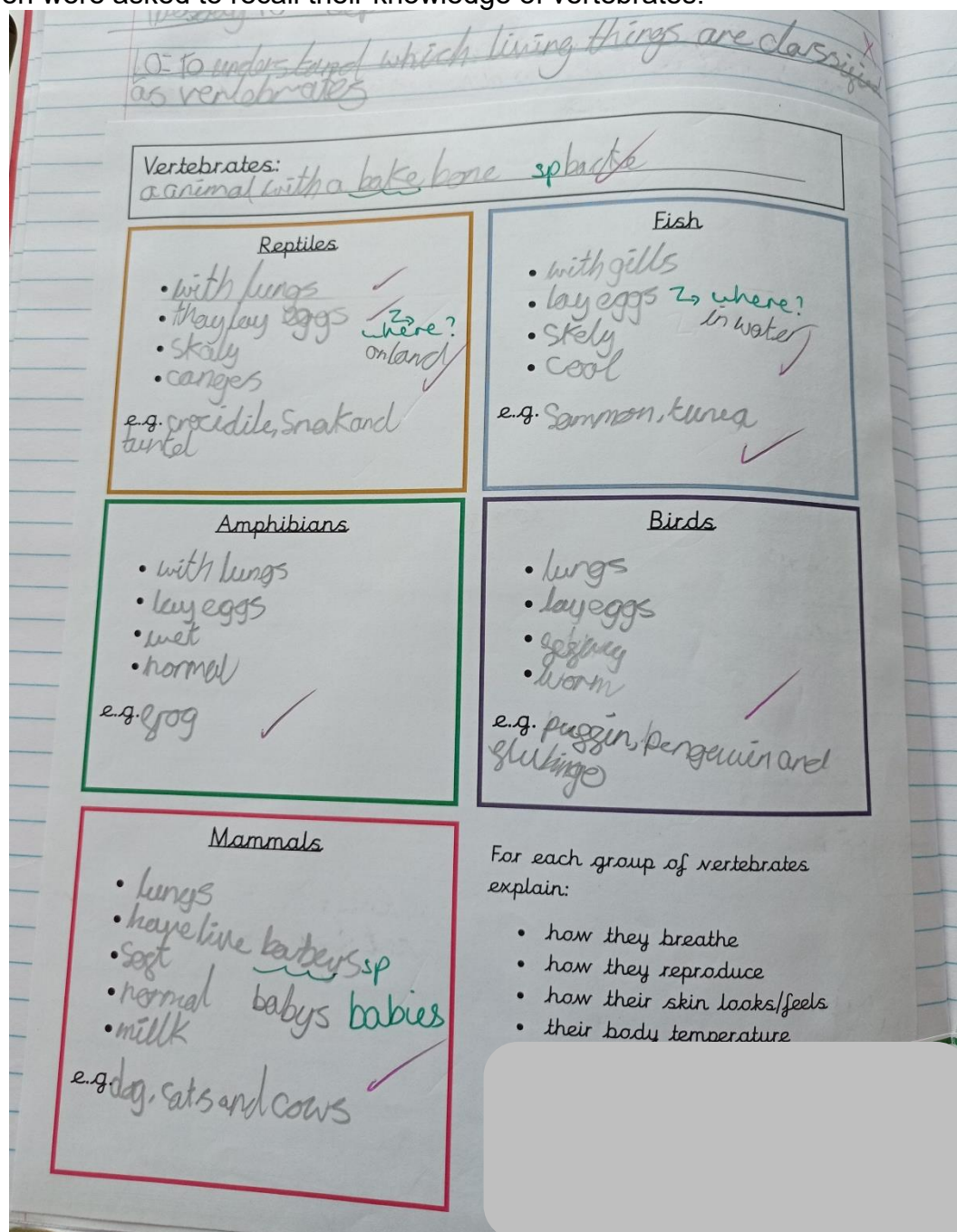
Children were asked to research and describe the life cycles of two different kinds of animal (e.g. mammal, amphibian, insect or bird).

Children meeting the objective would be able to describe and compare stages in the life cycle of different animals.

Next, this child could be asked to state how the life cycles are different.

Topic: Living things	Year 6 Age 10-11	Title: Vertebrate groups
Working Scientifically		Science content use the observable features of animals to group, classify and identify them into broad groups

Children were asked to recall their knowledge of vertebrates:



Children meeting the objective would be able to list some features and examples of each vertebrate group.

Topic: Living things	Year 6 Age 10-11	Title: Invertebrate research
Working Scientifically explain their findings, communicating these in a variety of ways (research)		Science content use the observable features of animals to identify them

Children were asked to present their research on invertebrates:



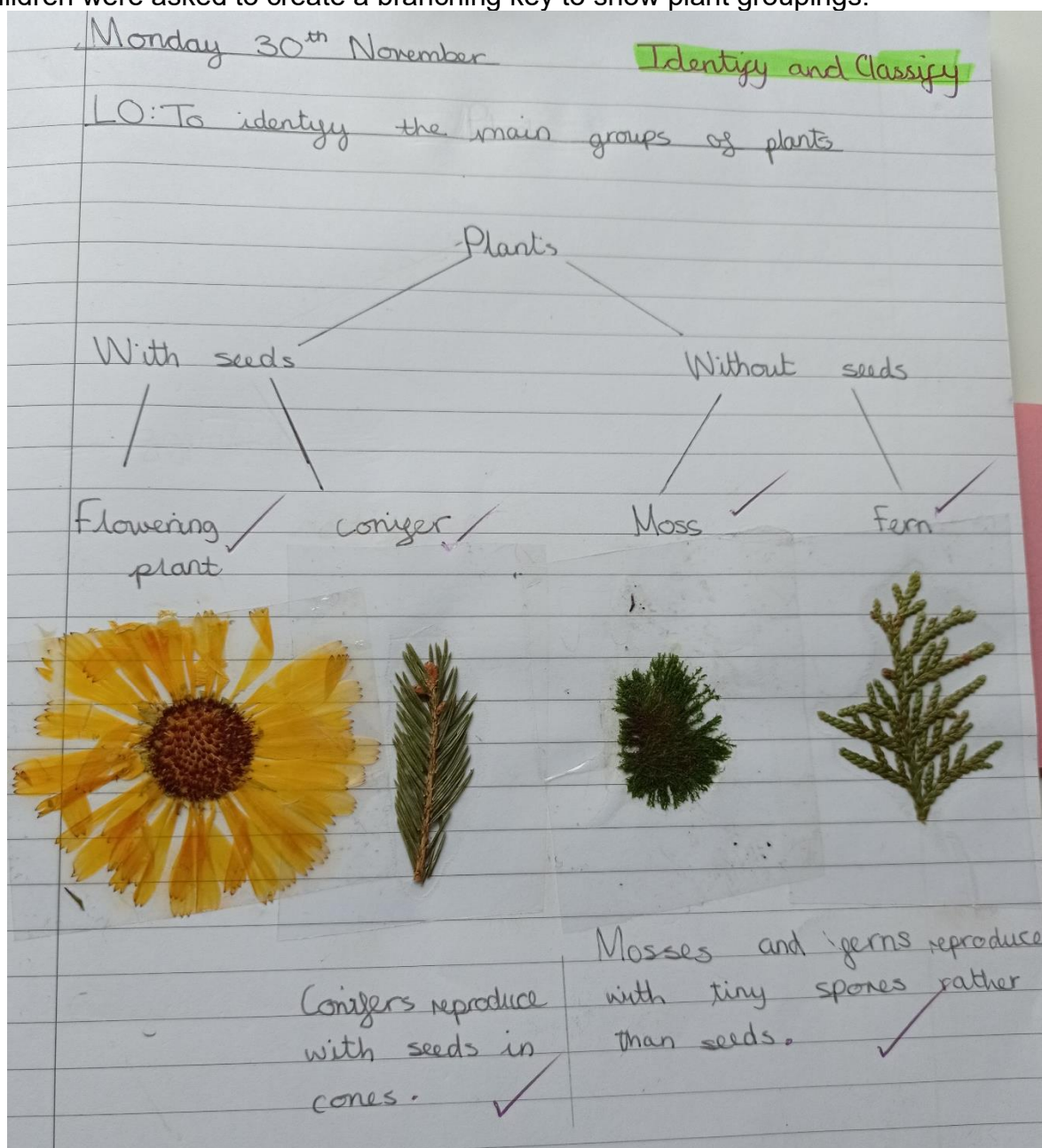
Children meeting the objective would be able to identify distinguishing features of their chosen animal.

Topic: Living things	Year 6 Age 10-11	Title: Animal classification key
Working Scientifically Do: record data using classification keys (group and classify)		Science content use the observable features of animals to group, classify and identify them into broad groups, using keys or other methods
<p>Children were asked to create a classification key to use observable features to distinguish some common animals:</p> <div data-bbox="102 685 1321 1447" data-label="Diagram"> <pre> graph TD Q1[Do they swim?] -- yes --> Q2[Do they have gills?] Q1 -- no --> Q3[Do they have fur?] Q2 -- yes --> A1[sh] Q2 -- no --> Q4[Do they have feathers?] Q3 -- yes --> Q5[Do they have pointy ears?] Q3 -- no --> Q6[Do they have a trunk?] Q4 -- yes --> A2[Flamingo] Q4 -- no --> A3[Turtle] Q5 -- yes --> A4[Rabbit] Q5 -- no --> A5[Field mouse] Q6 -- yes --> A6[Elephant] </pre> </div> <div data-bbox="102 1447 1197 2042" data-label="Diagram"> <pre> graph TD Q1[Does it have four legs?] -- Yes --> Q2[Does it have a tail?] Q1 -- No --> Q3[Can it swim?] Q2 -- No --> A1[ant] Q2 -- Yes --> Q4[Does it eat meat?] Q3 -- No --> A2[Butterfly] Q3 -- Yes --> Q5[Can it walk on land?] Q4 -- Yes --> A3[Tiger] Q4 -- No --> A4[Rabbit] Q5 -- Yes --> A5[turtle] Q5 -- No --> A6[fish] </pre> </div>		

Children meeting the objective would be able to ask yes/no questions to create a branching classification key.

Topic: Living things	Year 6 Age 10-11	Title: Plant groups key
Working Scientifically Do: record data using keys (group and classify)		Science content use the observable features of plants to group, classify and identify them into broad groups, using keys or other methods

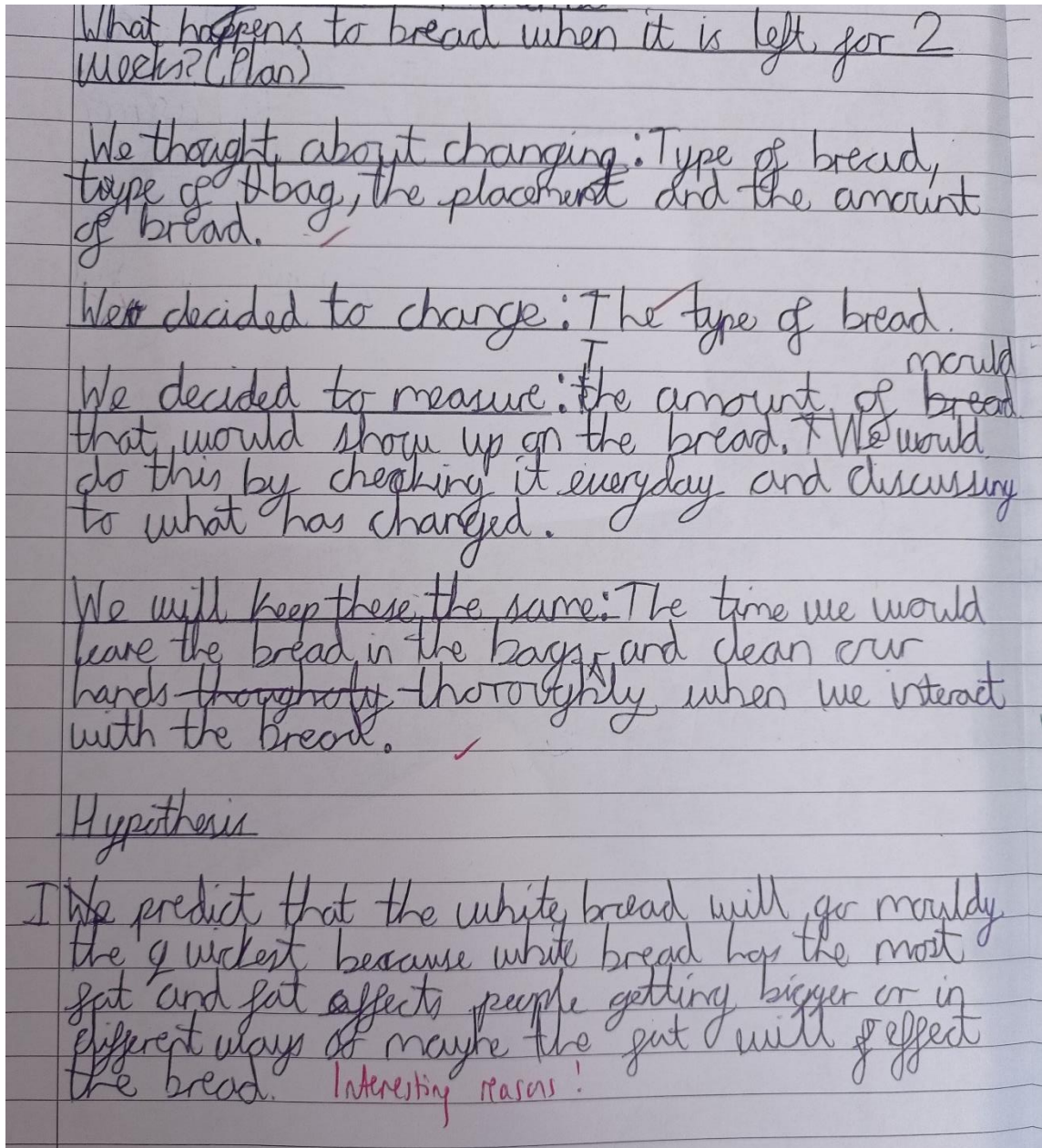
Children were asked to create a branching key to show plant groupings:



Children meeting the objective would be able to classify plants into broad groups using a key structure.

Topic: Living things	Year 6 Age 10-11	Title: Bread mould plan
Working Scientifically Plan: select the most appropriate way to answer their question (observing over time)	Science content (In the context of: use the observable features of plants, animals and micro-organisms to group, classify and identify them into broad groups).	

Children were asked to plan how to observe the growth of bread mould fungus safely (bread must be kept in sealed bags/containers to avoid the release of spores once mould is growing):



What happens to bread when it is left for 2 weeks? (Plan)

We thought about changing: Type of bread, type of bag, the placement and the amount of bread.

We decided to change: The type of bread.

We decided to measure: the amount of bread that would show up on the bread. We would do this by checking it everyday and discussing to what has changed.

We will keep these the same: The time we would leave the bread in the bags, and clean our hands thoroughly when we interact with the bread.

Hypothesis

I predict that the white bread will go mouldy the quickest because white bread has the most fat and fat affects people getting bigger or in different ways or maybe the fat will affect the bread. Interesting reasons!

Children meeting the objective would be able clearly describe what they will be observing over time and how to do this safely.

Key Stage 2: Rocks and Evolution

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 3: Rocks

Pupils should be taught to:

- compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
- describe in simple terms how fossils are formed when things that have lived are trapped in rock
- recognise that soils are made from rocks and organic matter.

NC Year 6: Evolution and inheritance

- recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago
- recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents
- identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution.

KS2 TAF expected standard: Science content for Rocks and Evolution

The pupil can:




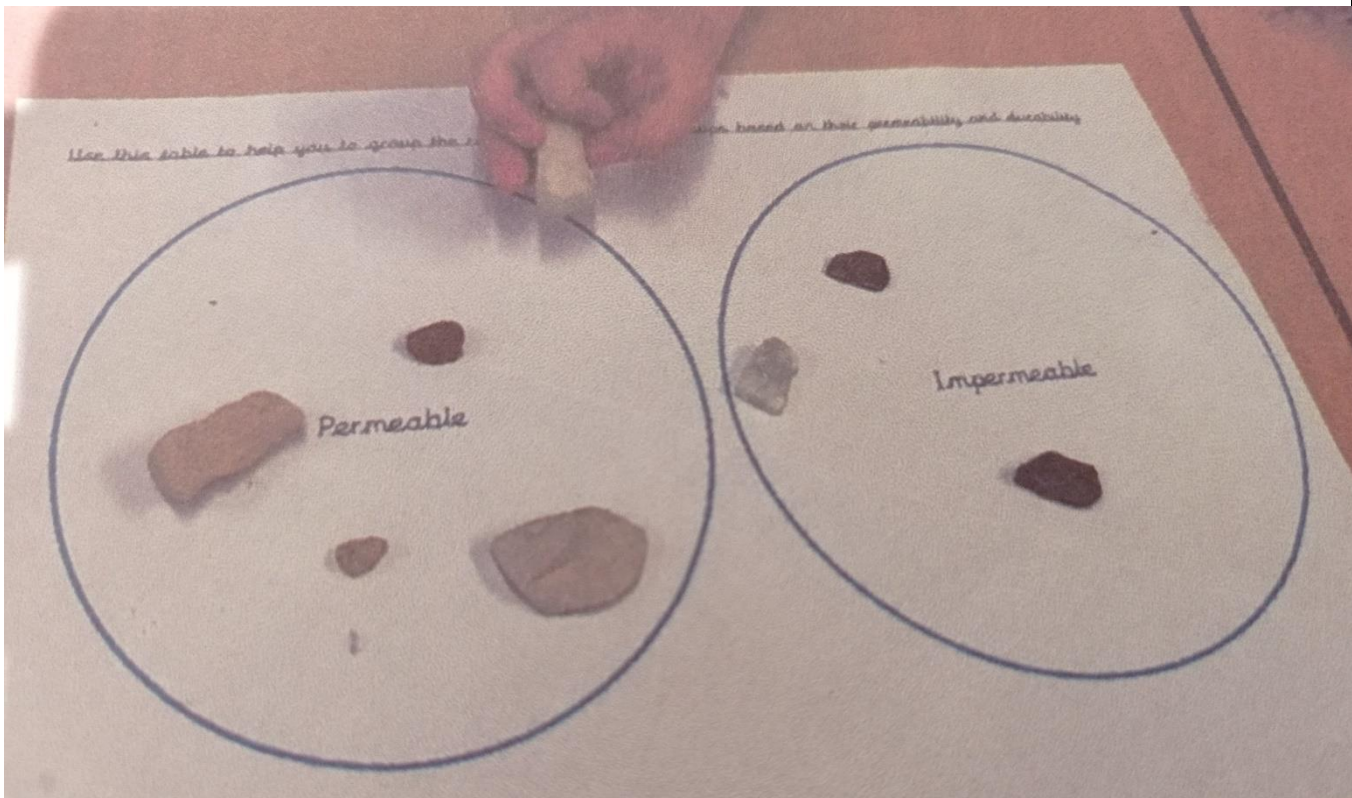
- group and identify *materials* [see year 5], including rocks [year 3], in different ways according to their properties, based on first-hand observation
- use the basic ideas of inheritance, variation and adaptation to describe how living things have changed over time and evolved [year 6]; and describe how fossils are formed [year 3] and provide evidence for evolution [year 6]

KS2 TAF expected standard: Working scientifically*

The pupil can, using appropriate scientific language from the national curriculum:

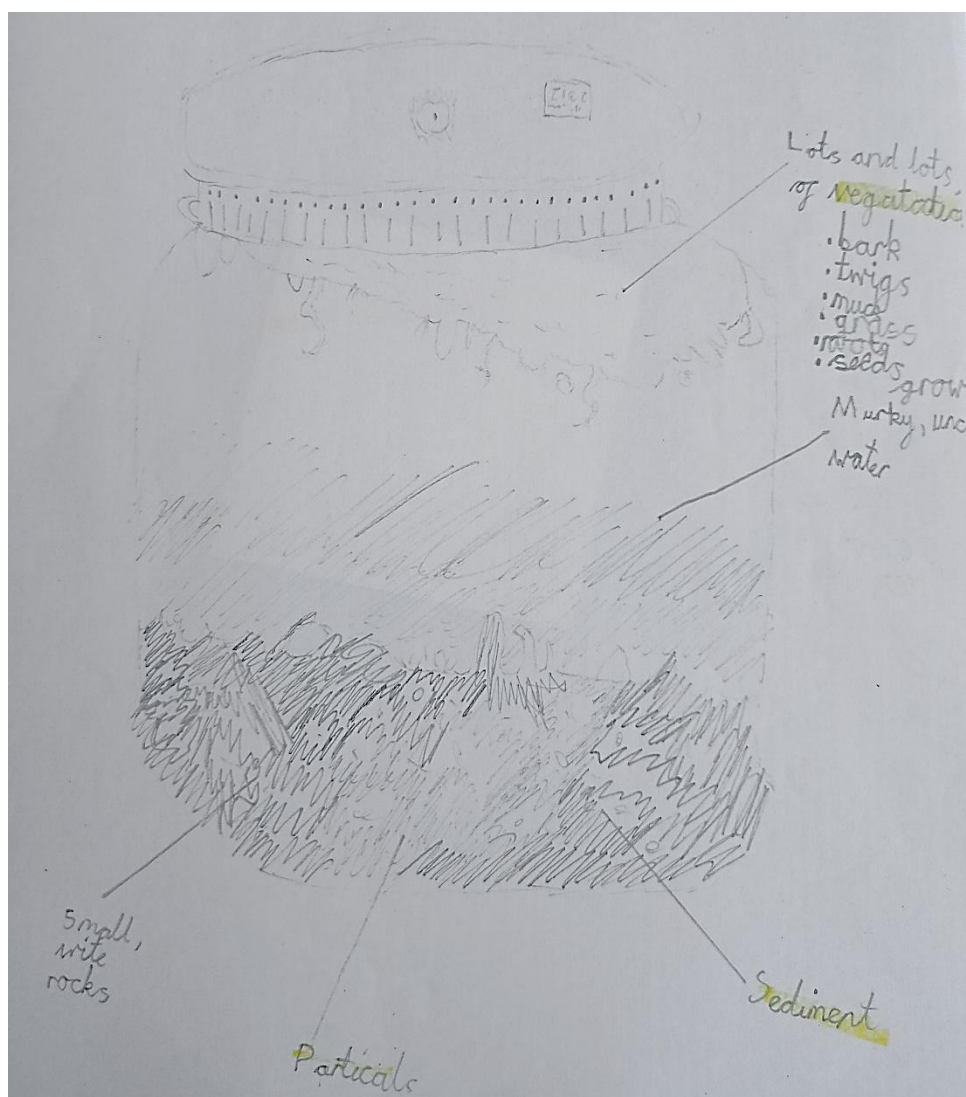
- **describe and evaluate their own and others' scientific ideas** related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own questions about the scientific phenomena that they are studying, and **select the most appropriate ways to answer these questions**, recognising and controlling variables where necessary (i.e. **observing changes over different periods of time, noticing patterns, grouping and classifying things**, carrying out comparative and fair tests, and finding things out using a wide range of secondary sources)
- **use a range of scientific equipment** to take accurate and precise measurements or readings, with repeat readings where appropriate
- **record data and results using scientific diagrams and labels**, classification keys, tables, scatter graphs, bar and line graphs
- **draw conclusions**, explain and evaluate their methods and findings, communicating these in a variety of ways
- raise further questions that could be investigated, based on their data and observations.

**The working scientifically objectives will be taught in conjunction with science content. Statements exemplified in this topic are in bold.*

Topic: Rocks	Year 3 Age 7-8	Title: Testing and grouping rocks
Working Scientifically Do: select the most appropriate ways to answer questions (grouping and classifying)	Science content group and identify materials, including rocks, in different ways according to their properties, based on first-hand observation	
<p>Children explored the properties of rocks by close observation and testing (rub test for durability, scratch test for hardness and dripping water to test permeability). Using their test results they grouped and ordered the rocks in a range of ways e.g. hardest to softest and permeable/impermeable.</p>		
<div></div> <div></div> <div></div> <div></div>		
<p>Children meeting the objective would be able to use their observations and rock testing results to group rocks in terms of their properties</p>		

Topic: Rocks	Year 3 Age 7-8	Title: Soil observation
Working Scientifically Do: observing changes (observing over time)	Science content Y3 NC: recognise that soils are made from rocks and organic matter KS2 TAF: group and identify materials including rocks, based on first-hand observation	

Soil samples from the garden were placed in separate jars and mixed with water. The following day, children observed the jars closely to consider the different components of soil.

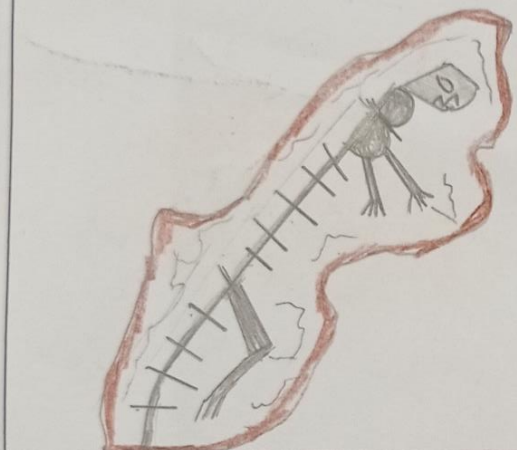


Children meeting the objective would be able to identify that soil is made up of different materials.

Topic: Rocks	Year 3 Age 7-8	Title: Fossil formation
Working Scientifically describe and evaluate their own scientific ideas using evidence from a range of sources		Science content describe how fossils are formed

After exploring fossils/replicas/images and sequencing activities, the children were asked to explain how a fossil was formed.

Diagram of our fossil:



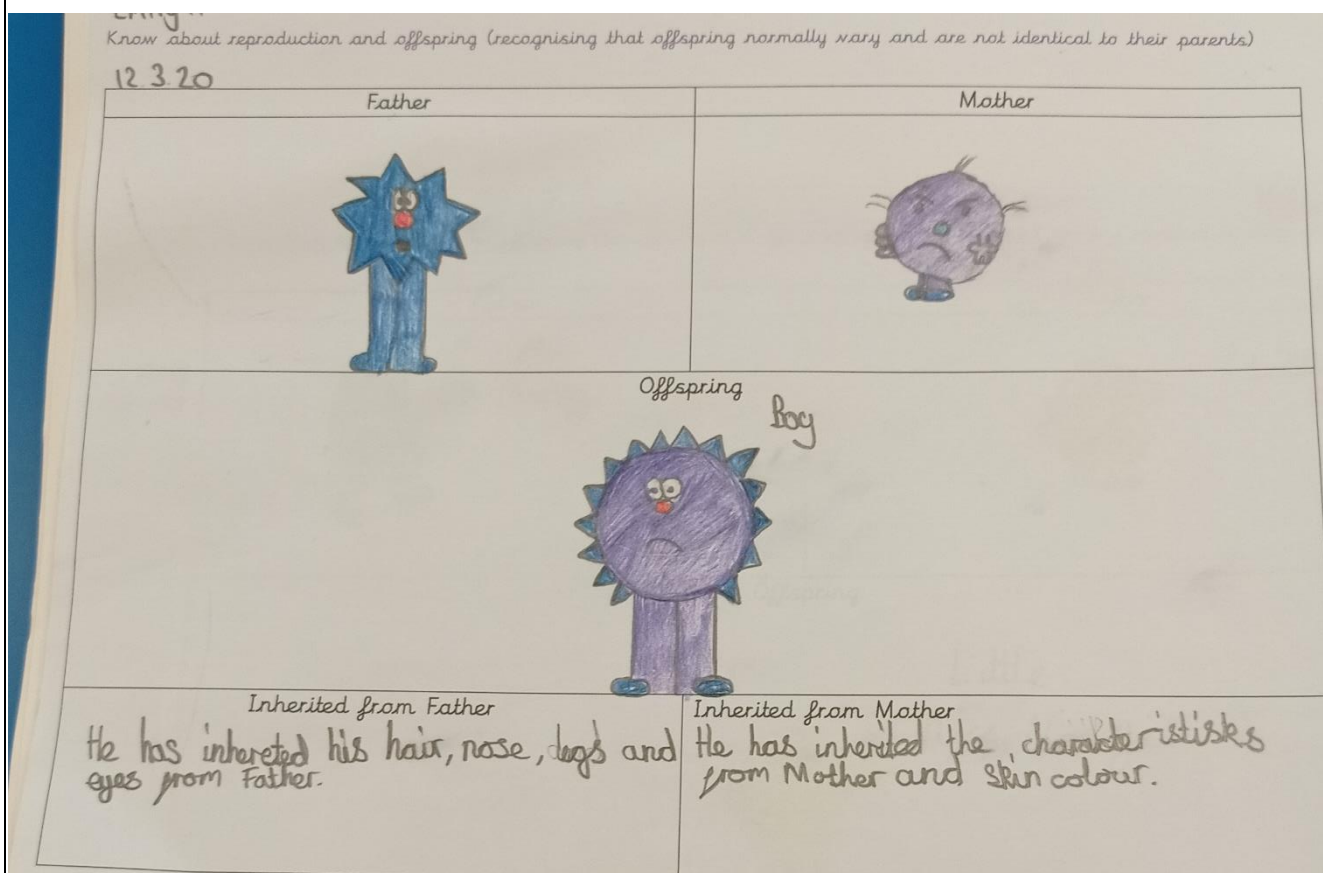
How is this fossil made?

Sometimes, only the soft parts inside the bones decay leaving the hard outside of the skeleton. The bones have small holes in them, like a sponge, which can fill with minerals. The minerals then harden.

Children meeting the content objective would be able to explain the process of fossilisation in words, pictures or orally. For example, that the animal would rot away and minerals would fill the gaps to leave an imprint of the creature in rock.

Topic: Evolution and inheritance	Year 6 Age 10-11	Title: Mr Men inheritance
Working Scientifically		Science content use basic ideas of inheritance and variation

Children were asked to create their own Mr Men 'cross-breed':



Children meeting the objective would be able to recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents. When asked, they would be clear about features that could be inherited (e.g. hair, eye colour etc) and features that would not be inherited (e.g. accessories like hats and piercings etc).


Topic: Evolution and inheritance	Year 6 Age 10-11	Title: Dog inheritance
Working Scientifically		Science content use basic ideas of inheritance and variation

Children were asked to create their own dog breed:


Know about reproduction and offspring recognising that offspring normally vary and are not identical to their parents)
Know how animals and plants are adapted to suit their environment

Selective breeding, also known as artificial selection, is a process used by humans to develop new organisms with desirable characteristics. Breeders select two parents that have beneficial phenotypic traits to reproduce, yielding offspring with those desired traits.

Task: Decide what features you would like the offspring to have and then select your parent




Jack Russell Terrier



German Shepherd

Inherited from the male

- friendly
- intelligence
- tail
- colour spots
- ears



Inherited from the female

- fur
- eyes
- body type
- colour
- strength
- ears

Explain why you selected the parents and the features the offspring will have.
I picked Jack Russell and German Shepherd because they are both really friendly and intelligent. It has its Mother's body so its big and its Father's legs so it can run fast.

Children meeting the objective would be able to recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents.

Topic: Evolution and inheritance	Year 6 Age 10-11	Title: Bird beak modelling
Working Scientifically Review: draw conclusions (pattern seeking, modelling)		Science content use the basic ideas of inheritance and adaptation to describe how living things have changed over time and evolved

Children were asked to consider survival and adaptation by modelling 'bird beaks' (tweezers, spoons, chopsticks) picking up 'food' (pennies, marbles, sticks):

food	Pennies	Marballs	sticks
Tweezers	7	6	7
food	Pennies	Marballs	sticks
Spoons	3	11	0
food	Pennies	Marballs	sticks
Chop sticks	1	0	5

→ Explain how this relates to Darwin's theory of Evolution.
It is related to survival of the fittest.
It shows how the birds with the beak best for the type of food such as a spoon bird that eats marballs will survive longer and with create stronger and smarter offspring.

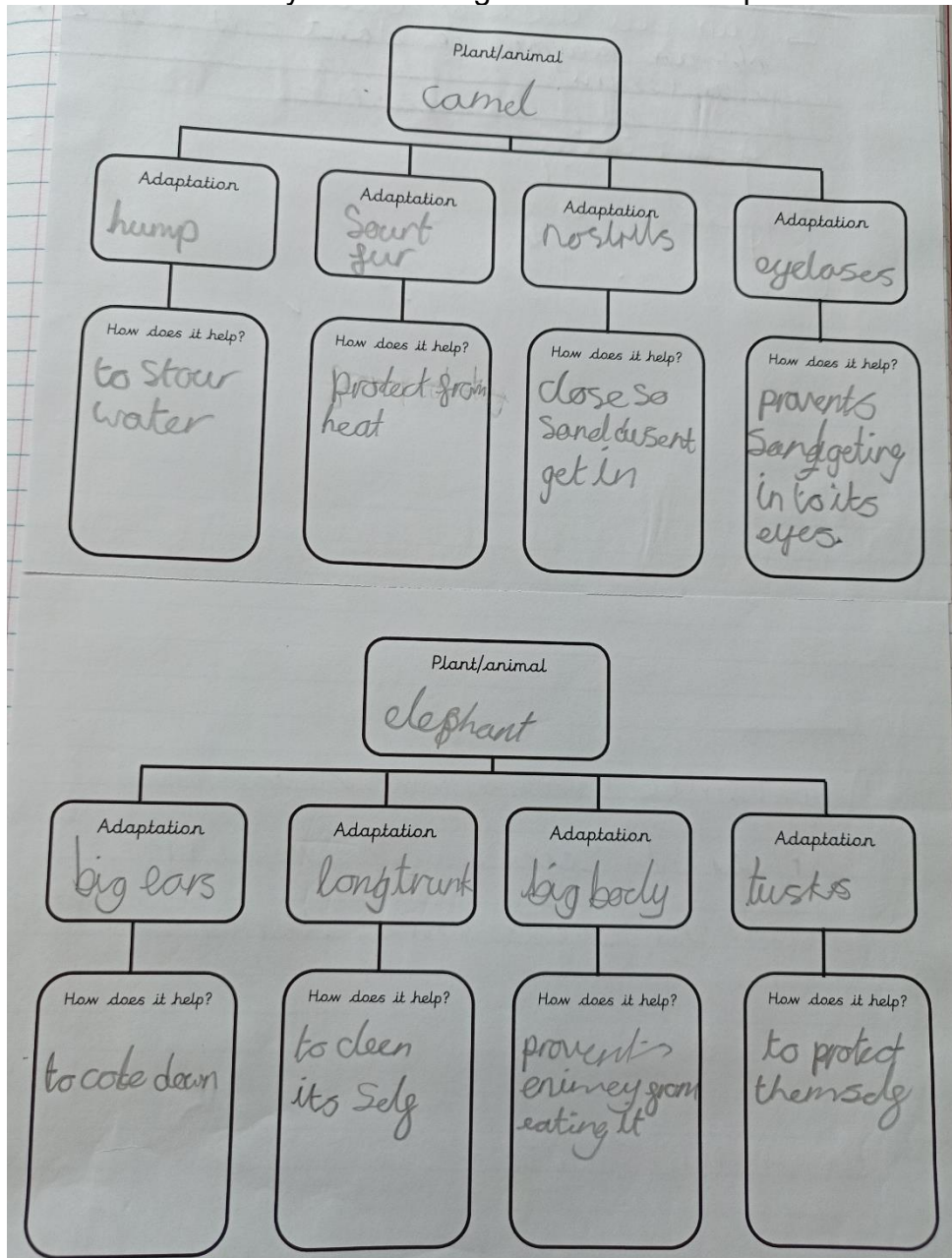
Children meeting the objective would be able to link the amount of 'food' collected to survival.

The pattern shows that if a bird had chopsticks for a beak it wouldn't have enough good to eat and would die. Whereas if a bird had tweezers for a beak it would get enough to eat - relating to survival of the fittest. So birds would mate and have offspring. So more birds would survive.

Great explanation

Topic: Evolution and inheritance	Year 6 Age 10-11	Title: Adaptation graphic organiser
Working Scientifically		Science content use the basic idea of adaptation

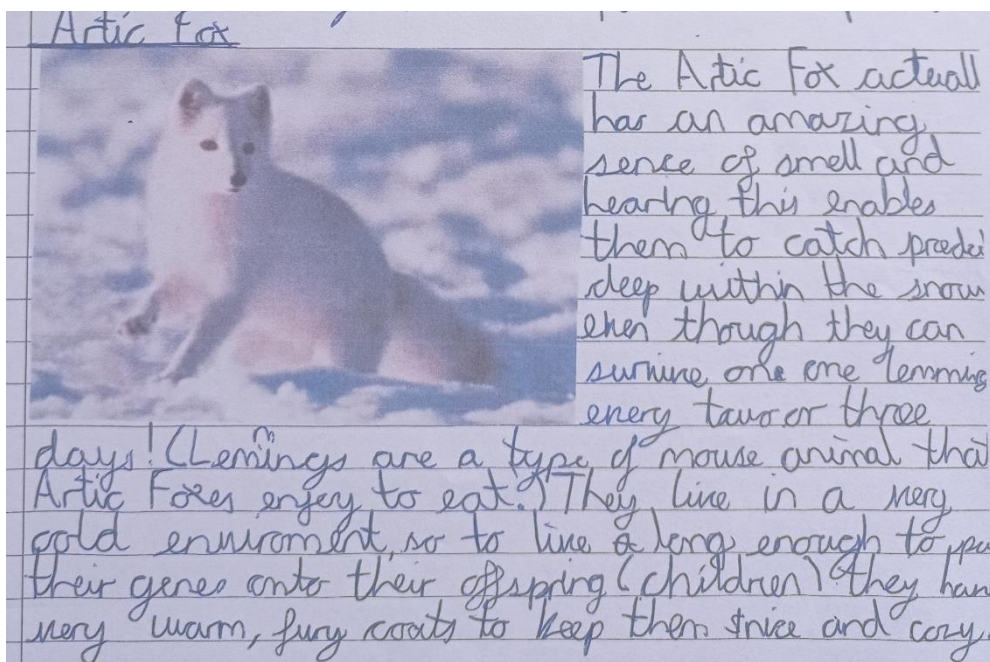
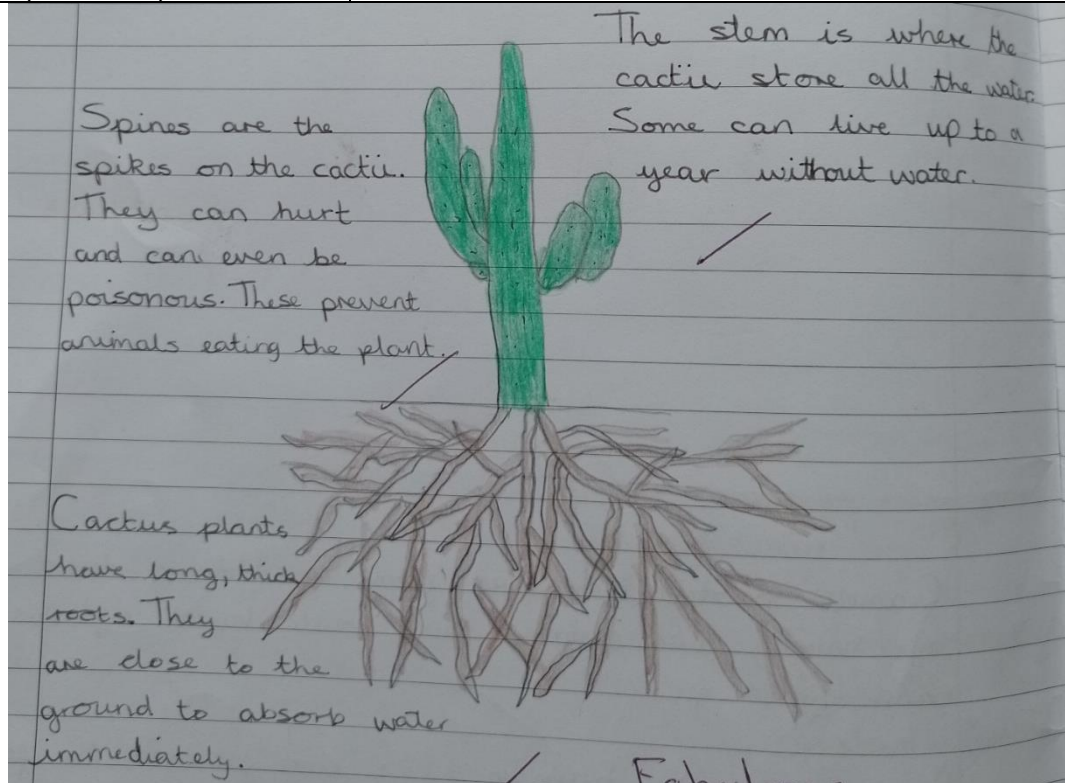
Children were asked to identify the advantages of different adaptations:



Children meeting the objective would be able to identify a range of features and how these advantaged the plant/animal for survival.

Topic: Evolution and inheritance	Year 6 Age 10-11	Title: Adaptation explanation
Working Scientifically describe and evaluate their own scientific ideas using evidence from a range of sources (research)		Science content use the basic ideas of inheritance and adaptation to describe how living things have changed over time and evolved

Children were asked to research, then explain how a plant/animal is adapted to survive in its habitat:



Children meeting the objective would be able to identify a range of features and how these help the plant or animal to survive.

Key Stage 2: Materials

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 4: States of matter

- compare and group materials together, according to whether they are solids, liquids or gases
- observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
- identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.

NC Year 5: Properties and changes of materials

- compare & group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal) & response to magnets
- know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
- give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
- demonstrate that dissolving, mixing and changes of state are reversible changes
- explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

KS2 TAF expected standard: Science content for materials

The pupil can:

- group and identify materials [year 5], *including rocks [see year 3]*, in different ways according to their properties, based on first-hand observation; and justify the use of different everyday materials for different uses, based on their properties [year 5]
- describe the characteristics of different states of matter and group materials on this basis; and describe how materials change state at different temperatures, using this to explain everyday phenomena, including the water cycle [year 4]
- identify and describe what happens when dissolving occurs in everyday situations; and describe how to separate mixtures and solutions into their components [year 5]
- identify, with reasons, whether changes in materials are reversible or not [year 5]

KS2 TAF expected standard: Working scientifically*

The pupil can, using appropriate scientific language from the national curriculum:

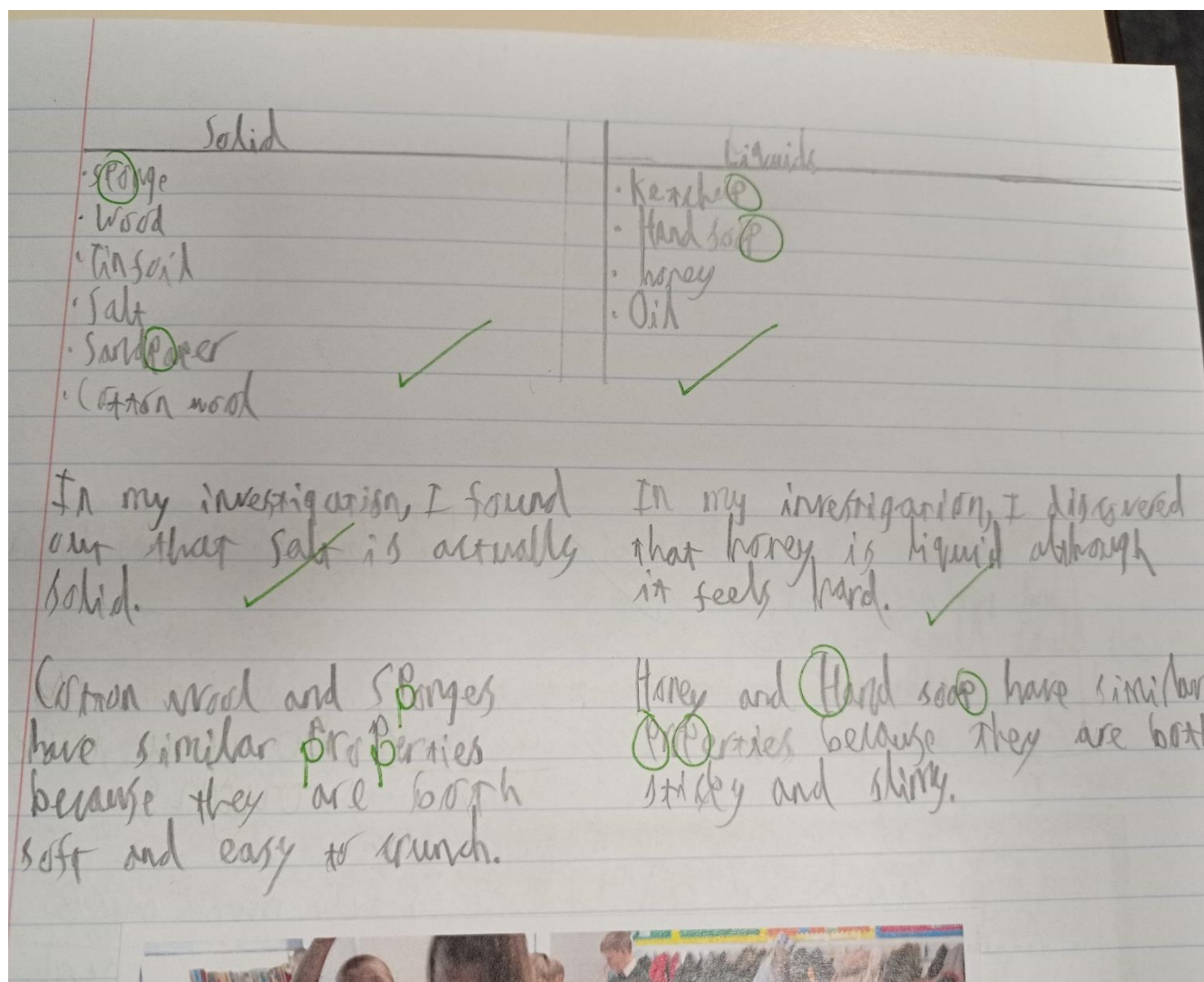
- **describe and evaluate their own and others' scientific ideas** related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own questions about the scientific phenomena that they are studying, and **select the most appropriate ways to answer these questions**, recognising and controlling variables where necessary (i.e. **observing changes over different periods of time**, noticing patterns, **grouping and classifying things, carrying out comparative and fair tests**, and finding things out using a wide range of secondary sources)
- **use a range of scientific equipment** to take accurate and precise measurements or readings, with repeat readings where appropriate
- **record data and results using scientific diagrams and labels**, classification keys, tables, scatter graphs, bar and **line graphs**
- **draw conclusions**, explain and evaluate their methods and findings, communicating these in a variety of ways
- raise further questions that could be investigated, based on their data and observations.

**Statements exemplified in this topic are in bold.*

Topic: States of matter	Year 4 Age 8-9	Title: Solid, liquid, gas description
Working Scientifically (grouping and classifying)		Science content describe the characteristics of different states of matter
<p>A solid...</p> <p>Keep's its shape unless you put pressure on it. ✓</p> <p>A liquid...</p> <p>it flows and its readily wet. ✓</p> <p>A gas...</p> <p>it spreads out in every direction. ✓</p>		<p>After exploring the properties of a range of everyday materials and whether they were solid, liquid or gas, the children were asked to describe the key properties of each state.</p>
<p>A solid...</p> <p>doesn't flow or change its shape and it doesn't spread out but you can pick up a solid. ✓</p> <p>A liquid...</p> <p>spreads out it also is wet and when you pour a liquid in a container the liquid turns into the shape of the container but you can't pick it up. ✓</p> <p>A gas...</p> <p>is mostly invisible and it spreads out in every direction it also changes into different shapes but you can't pick it up. ✓</p>		<p>Children meeting the objective would be able to describe characteristics for each state, e.g. solids hold their shape, liquids flow to fill the shape of the container, gases spread out in every direction (change their volume).</p>

Topic: States of matter	Year 4 Age 8-9	Title: Sorting into solids and liquids
Working Scientifically describe and evaluate their own scientific ideas using evidence from a range of sources (group and classify)		Science content group materials on the basis of different states of matter

The children explored and discussed a range of everyday materials, considering their properties and whether they were solid or liquid.









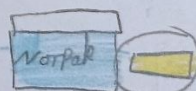


Children meeting the content objective would be able to classify different materials, explaining in words, diagrams or orally, their thinking around the properties of solids and liquids.

NB. More discussion of characteristics (e.g. solids hold their shape, liquids fill the shape of the container) would strengthen understanding here.

Topic: States of matter	Year 4 Age 8-9	Title: Heating and cooling
Working Scientifically Do: observe closely (observation over time)	Science content describe how materials change state at different temperatures	

The children were given different materials to heat (on the radiator) or cool (in the fridge) and were asked to observe what happened, recording in pictures and noting whether there was a change in state.

Material Room Temperature	Heated Placed on the Radiator/Warmed Up	Draw a Picture of What Happens When It Is Heated	Cooled Placed in the Fridge/Freezer	Draw a Picture of What Happens When It Is Cooled
Chocolate 	Melts <input checked="" type="checkbox"/> Boils <input type="checkbox"/> Hardens <input type="checkbox"/> Freezes <input type="checkbox"/> No Change <input type="checkbox"/>		Melts <input type="checkbox"/> Boils <input type="checkbox"/> Hardens <input checked="" type="checkbox"/> Freezes <input type="checkbox"/> No Change <input type="checkbox"/>	
Ice Cream 	Melts <input checked="" type="checkbox"/> Boils <input type="checkbox"/> Hardens <input type="checkbox"/> Freezes <input type="checkbox"/> No Change <input type="checkbox"/>		Melts <input type="checkbox"/> Boils <input type="checkbox"/> Hardens <input type="checkbox"/> Freezes <input checked="" type="checkbox"/> No Change <input type="checkbox"/>	
Butter 	Melts <input checked="" type="checkbox"/> Boils <input type="checkbox"/> Hardens <input type="checkbox"/> Freezes <input type="checkbox"/> No Change <input type="checkbox"/>		Melts <input type="checkbox"/> Boils <input type="checkbox"/> Hardens <input type="checkbox"/> Freezes <input type="checkbox"/> No Change <input checked="" type="checkbox"/>	

Children meeting the objective would be able to describe whether materials changed their state when heater or cooled.

Topic: States of matter	Year 4 Age 8-9	Title: Ice hands
Working Scientifically Review: draw conclusions (observation over time)		Science content describe how materials change state at different temperatures

The class placed 'ice hands' in different places (including an insulated lunchbox) to investigate the time taken to melt.



Control windowsill lunchbox

Conclusion

In this investigation, I found that my predictions were correct. The ice hand that melted first was the one in the windowsill. The hand which melted the slowest was the one in the lunchbox. I have learnt that heat helps ice melt faster and insulating helps the ice melt slower. This investigation can be improved or changed by if we checked each hour.

Children meeting the objective would be able to draw conclusions about the different conditions e.g. the windowsill was warmer and the lunchbox stopped the heat getting in.

Topic: States of matter	Year 4 Age 8-9	Title: Water cycle in a bag
Working Scientifically describe and evaluate their own and others' scientific ideas, using evidence from a range of sources		Science content use change of state to explain everyday phenomena, including the water cycle

The class created water cycle bags that were placed in the sun to evaporate and condense.



We made our own Water Cycle in a bag! We drew on the different stages, put water and blue food colouring in the bag, and waited to see what happened!



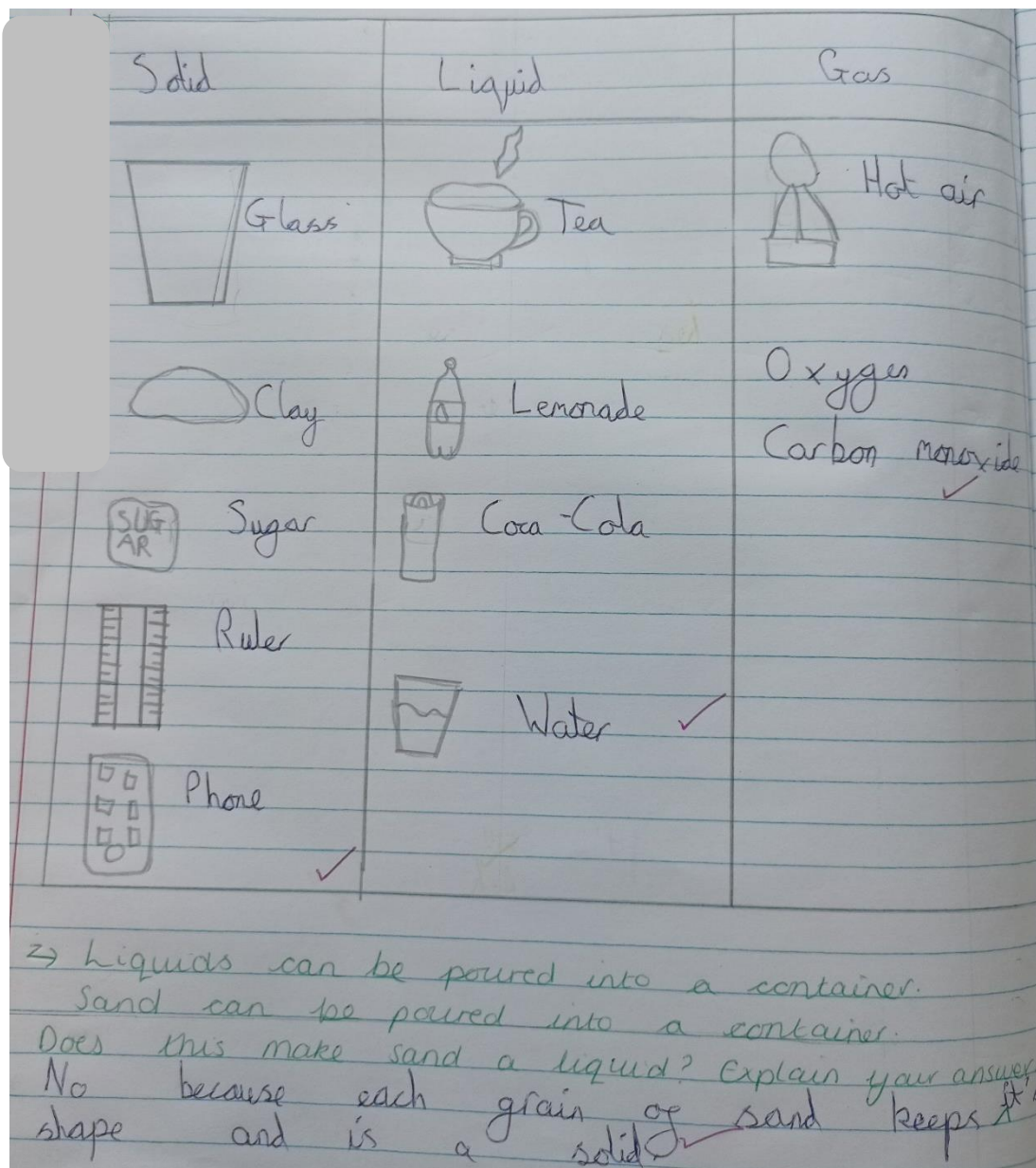
Write a summary of what we saw happening below:

We saw the water droplets go higher into the bag and when there's a lot those heavy and they go down, so rain or drop back at the bottom of the bag. When it goes up it's evaporation. When it's in the cloud it's condensation and when it falls it's precipitation.

Children meeting the content objective would be able to recognise evaporation and condensation happening in the modelling of the water cycle.

Topic: Materials	Year 5 Age 9-10	Title: Solid, liquid, gas grouping
Working Scientifically (grouping and classifying)		Science content describe the characteristics of different states of matter and group materials on this basis

Children were asked to review prior knowledge by grouping everyday materials at room temperature into solids, liquids and gases. This activity could be followed up by asking children to consider what characteristics are shared/not shared by solids, liquids and gases.



Children meeting the objective would be able to classify a range of materials by state of matter at room temperature.

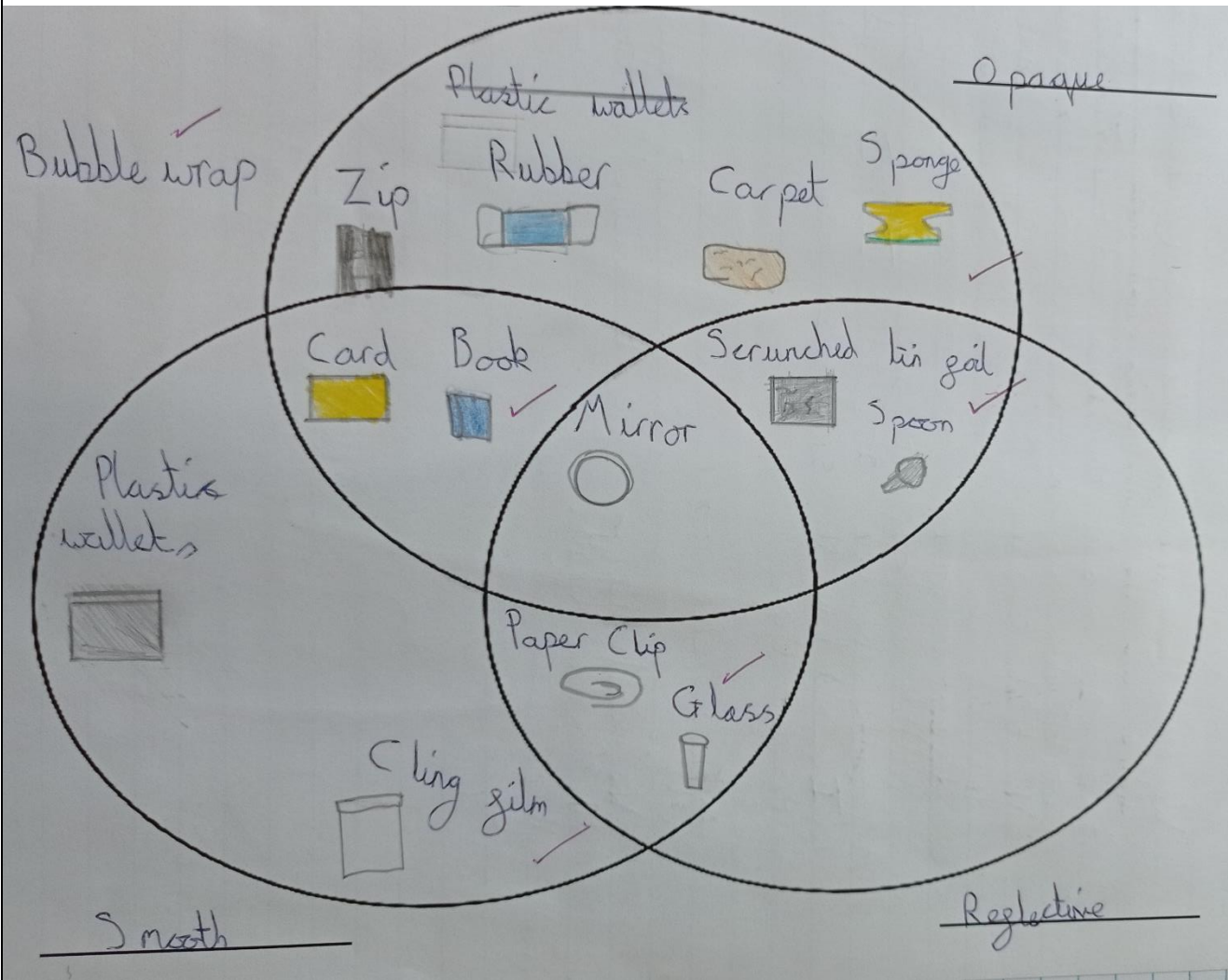
Topic: Materials	Year 5 Age 9-10	Title: Properties of materials
Working Scientifically Do: use a range of scientific equipment and record results using tables (group and classify)		Science content group and identify materials, in different ways according to their properties, based on first-hand observation

Children were asked to explore the properties of different materials, including rating their flexibility and hardness, together with testing electrical conductivity and whether they were attracted to magnets. They recorded results in a table and summarised something they had found out at the end of the lesson.

Material		Metal or non-metal	Conducts electricity	Magnetic	Order of flexibility	Order of hardness
Plastic	Predicted	non-metal	X	X	1	4
	Actual	non-metal	✓	X	1	3
Wood	Predicted	non-metal	✓	X	4	2
	Actual	non-metal	X	X	4	12
Rubber	Predicted	non-metal	X	X	3	3
	Actual	non-metal	X	X	3	4
Cotton Wool	Predicted	non-metal	X	X	2	5
	Actual	non-metal	X		2	5
Copper	Predicted	metal	X	✓	5	2
	Actual	metal	✓	✓	5	4

"I found out that wood is an insulator as it doesn't conduct electricity."

Children meeting the objective would be able to identify properties of a range of materials.

Topic: Materials	Year 5 Age 9-10	Title: Venn property grouping
Working Scientifically Review: record data and conclusions in a variety of ways (grouping and classifying)		Science content group and identify materials in different ways according to their properties, based on first-hand observation
<p>Children were asked to compare and group everyday materials by their properties:</p> 		
<p>Children meeting the objective would be able to group and classify a range of materials on the basis of their properties.</p>		

Topic: Materials	Year 5 Age 9-10	Title: Dissolving plan
Working Scientifically Plan: select the most appropriate ways to answer their question, recognising and controlling variables where necessary (fair testing)		Science content (In the context of: dissolving in everyday situations).

The variable that we will be changing is:
the water temperature. ✓

The variables we will be keeping the same are:

- Time taken to stir
- Mass of materials
- Amount of stirs
- Particle size ✓

Our scientific question is:

Does the water temperature affect what will happen to the time taken for the sugar to dissolve? ✓

To make it a fair test, we will:

Only change the water temperature and keep everything else the same. ✓

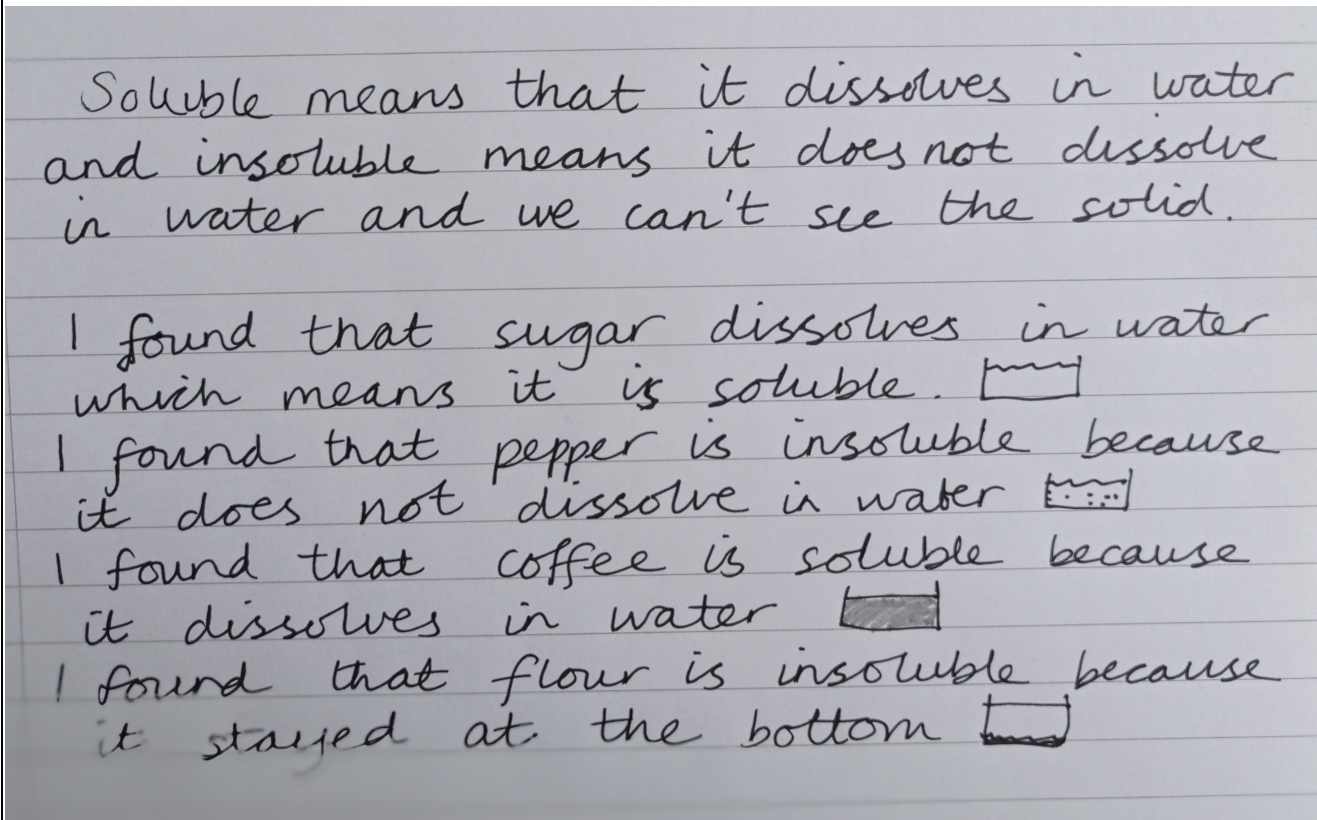
We predict that:

The hotter the water the quicker it dissolves. ✓

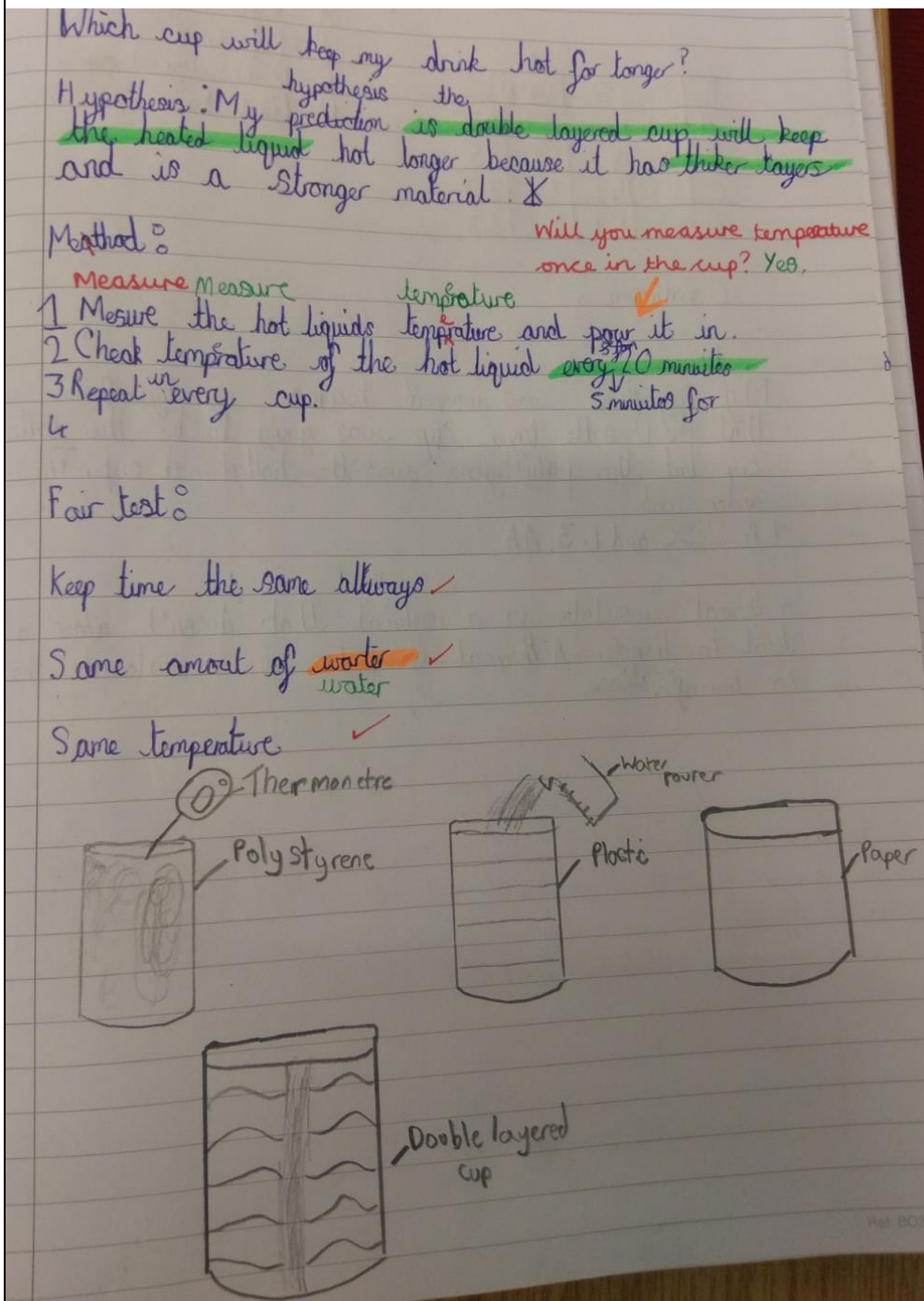
↓
Why do you think this is?
Because the particles will have more energy when they are heated so they move more quickly. ✓

Children were asked to plan an investigation to find out the effect of temperature on the rate of sugar dissolving:

Children meeting the objective would be able to identify the change, measure and control variables in order to carry out a fair test.

Topic: Materials	Year 5 Age 9-10	Title: Dissolving conclusions
Working Scientifically Review: draw conclusions, explain their findings (grouping and classifying)		Science content identify and describe what happens when dissolving occurs in everyday situations
<p>Children were asked to mix a range of solids with water to decide whether they were soluble or insoluble.</p> 		
<p>Children meeting the objective would be able to identify some materials will dissolve in a liquid to form a solution and some that will not.</p>		

Topic: Materials	Year 5 Age 9-10	Title: Best cup plan
Working Scientifically Plan: select the most appropriate way to answer their question, recognising and controlling variables where necessary (comparative and fair testing)		Science content (In the context of: properties and uses of different everyday materials).

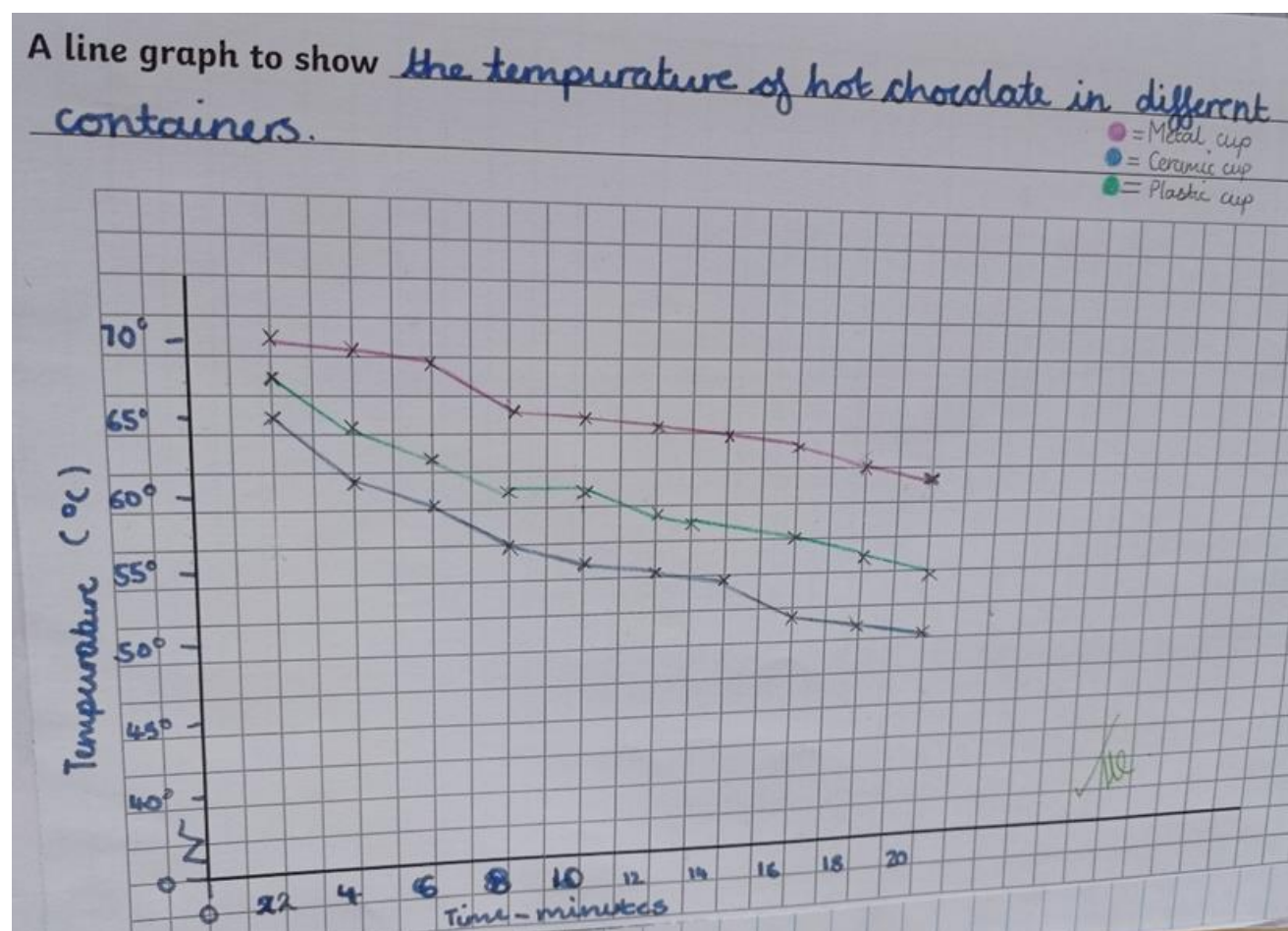


Children were asked to plan how they would investigate which cup would keep their drink hot the longest.

Children meeting the Working Scientifically objective would be able to explain how they would answer their question, identifying change, measure and control variables for a fair comparison.

Topic: Materials	Year 5 Age 9-10	Title: Insulation graph
Working Scientifically Do: record data and results using line graphs (comparative and fair testing)		Science content (In the context of: properties and uses of different everyday materials).

Children were asked to measure the temperature of water in different cups to find out which cup would keep the drink hot the longest. They recorded a cup each in a group results table, then plotted the results on a line graph.

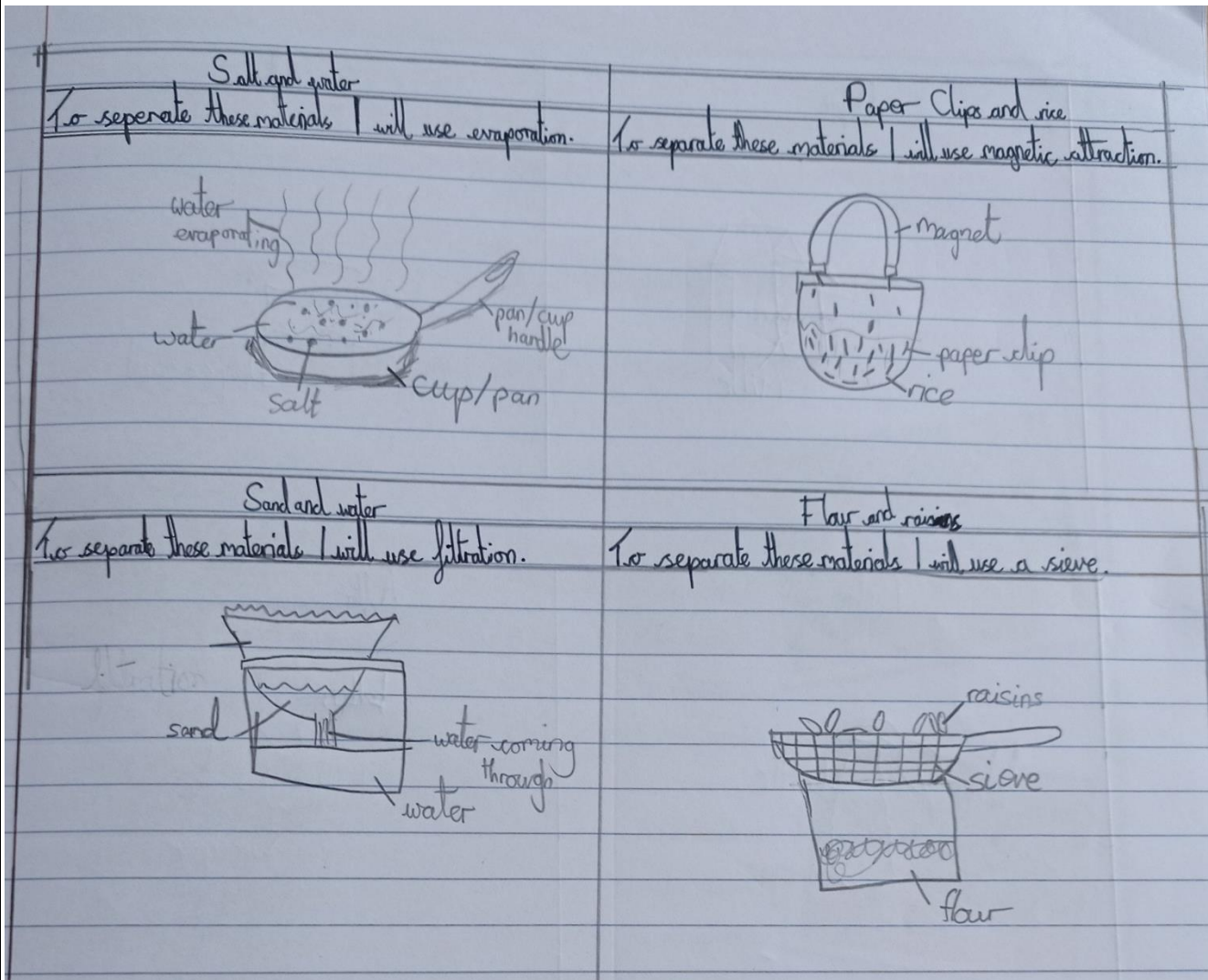


Children meeting the Working Scientifically objective would be able to plot their results on a legible line graph (this could be different children plotting one cup each, or collated results like the example above).

NB. The metal cup in this case was a 'thermos commuter cup' which has a layer of air in between two layers of metal and it is the air layer which is slowing heat transfer.

Topic: Materials	Year 5 Age 9-10	Title: Separating materials explanations
Working Scientifically Review: explain and communicate findings (grouping and classifying, observing over time)		Science content describe how to separate mixtures and solutions into their components

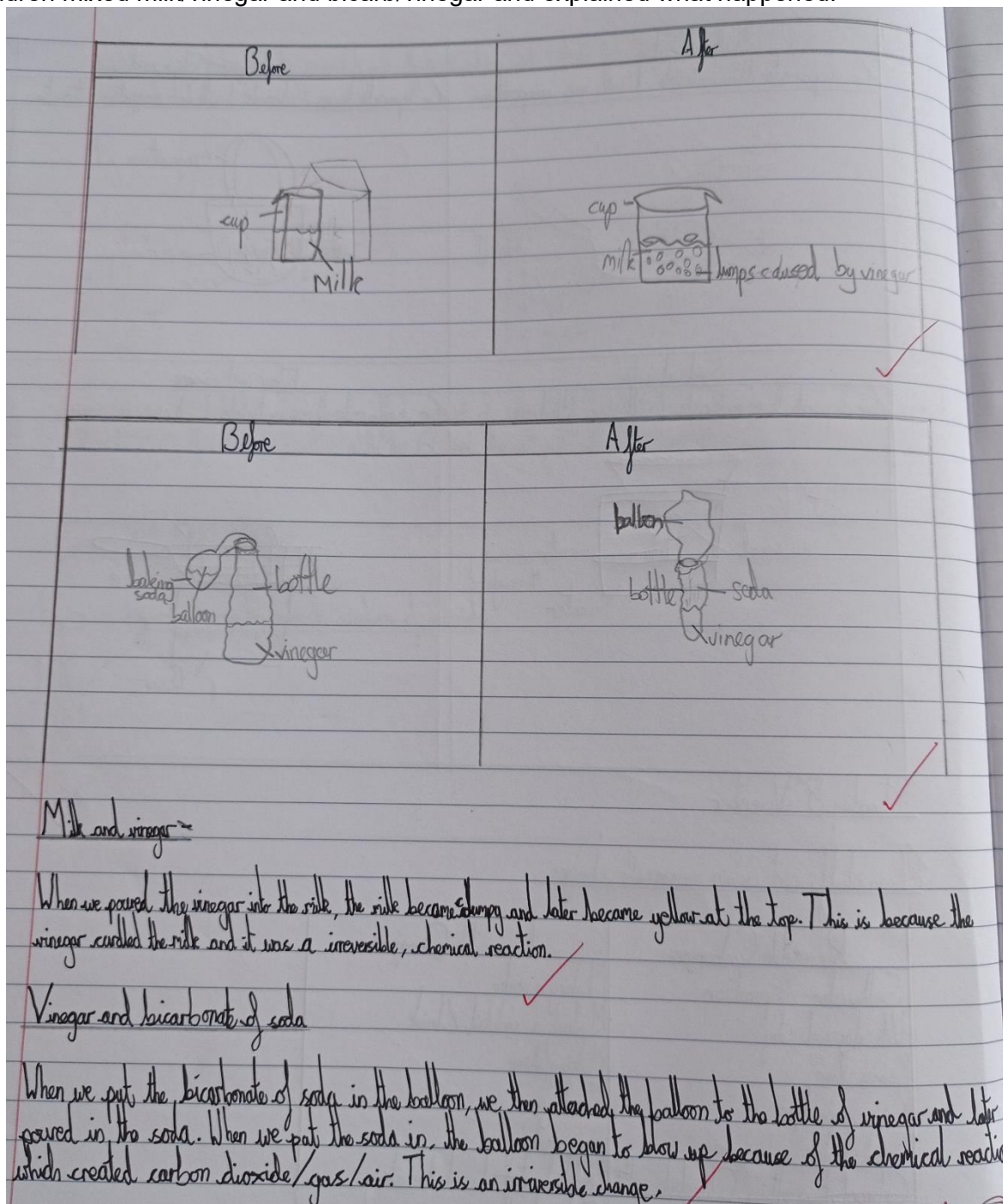
Children were asked to explain how to separate different mixtures.



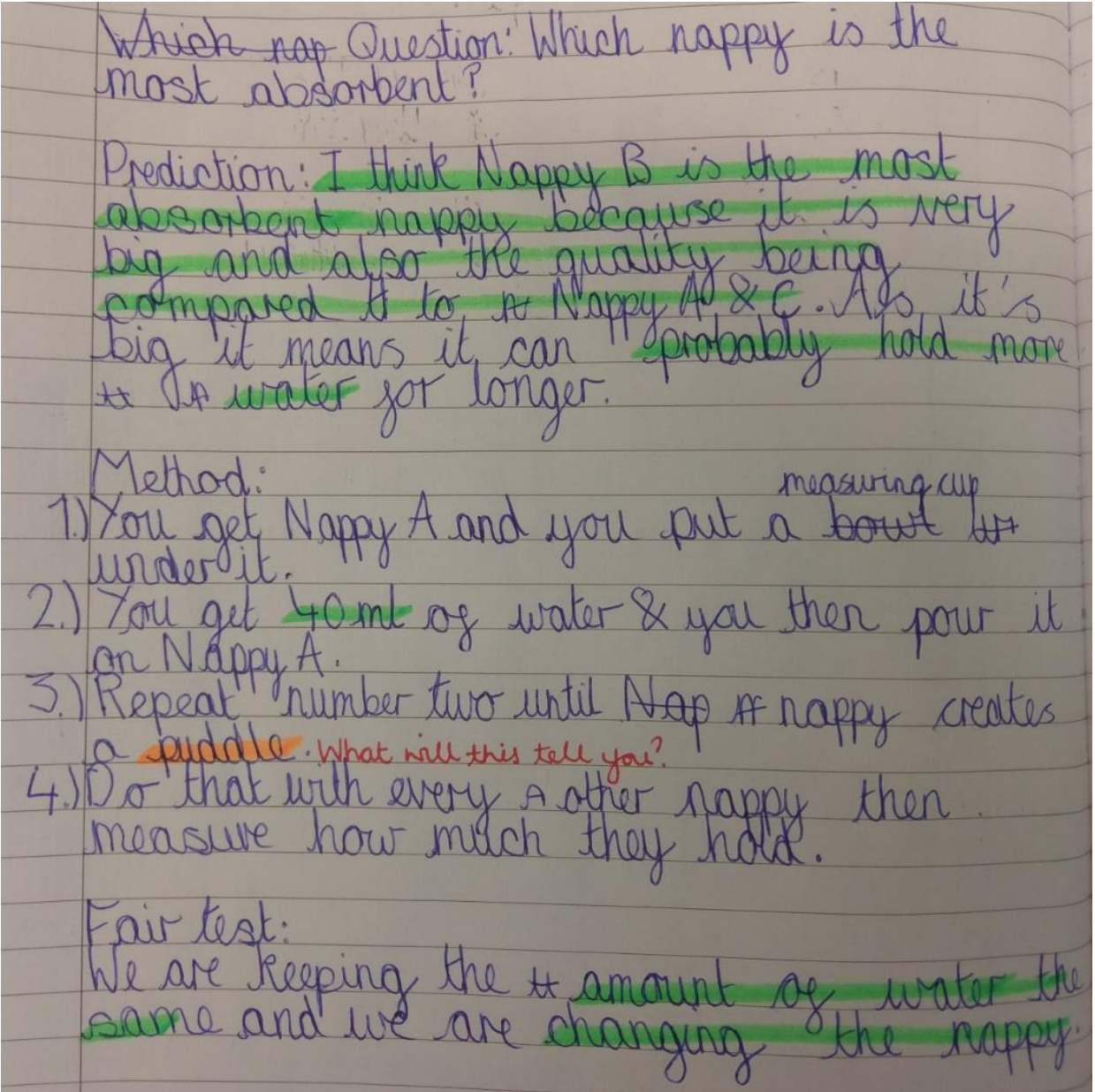
Children meeting the objective would, in words and/or diagrams, be able explain their methods, using appropriate equipment.

Topic: Materials	Year 5 Age 9-10	Title: Irreversible changes
Working Scientifically Review: explain and communicate findings (observing over time, group & classify)		Science content identify, with reasons, whether changes in materials are reversible or not

Children mixed milk/vinegar and bicarb/vinegar and explained what happened.



Children meeting the objective would, in words and/or diagrams, be able explain that the changes were irreversible because new substances were formed.

Topic: Materials	Year 5 Age 9-10	Title: Nappy plan
Working Scientifically Plan: select the most appropriate way to answer their question, recognising and controlling variables where necessary (comparative and fair testing)		Science content (in the context of properties and uses of different everyday materials)
Children were asked to plan how they would investigate which nappy material was the most absorbent.		
		
Children meeting the Working Scientifically objective would be able to explain how they would answer their question, identifying control variables for a fair comparison.		

Key Stage 2: Light and Sound

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 3: Light

Pupils should be taught to:

- recognise that they need light in order to see things and that dark is the absence of light
- notice that light is reflected from surfaces
- recognise that sunlight can be dangerous and that there are ways to protect their eyes
- recognise that shadows are formed when the light from a source is blocked by a solid object
- find patterns in the way that the size of shadows change.

NC Year 4: Sound

- identify how sounds are made, associating some of them with something vibrating
- recognise that vibrations from sounds travel through a medium to the ear
- find patterns between the pitch of a sound and features of the object that produced it
- find patterns btw the volume of a sound and the strength of the vibrations that produced it
- recognise that sounds get fainter as the distance from the sound source increases.

NC Year 6: Light

- recognise that light appears to travel in straight lines
- use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye
- explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes
- use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them.

KS2 TAF expected standard: Science content for light and sound

The pupil can:

- use the idea that light from light sources, or reflected light, travels in straight lines & enters our eyes to explain how we see objects [Y6], & the formation [Y3], shape [Y6] & size of shadows [Y3]
- use the idea that sounds are associated with vibrations, and that they require a medium to travel through, to explain how sounds are made and heard [Y4]
- describe the relationship between the pitch of a sound & the features of its source; & between the volume of a sound, the strength of the vibrations and the distance from its source [Y4]

KS2 TAF expected standard: Working scientifically*

The pupil can, using appropriate scientific language from the national curriculum:

- **describe and evaluate their own and others' scientific ideas** related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own questions about the scientific phenomena that they are studying, and select the most appropriate ways to answer these questions, recognising and controlling variables where necessary (i.e. observing changes over different periods of time, **noticing patterns, grouping and classifying things, carrying out comparative and fair tests**, and finding things out using a wide range of secondary sources)
- **use a range of scientific equipment** to take accurate and precise measurements or readings, with repeat readings where appropriate
- **record data and results using** scientific diagrams and labels, classification keys, **tables, scatter graphs, bar and line graphs**
- **draw conclusions**, explain and evaluate their methods and findings, communicating these in a variety of ways
- raise further questions that could be investigated, based on their data and observations.

**Statements exemplified in this topic are in bold.*

Topic: Light	Year 3 Age 7-8	Title: Cave box
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Working Scientifically describe and evaluate their own scientific ideas	Science content Y3 NC: recognise that they need light in order to see things
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Children were given a 'cave box' to explore (a shoe box with a spy hole, a 'window' cut out and some stickers on the inside).

Amount of Light	Observations
Window covered	Number of Stickers seen 000
Window open	Number of Stickers seen 555
Lid off	Number of Stickers seen 288

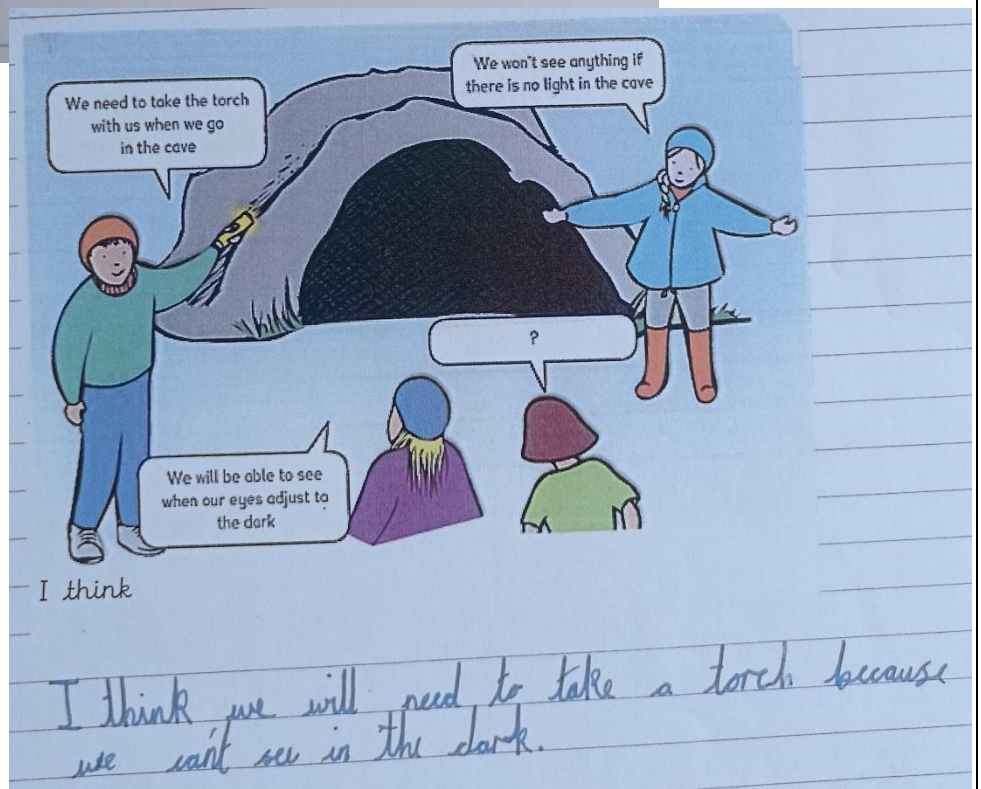
What do your results tell you about light and dark?
We can't see in the dark. You need light to see.

They looked through the spy hole and counted how many stickers they could see when the window was covered, the window was open and the whole lid was taken off. They repeated this a couple of times to check their results.

They also discussed a Concept Cartoon as a class about whether a torch was needed to be able to see in a dark cave.

Children meeting the objective would be able to recognise that they would not be able to see if there was no light coming into the cave.

(Concept Cartoon from Naylor and Keogh, Millgate House Publishers)



Topic: Light	Year 3 Age 7-8	Title: Shiny materials
Working Scientifically Do: results using a table (grouping and classifying)	Science content Y3 NC: notice that light is reflected from surfaces	

Children were asked to explore the shininess of different materials. They completed a table to record their findings. The discussed the most and least shiny materials.

Object	Describe what it looks like	How shiny is it? (0-5)
tin foil	flat mirror	1
mirror	shiny, clear	3
tracing paper	white	2
baking paper	brown	0
kitchen x foil x roll	white	0

I found out that not all materials aren't all reflective.
Which material was the most reflective?
The most reflective was the mirror.

Children meeting the objective would be able to notice that materials can reflect light. They may have noticed that more light was reflected by shiny materials.

NB. Even dull objects reflect some light – this is how we see them.

Topic: Light	Year 3 Age 7-8	Title: Materials to block light
Working Scientifically Review: draw conclusions (grouping and classifying)	Science content In the context of: Y3 NC: recognise that shadows are formed when the light from a light source is blocked by a solid object.	

Children were asked to find out which material would be the best at blocking light (to make shadows and to be used for curtains). They briefly recorded results and came to a conclusion about which materials were better at blocking light.

Material	Opaque (blocks all light and makes a shadow)	Translucent (lets some light through and makes a faint shadow)	Transparent (lets all the light through and does not make a shadow)
cling film	x ✓ x		✓ x ✓
cardboard	✓		
black plastic		✓	
baking paper		✓	
tin foil	✓		

I think that cardboard and tin foil would be the best material to use for the new curtains because you can't see through so they are opaque.

I think that shadows are made by something blocking the sun or light.

Children meeting the objective would be able to use their results to draw conclusions about which materials were better at blocking light.

Topic: Light	Year 3 Age 7-8	Title: Shadow measuring
Working Scientifically Do: take accurate and precise measurements and record results using a table (comparative/fair test)		Science content (In the context of: the formation and size of shadows).

Children were asked to find out how the size of the shadow changed as they moved the object further away from the light source.

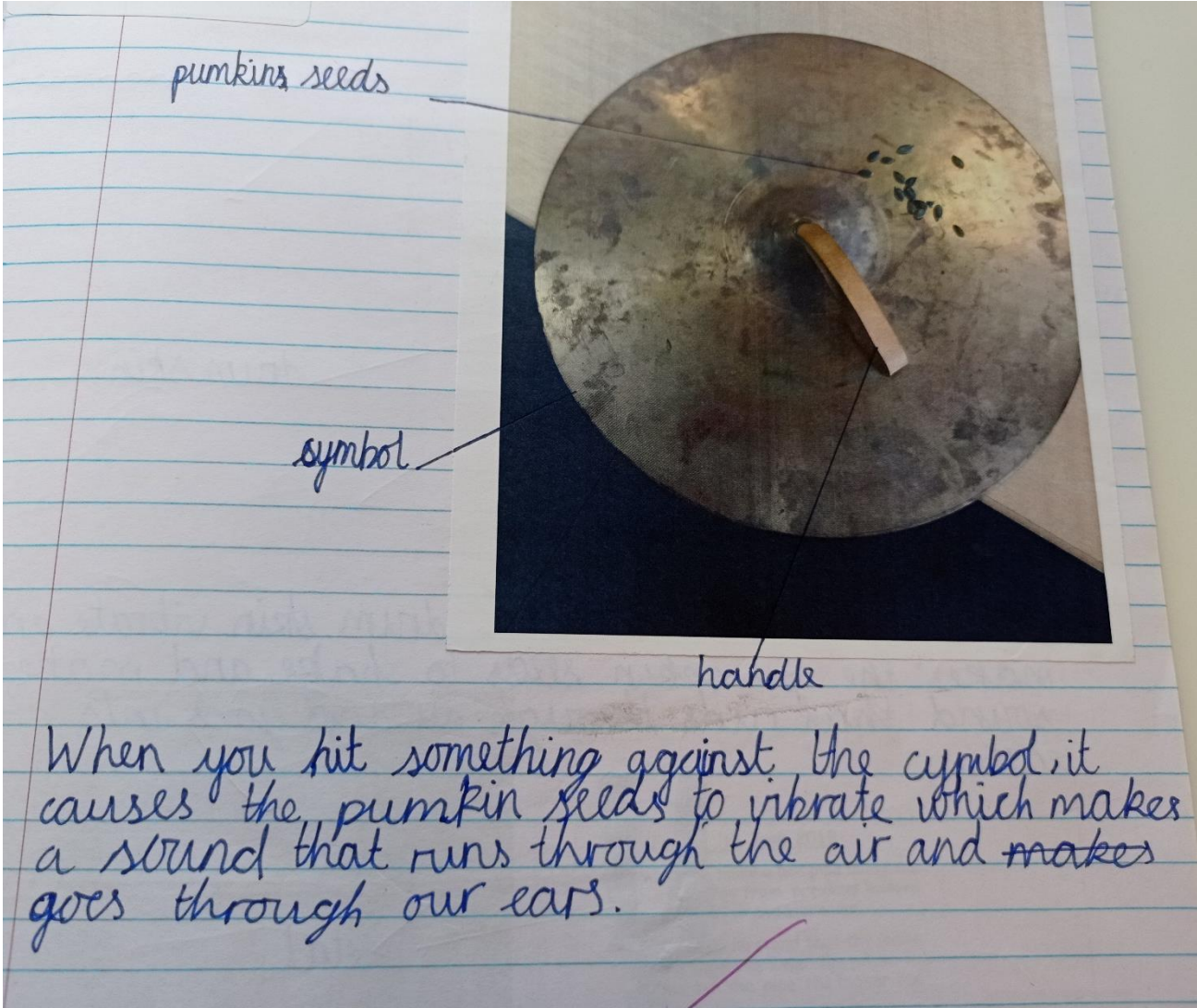
Monday 4th October

Lo: To understand how shadows are formed

Complete this table with your results as you carry out your investigation.
How do shadows change when the distance between the light source and the object changes?

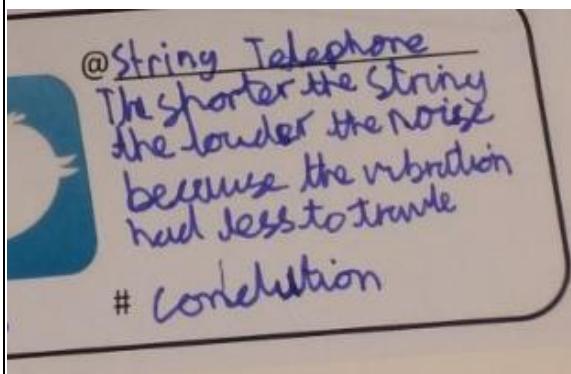
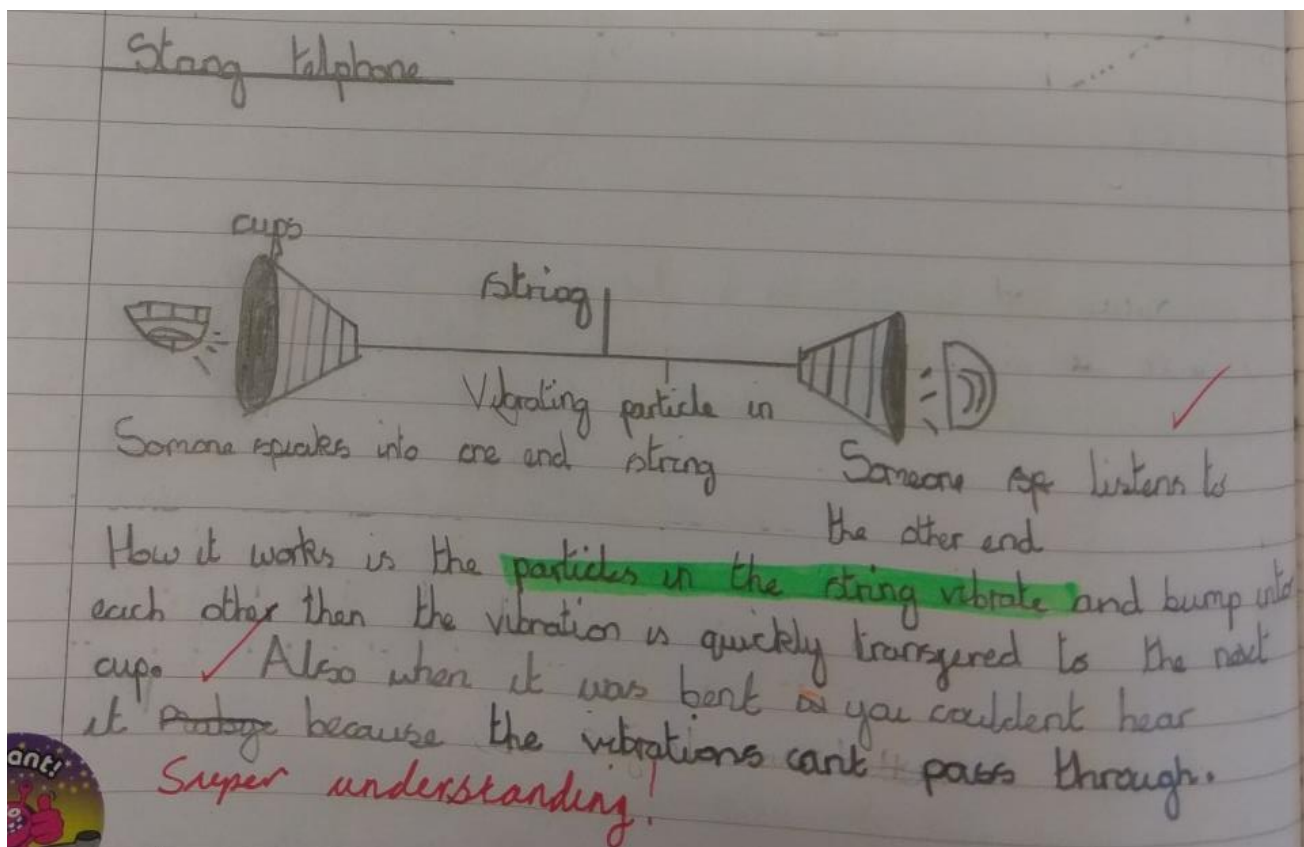
Distance between the light source and the object.	Size of the object's shadow.
10cm	13 cm
20cm	15 cm
30cm	18 cm
40cm	20 cm
50cm	23 cm

Children meeting the Working Scientifically objective would be able to take careful measurements and record these in a table (as this was early in Y3, a pre-prepared table was used).

Topic: Sound	Year 4 Age 8-9	Title: Vibrations
Working Scientifically describe and evaluate their own and others' scientific ideas, using evidence from a range of sources		Science content use the idea that sounds are associated with vibrations, to explain how sounds are made and heard
<p>Children explored a range of sound sources and then chose one to explain how they could hear the sound it made.</p>  <p>When you hit something against the cymbal, it causes the pumpkin seeds to vibrate which makes a sound that runs through the air and makes goes through our ears.</p>		
<p>Children meeting the objective would be able to explain, through words and/or annotated diagrams, that the instrument vibrates and that these vibrations travel to the ear (through the air).</p> <p><i>NB. The teacher may want to check the role (or not) of the pumpkin seeds with the child.</i></p>		

Topic: Sound	Year 4 Age 8-9	Title: String phone conclusions
Working Scientifically Review: draw conclusions, explain their methods and findings		Science content use the idea that sounds are associated with vibrations, and that they require a medium to travel through, to explain how sounds are made and heard

The class made string telephones using different strings and cups. After trying their own and others, they drew conclusions about how they worked. One class explained using annotated diagrams. Another class wrote conclusion 'tweets'.



Children meeting the objective would be able to explain, through words and/or annotated diagrams, that the phone works if the string can carry the vibrations. They might mention observations e.g. the string needs to be taut, certain cups/string/lengths worked better than others.

Topic: Sound	Year 4 Age 8-9	Title: Distance and volume
Working Scientifically Do: use a range of scientific equipment to take accurate and precise readings (pattern-seeking)	Science content describe the relationship between the volume of a sound and the distance from its source	

From the sound source, we walked in a ~~the~~ East direction.

Amount of steps away from the sound source	Decibels recorded (DB)
5	88
10	83
20	72
40	65
50	62
	57

Was your data the same as everyone else's? If your answer is no, why do you think this is? What affected your ability to hear the sound from the speaker?

No it was not the same. This is because we were at the side of the speaker and we were heading towards the reception classes.

Children used a soundmeter app to record the sound coming from a speaker as they moved further away in different directions.

Children meeting the content objective would be able to recognise that sounds got fainter as they got further away (in this case, during discussion).

Children meeting the Working Scientifically objective would be able to use the app to measure the volume (may also recognise problems with the accuracy due to other sounds).

Children used a soundmeter app to record the sound coming from a speaker as they moved further away in different directions.

Children meeting the content objective would be able to recognise that sounds got fainter as they got further away (in this case, during discussion).

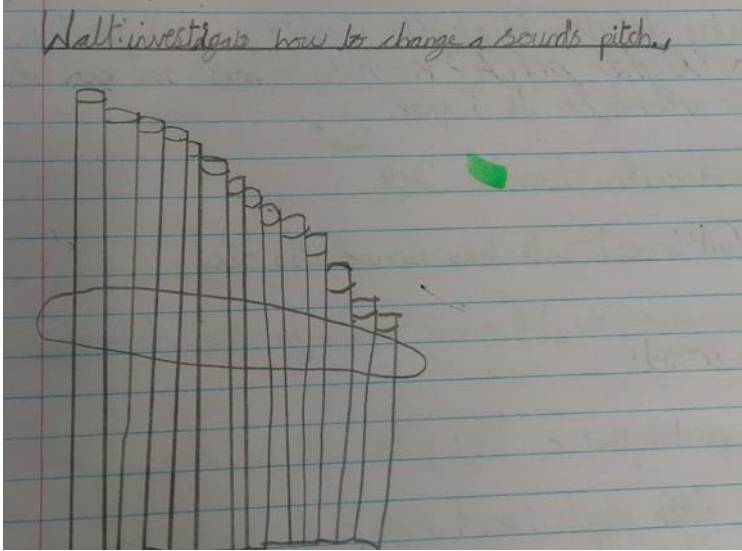
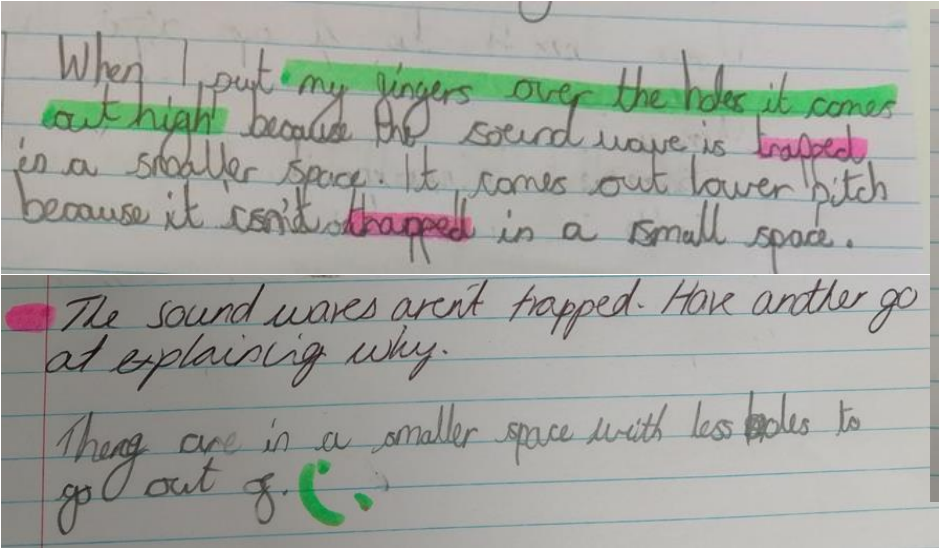
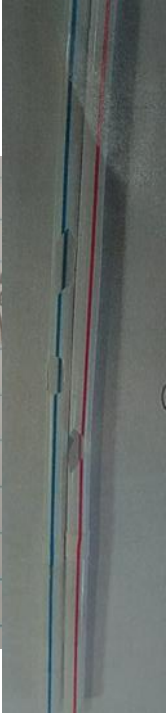
Children meeting the Working Scientifically objective would be able to use the app to measure the volume (may also recognise problems with the accuracy due to other sounds).

Topic: Sound	Year 4 Age 8-9	Title: Exploring instruments
Working Scientifically Review: use results to draw simple conclusions (pattern seeking)	Science content describe the relationship between the pitch of a sound and the features of its source; and between the volume of a sound, the strength of the vibrations	

Children explored how to change the volume and pitch of a range of instruments.

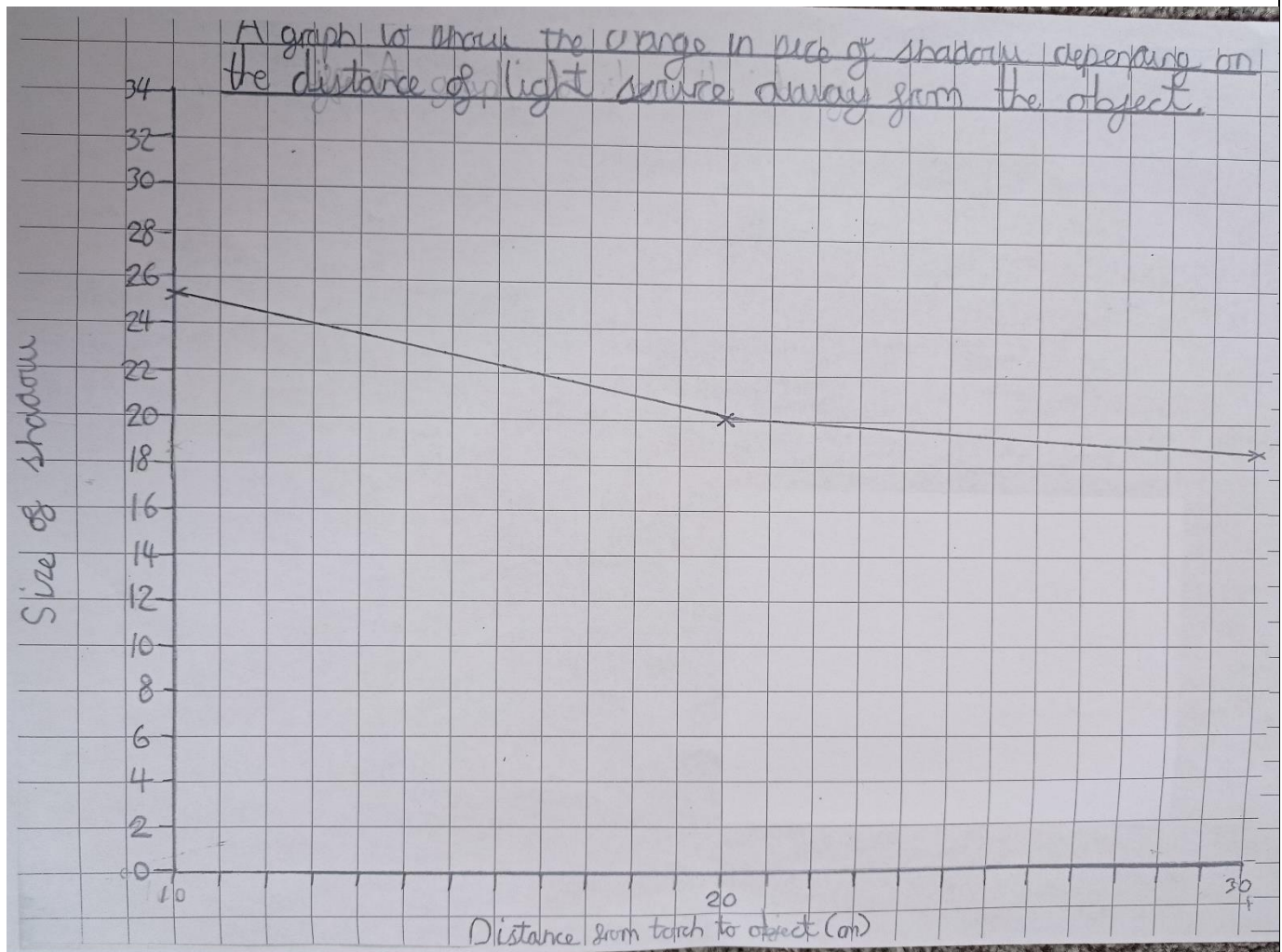
<u>Instrument</u>	<u>What is vibrating to make the sound?</u>	<u>Are you able to change the volume? If so, how?</u>	<u>Are you able to change the pitch of this instrument? If so, how?</u>
Gluckenspiel	The chords ^{keys} are vibrating on the stick.	no it stays the same	yes, the different ^{keys} chords have different pitches.
Drums	The skin of the drum	The lighter you tap the louder	no. It is only deep
Guitar	The strings when you pull them.	Yes because you can do it harder and softer.	Yes because there are different strings and they make different pitches so high and low
Boom-Whackers	The tube when you knock it against something it will vibrate in your hands	By hitting it softer and harder.	Is it is shorter or higher because there are longer and shorter.

Children meeting the objective would be able to recognise different ways to change the volume and pitch, depending on the features of the instrument and the strength of the 'hit' (to make it vibrate).

Topic: Sound	Year 4 Age 8-9	Title: Pitch explanations
Working Scientifically Review: use results to draw simple conclusions (pattern seeking)		Science content find patterns between the pitch of a sound and features of the object that produced it
		
		
		
Children meeting the objective would be able to describe how to change the pitch on their 'instrument'.		

Topic: Light	Year 6 Age 10-11	Title: Shadow graph
Working Scientifically Do: record data using line graphs (comparative and fair testing)		Science content (In the context of: use the idea that light from light sources, travels in straight lines to explain the shape and size of shadows)

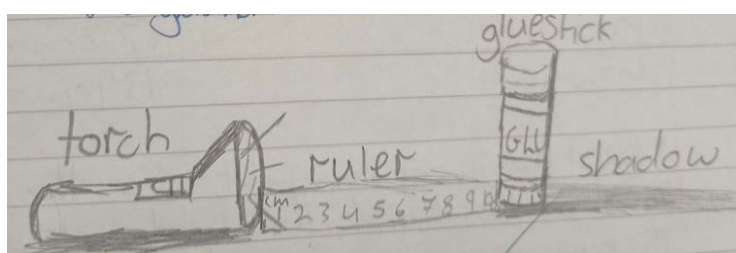
Children investigated how moving the torch affected the size of the shadow. They roughly noted down their results, then created a line graph for discussion.



Children meeting the objective would be able to draw a line graph to record and share their results.

Topic: Light	Year 6 Age 10-11	Title: Shadow results
Working Scientifically Do: record results using tables and/or line graphs (fair testing)		Science content use the idea that light from light sources travels in straight lines to explain the formation and size of shadows

Children were asked to investigate the effect of moving the light source on the size of the shadow.

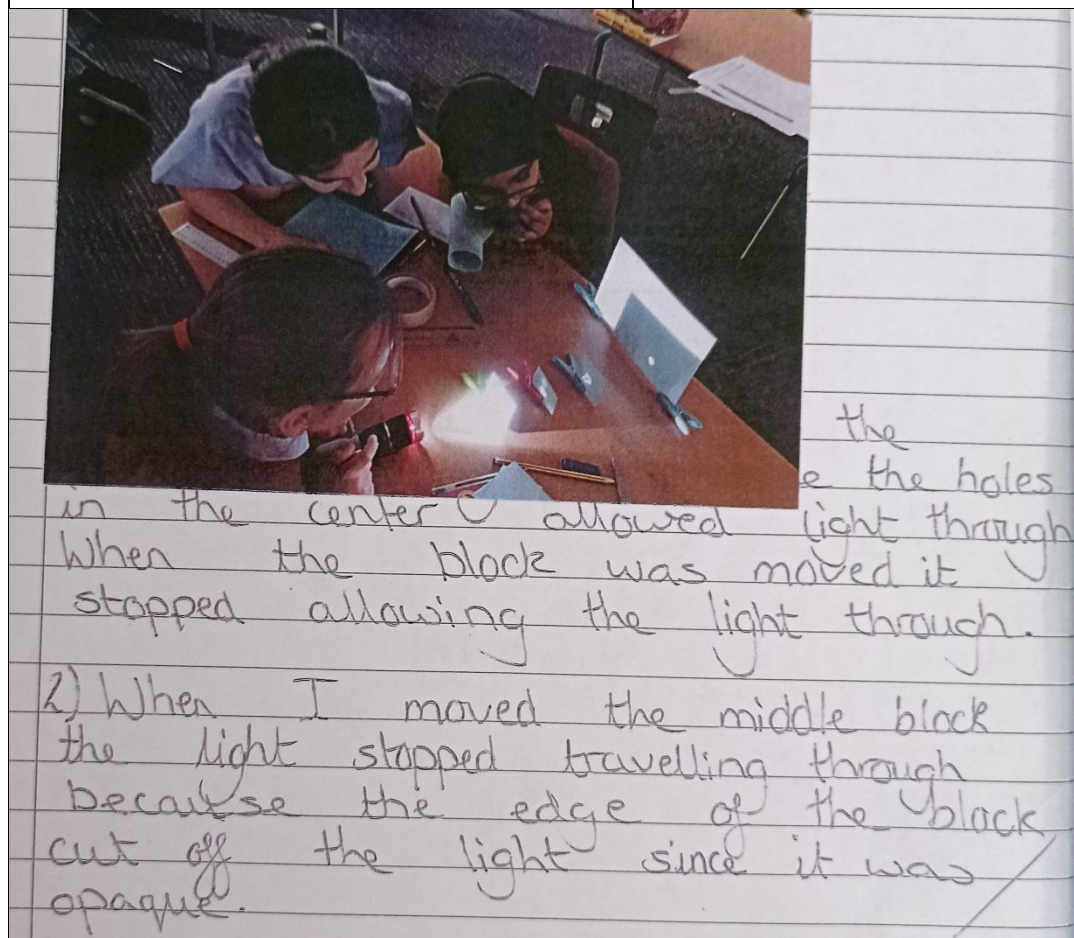


Distance object is from the torch	Size of the shadow
5cm	48cm
10cm	80cm
15cm	1m 5cm
20cm	1m 3cm
25cm	1m 10cm
30cm	1m 76

In conclusion
Conclusion - Today I have learned that the further away the object is from the torch, the longer the shadow will be.

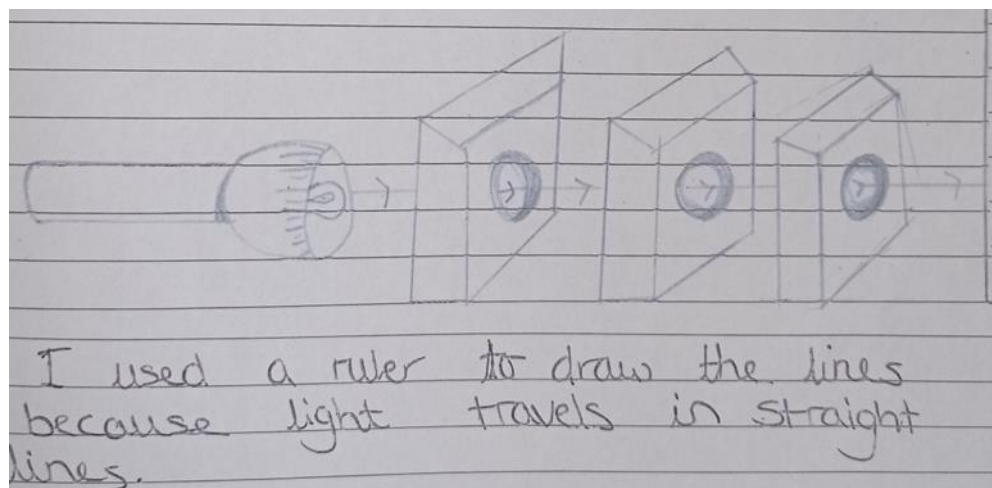
Children meeting the Working Scientifically objective would be able to record results in a table and/or graph to show the changing size of a shadow as the light source is moved.

Topic: Light	Year 6 Age 10-11	Title: Straight lines
Working Scientifically describe their own scientific ideas using evidence from a range of sources		Science content light from light sources travels in straight lines



Children explored how to direct light through card holes onto a 'screen'. They were later asked to explain how it worked in words and/or a labelled diagram.

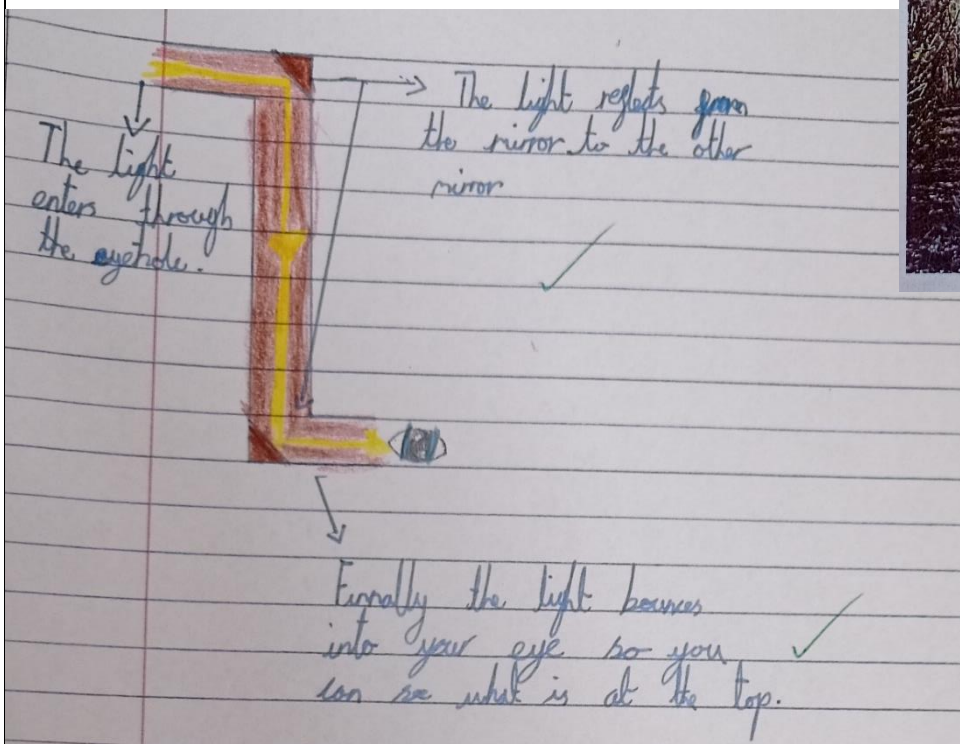
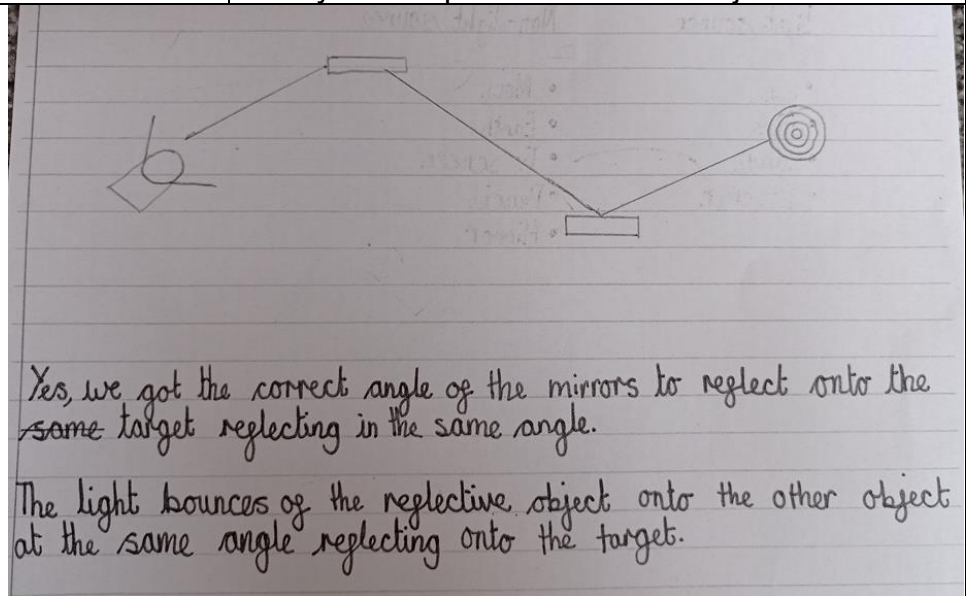
Children meeting the objective would be able to demonstrate that light travelled in a straight line through the card holes.



Topic: Light	Year 6 Age 10-11	Title: Targets and periscopes
Working Scientifically describe their own scientific ideas using evidence from a range of sources		Science content use the idea that light from light sources, or reflected light, travels in straight lines and enters our eyes to explain how we see objects

In one school, children were challenged to use mirrors to make light hit a target.

In another school, children made and explored a periscope. They were later asked to explain how it worked in a labelled diagram.



Children meeting the objective would be able to use their knowledge of light travelling in straight lines and reflection to in their explanations of how to hit the target/use the periscope.

Key Stage 2: Forces and space

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 3: Forces and magnets

Pupils should be taught to:

- compare how things move on different surfaces
- notice that some forces need contact btw objects, but magnetic forces can act at a distance
- observe how magnets attract or repel each other and attract some materials and not others
- compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials
- describe magnets as having two poles
- predict whether two magnets will attract or repel each other, depending on poles facing.

NC Year 5: Forces

- explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
- identify the effects of air resistance, water resistance & friction, that act btw moving surfaces
- recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect.

NC Year 5: Earth and space

- describe the movement of the Earth, and other planets, relative to the Sun in the solar system
- describe the movement of the Moon relative to the Earth
- describe the Sun, Earth and Moon as approximately spherical bodies
- use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

KS2 TAF expected standard: Science content for forces and space

The pupil can:

- describe the effects of simple forces that involve contact (air and water resistance, friction) [year 5], that act at a distance (magnetic forces, including those between like and unlike magnetic poles) [year 3], and gravity [year 5]
- identify simple mechanisms, including levers, gears and pulleys, that increase the effect of a force [year 5]
- describe the shapes and relative movements of the Sun, Moon, Earth and other planets in the solar system; and explain the apparent movement of the sun across the sky in terms of the Earth's rotation and that this results in day and night [year 5].

KS2 TAF expected standard: Working scientifically*

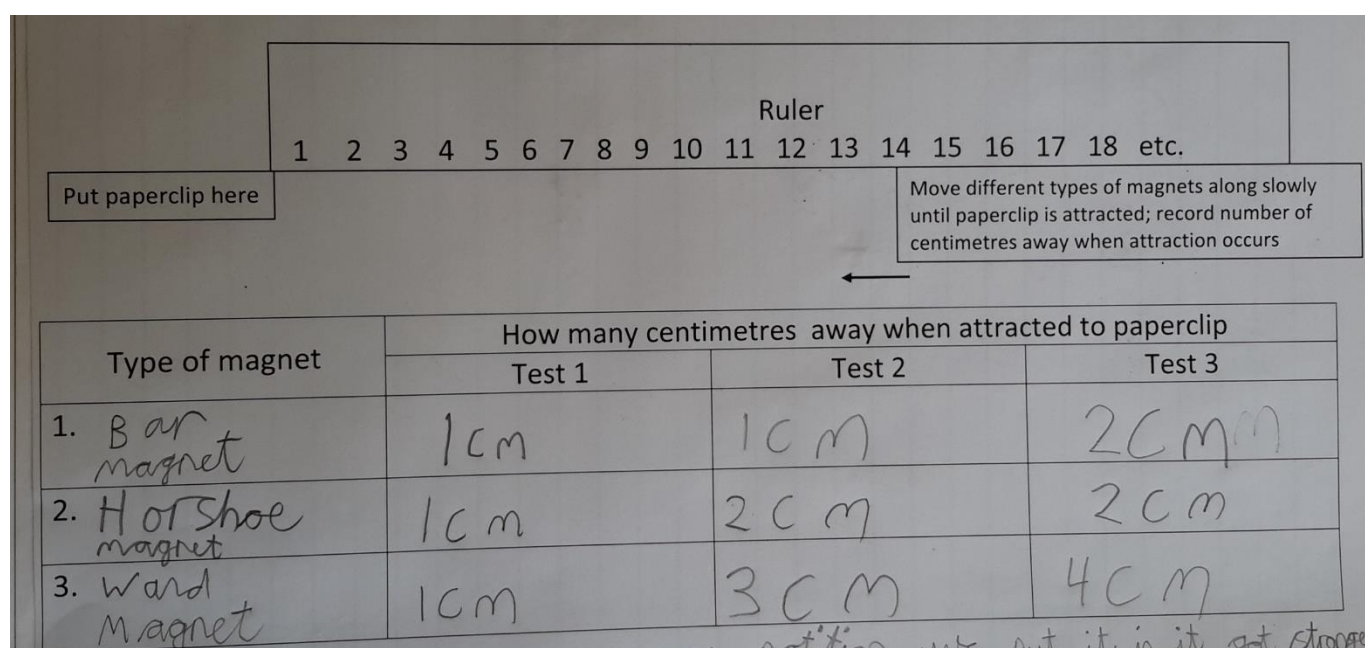
The pupil can, using appropriate scientific language from the national curriculum:

- **describe and evaluate their own and others' scientific ideas** related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own Qs about the scientific phenomena that they are studying, & **select most appropriate ways to answer these Qs, recognising & controlling variables where necessary** (i.e. observing changes over different periods of time, noticing patterns, grouping & classifying things, **carrying out comparative & fair tests**, & **finding things out using a wide range of secondary sources**)
- use a range of scientific equipment to **take accurate and precise measurements** or readings, with repeat readings where appropriate
- **record data and results** using scientific diagrams and labels, classification keys, **tables**, **scatter graphs**, **bar and line graphs**
- **draw conclusions, explain & evaluate their methods/findings**, communicate in variety of ways
- raise further questions that could be investigated, based on their data and observations.

**Statements exemplified in this topic are in bold.*

Topic: Forces	Year 3 Age 7-8	Title: Magnets investigation
Working Scientifically Do: use a range of scientific equipment to take accurate readings		Science content In the context of: effects of simple forces that act at a distance (magnetic forces, including those between like and unlike magnetic poles).

Both classes were investigating the strength of magnets by measuring how close a magnetic object could get to the magnet before it was attracted. One class chose to try different magnets, the other chose different object. One group also tried this in a tray of water to see if magnetism worked through water as well as air.



Put paperclip here

Ruler
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 etc.

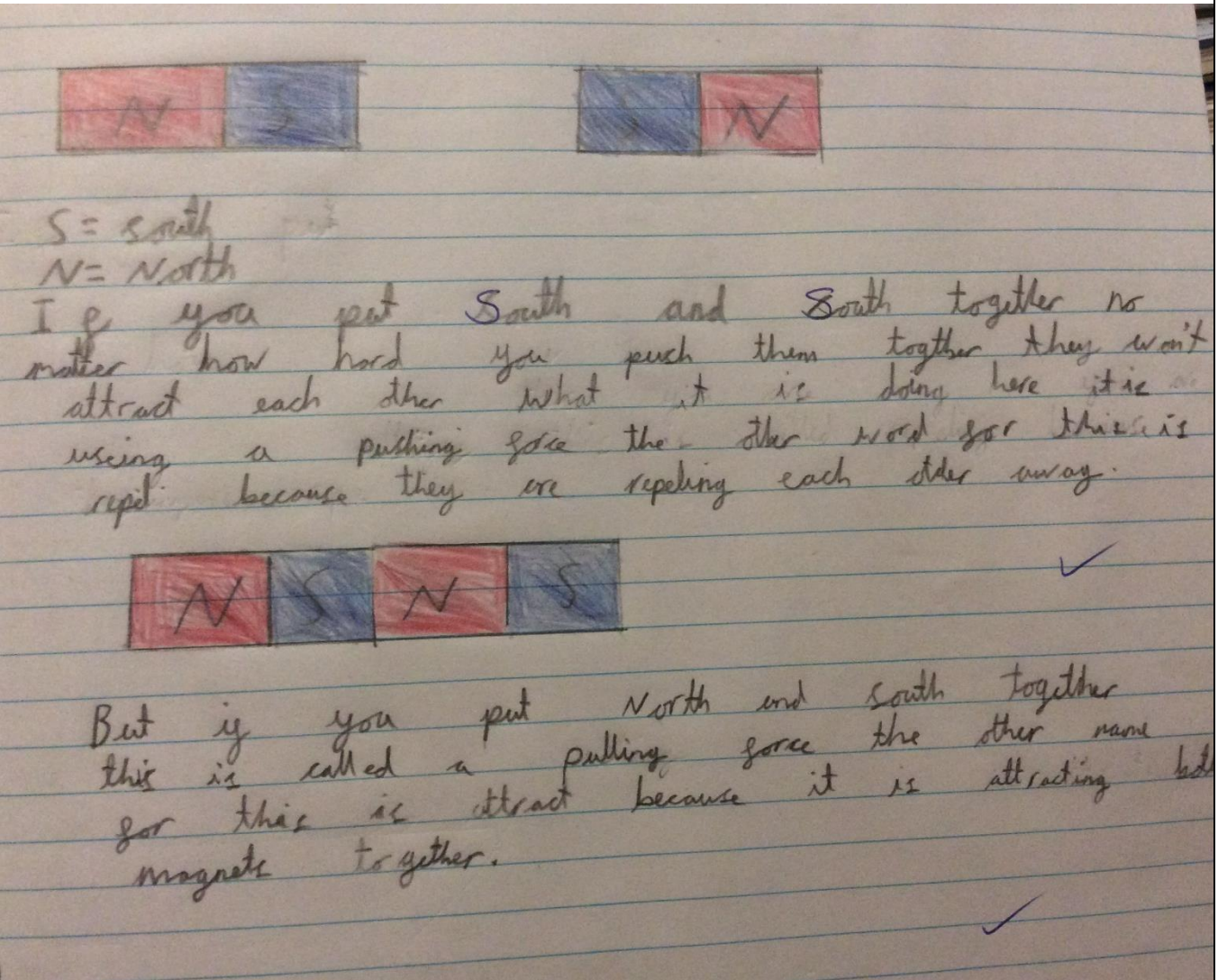
Move different types of magnets along slowly until paperclip is attracted; record number of centimetres away when attraction occurs

Type of magnet	How many centimetres away when attracted to paperclip		
	Test 1	Test 2	Test 3
1. Bar magnet	1cm	1cm	2cm
2. Horseshoe magnet	1cm	2cm	2cm
3. Wand Magnet	1cm	3cm	4cm

Magnetic object	In the water test 1	In the water test 2	Out of the water test 1	Out of the water test 2
boiled	28cm	27cm	27.9cm	27cm
Pin	28cm	27cm	27.6	28cm
Paperclip	27.9cm	28.2cm	28cm	28.3cm

Children meeting the **Working Scientifically objective** would be able to record results clearly enough so that someone else could read them.

NB. The water group held their ruler the other way (so the object was 2/3cm away from magnet).

Topic: Forces	Year 3 Age 7-8	Title: Magnetic poles
Working Scientifically describe and evaluate their own scientific ideas using evidence from a range of sources		Science content describe the effects of simple forces that act at a distance (magnetic forces, including those between like and unlike magnetic poles)
<p>After exploring bar magnets, the children were asked to draw and write about what they had found out about like and unlike magnetic poles.</p> 		
<p>Children meeting the content objective would be able to explain in words, pictures or orally that like poles repel and opposite poles attract.</p>		

Topic: Forces	Year 3 Age 7-8	Title: Block down ramps plan
Working Scientifically Plan: select the most appropriate ways to answer their questions, recognising and controlling variables where necessary (comparative and fair testing)		Science content (In the context of: describe the effects of simple forces that involve contact – friction).

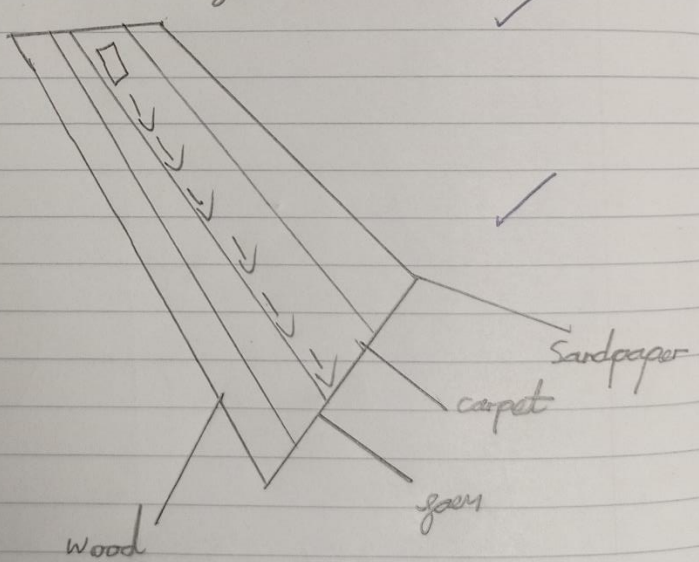
prediction

I think that the object will travel down the wood because it is smoother but if it traveled down the sand one it would be slower

Method

First we ^{sp.} carefully placed the object on the ramp and let go. Then we timed how long it took. Finally we put the results on paper and saw how long it took.

Diagram



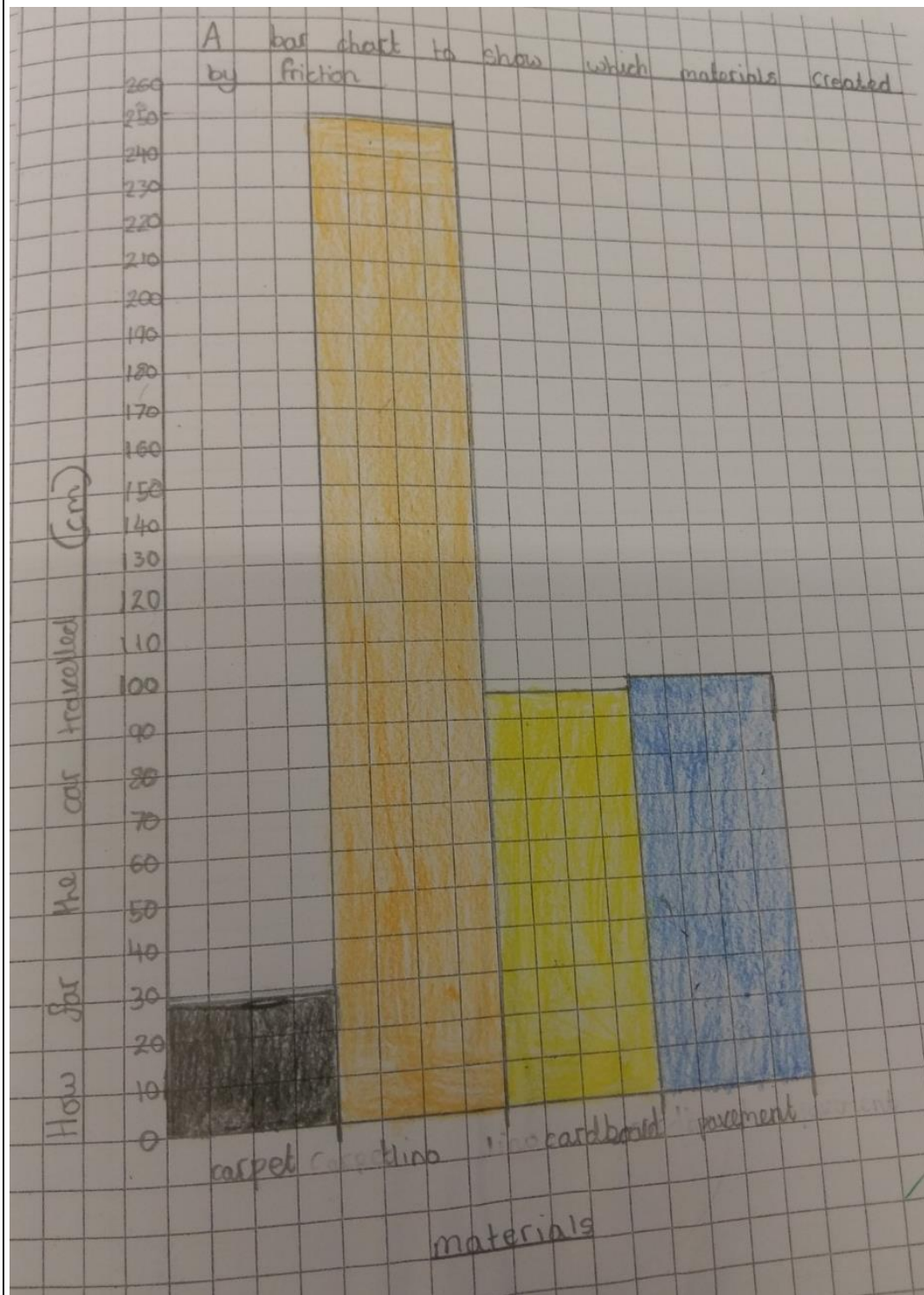
results

Sand paper	3:77
carpet	2:26
grass	2:3
Wood	1:6

After exploring the effects of friction with cars travelling down different surfaces, children were asked to explain how they could find out how well the block would move down.

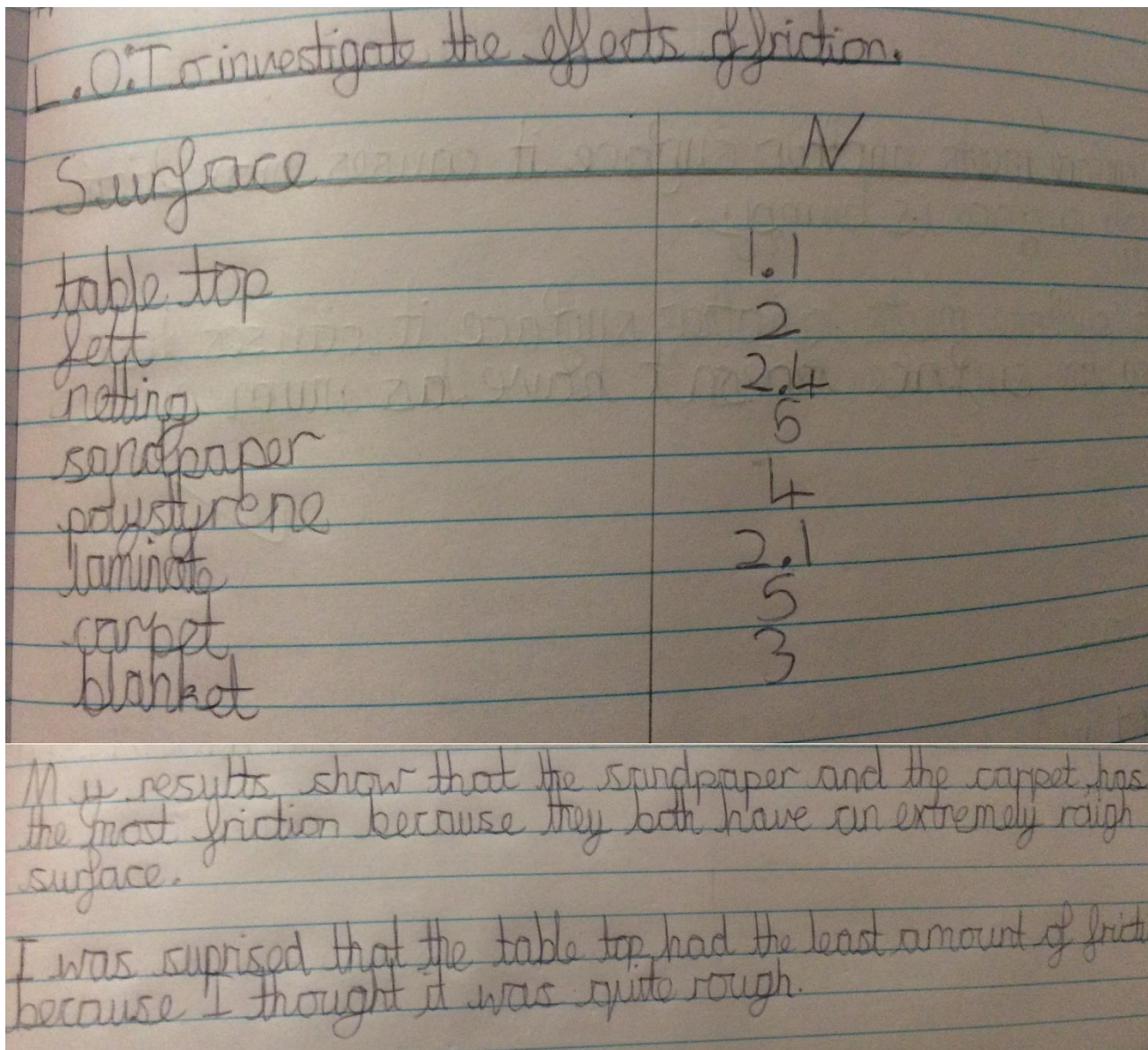
Children meeting the Working Scientifically objective would be able to draw and/or write a plan that others could follow.

Topic: Forces	Year 3 Age 7-8	Title: Cars down ramps graph
Working Scientifically Review: record data and results using bar graphs (comparative and fair testing)		Science content (In the context of: describe the effects of simple forces that involve contact – friction)




After investigating how far cars travelled down a ramp and across different surfaces, children were shown how to plot their results on a bar graph.

Children meeting the Working Scientifically objective would be able to present their results clearly enough for others to be able to read.

Topic: Forces	Year 5 Age 9-10	Title: Friction investigation
Working Scientifically Do: use a range of scientific equipment to take accurate and precise measurements (comparative and fair testing)		Science content describe the effects of simple forces that involve contact - friction
<p>Children were asked to investigate the effect of friction by measuring the force needed to drag an object across different surfaces.</p>  <p>The image shows a student's handwritten work on lined paper. At the top, it says 'L.O: To investigate the effects of friction.' Below this is a table with two columns: 'Surface' and 'N'. The table lists various surfaces and their corresponding friction measurements in Newtons (N). The surfaces listed are table top, felt, netting, sandpaper, polystyrene, laminate, carpet, and blanket. The measurements are 1.1, 2, 2.4, 5, 4, 2.1, 5, and 3 respectively. Below the table, the student writes a conclusion: 'My results show that the sandpaper and the carpet has the most friction because they both have an extremely rough surface.' and 'I was suprised that the table top had the least amount of frictio because I thought it was quite rough.'</p>		
Children meeting the Working Scientifically objective would be able to use a newton meter to measure the force needed to pull an object across a range of surfaces.		

Topic: Forces	Year 5 Age 9-10	Title: Sledge friction
Working Scientifically Review: describe and evaluate their own and others' scientific ideas, using evidence from a range of sources		Science content Describe the effects of simple forces that involve contact (friction)



Daniel and Sophie want to make a sled that they can pull along the ground. They are arguing about what material to make the bottom of the sled from. Sophie says that to make the sled move more easily, they need to make the bottom out of a smooth material. Daniel says that the material they make the sled out of will make no difference to how easily it moves. Who do you think is right?

I think Sophie is correct because a rough surface creates more friction. It also depends on the ground and the weight, in the sled. The ground underneath the sled also needs to be smooth or wet so the material doesn't damage it. The ground should be snow, grass or mud so the bottom of the sled doesn't get damaged or ruined. Forces are measured in newtons. It's represented with an "(N)".

	Drag 1	Drag 2	Drag 3
Sand Paper	7 newtons	7 newtons	7 newtons
Foam	1 newtons	2 newtons	1 newtons
Tin foil	0.2 newtons	0.2	

1. The tin foil created the least friction.
2. The sand paper created the most friction.
3. The foil would be the best material.
4. I think Sophie was correct.

Children were asked to consider the best material to attach to the bottom of a sledge. They tested their ideas by measuring the newtons required to pull a block covered in sand paper, foam or foil.

Children meeting the objective would be able to explain their ideas and findings in terms of friction.

Children were asked to consider the best material to attach to the bottom of a sledge. They tested their ideas by measuring the newtons required to pull a block covered in sand paper, foam or foil.

Children meeting the objective would be able to explain their ideas and findings in terms of friction.

Topic: Forces	Year 5 Age 9-10	Title: Spinner results
Working Scientifically Do: use a range of scientific equipment to take accurate and precise measurements, with repeat readings where appropriate (comparative and fair testing)		Science content (In the context of the effects of simple forces that involve contact – air resistance)



Children were asked to investigate the effect of air resistance by measuring the time for different shaped spinners to fall.

Shape of the spinner to fall

Wings	1	2	3	4	AV
Wiggly line	1.15	0.59	0.92	0.35	0.775
Straight	0.90	0.79	0.50	1.19	0.845
Spiky	2.12	1.33	0.30	0.9	1.08.75
Gagedy	0.73	2.41	0.99	1.03	1.29

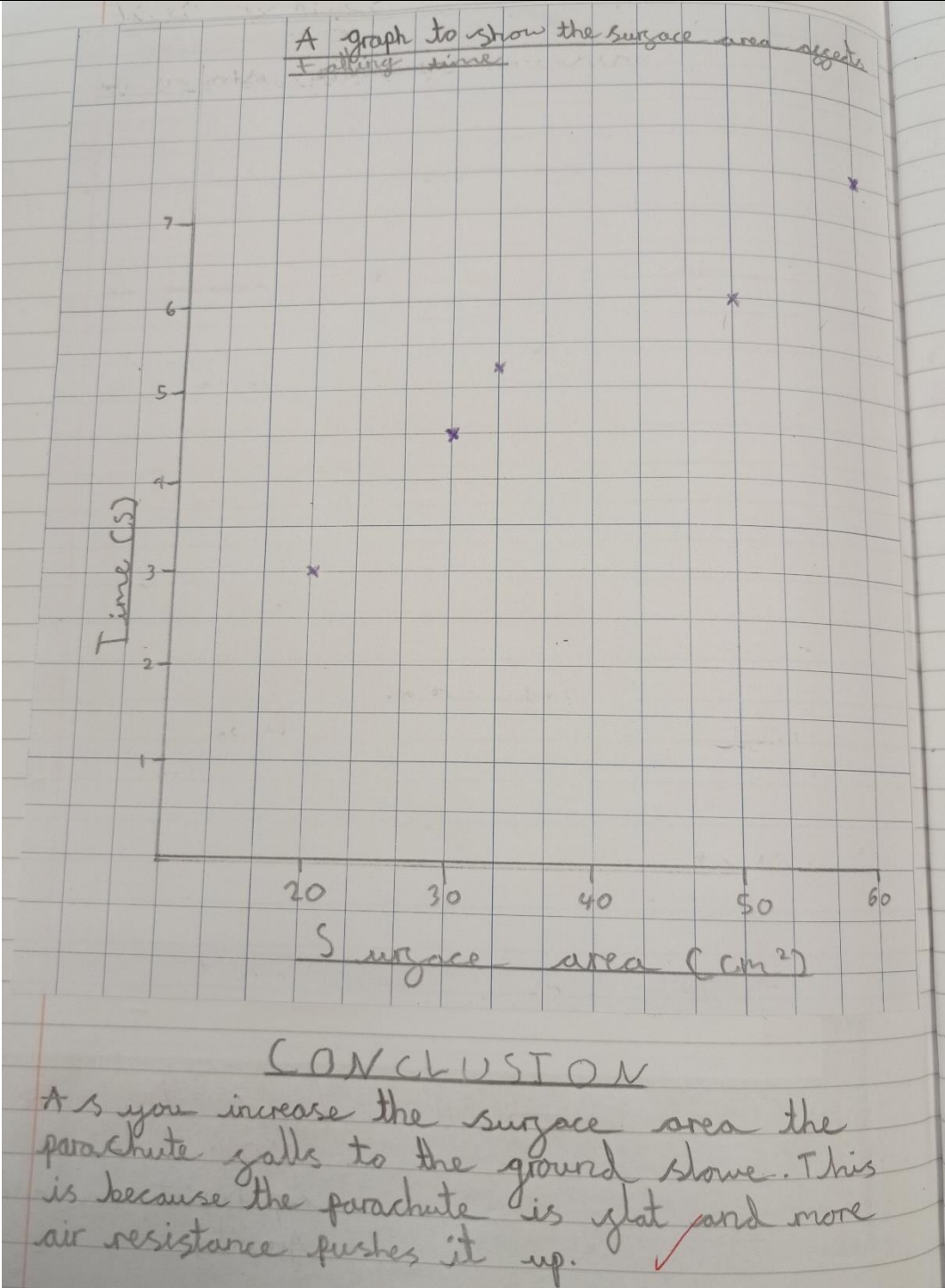
To collect and record results effectively.

spinner	1	2	3	Average
A	1.92	1.41	1.26	1.53
B	0.86	0.73	0.96	0.85
C	0.68	0.79	0.73	0.73
Short stem	1.34	1.12	1.10	1.18
Long stem	0.92	0.79	1.1	0.93
Long stem	1.10	0.94	0.73	0.92
short wing				
rainbow	0.77	1	1.6	1.12
normal	0.81	1.26	1.14	1.07

We found that the best spinner was A because it has longer wings and a shorter stem so it has more air resistance.

Children meeting the Working Scientifically objective would be able to use a stopwatch to measure the time taken to fall, repeating readings to improve accuracy.

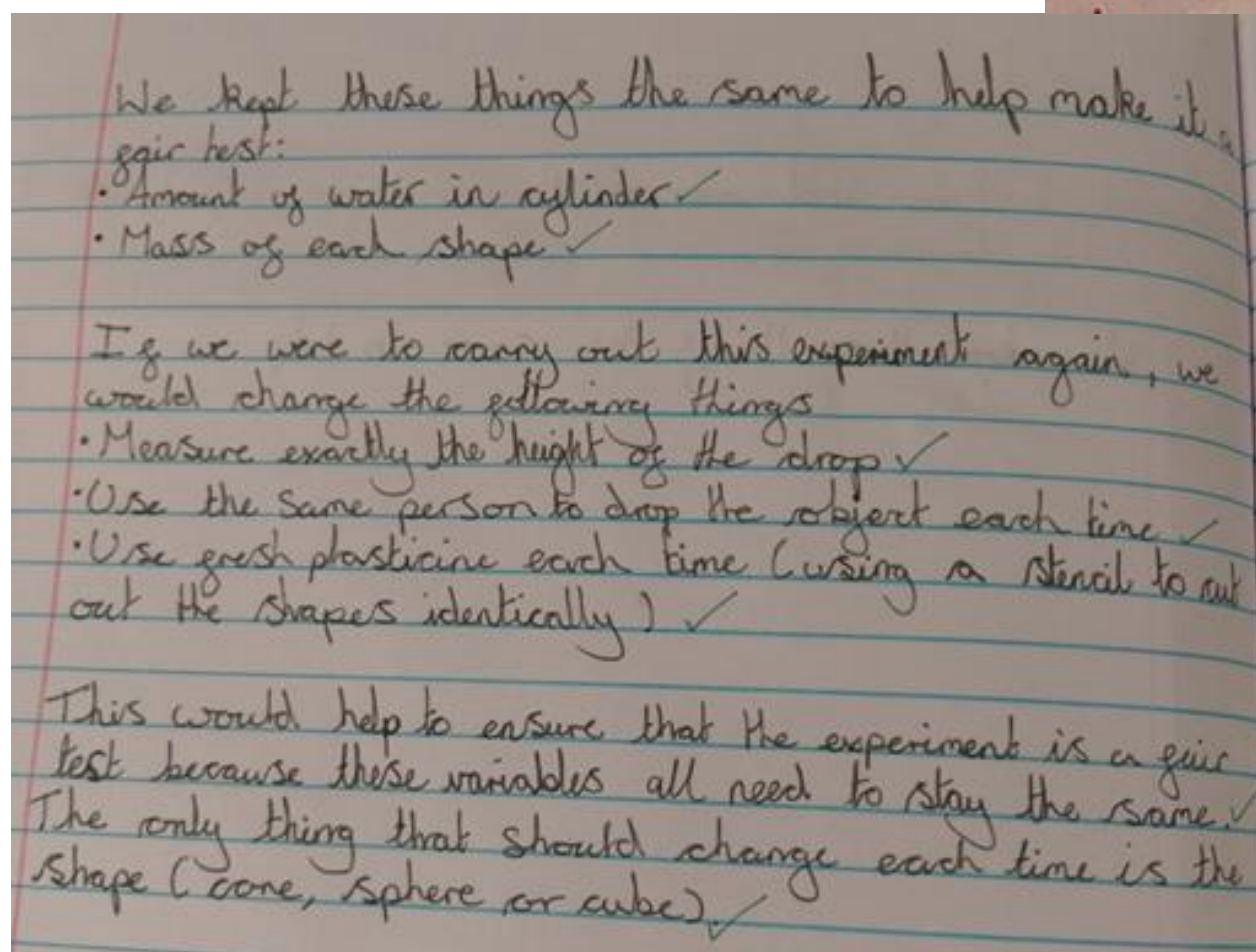
Topic: Forces	Year 5 Age 9-10	Title: Parachute investigation
Working Scientifically Review: record data and draw conclusions, communicating these in a variety of ways (comparative and fair testing)		Science content describe the effects of simple forces that involve contact – air resistance
<p>Children were asked to investigate the effect of air resistance by measuring the time for different sized parachutes to fall.</p> <p>Children meeting the Working Scientifically objective would be able to draw conclusions from their results, showing or describing any patterns they have found.</p>		



Topic: Forces	Year 5 Age 9-10	Title: Aquadynamics evaluation
Working Scientifically Review: explain and evaluate their methods and findings (comparative and fair testing)		Science content (In the context of: the effects of simple forces that involve contact - water resistance).

Following class investigations into water resistance (dropping plasticine shapes through water), the children evaluated their method.


Children meeting the objective would be able to consider the fairness of their investigation and/or the accuracy of their results. They may suggest improvements to their method, if they were to repeat the investigation.



Topic: Forces	Year 5 Age 9-10	Title: Levers explanation
Working Scientifically Review: describe and evaluate their own scientific ideas, using evidence from a range of sources		Science content identify simple mechanisms that increase the effect of a force - levers

Children were asked to explore, observe and explain the effect of moving the pivot position in a lever (seesaw).

Lever



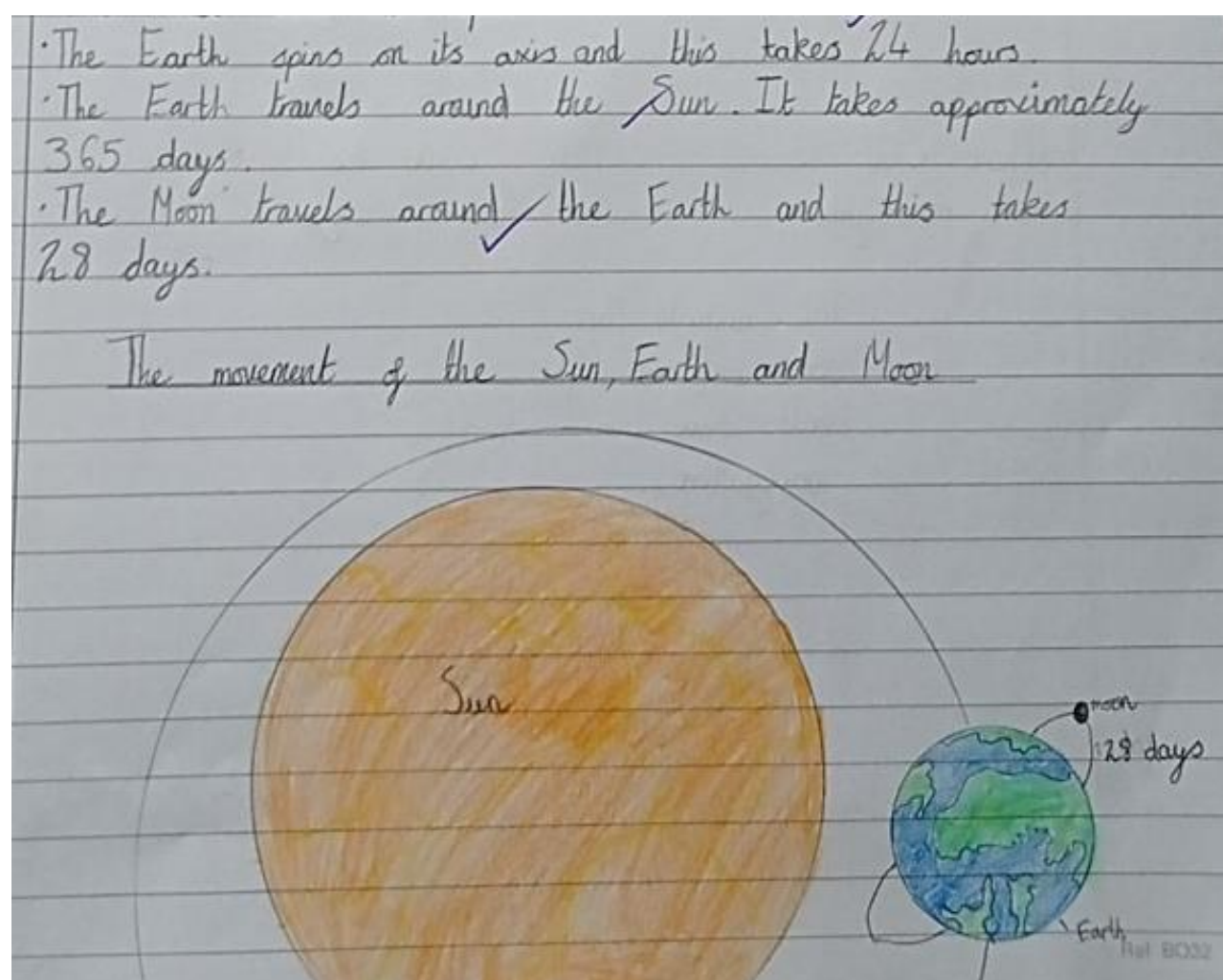
Here, two smaller people are managing to lift a heavier person using a lever. The reason why the larger person isn't lifting the heavier person up in picture 2, is because she is nearer to the pivot. There, she is generating less force to lift the teacher up. When she goes to the end she will generate more force to lift the teacher up. This is ~~not~~ partly why the smaller person in picture 1 is lifting the teacher up.

The reason this is possible is because the position of the pivot is not in the centre. There, ~~is~~ one end is shorter and therefore requires less force to lift.

Children meeting the objective would be able to recognise that a lever can help a smaller force (the weight of the child) to have a greater effect (lift the adult). They may explain this in a labelled diagram, in writing or orally.

Topic: Earth and space	Year 5 Age 9-10	Title: Earth orbits around Sun
Working Scientifically		Science content describe the shapes and relative movements of the Sun, Moon and Earth

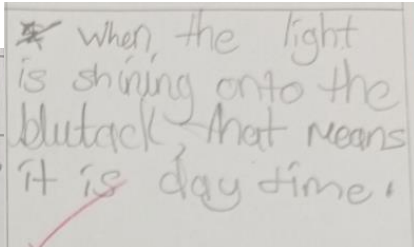



Children were asked to summarise their learning about the Sun, Earth and Moon in words and a labelled diagram.



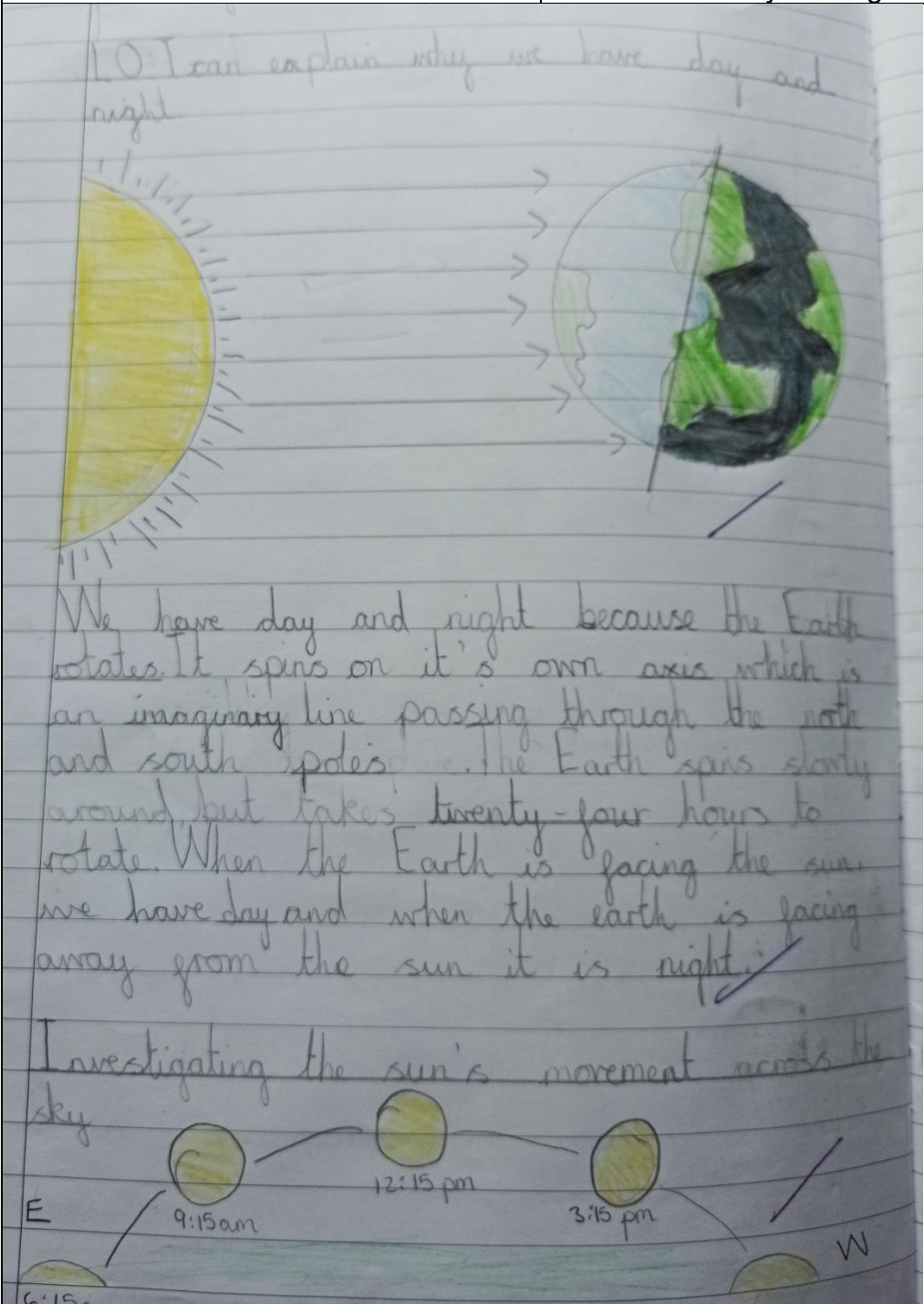
Children meeting the objective would be able to show or describe the orbit of the Earth around the Sun and the Moon around the Earth.

Topic: Earth and space	Year 5 Age 9-10	Title: Day night model
Working Scientifically (modelling)		Science content explain the apparent movement of the sun across the sky in terms of the Earth's rotation and that this results in day and night

Children were asked to explore and explain what was happening to day and night using a globe, light source and 'blutack' to represent their place in the world.

Can you explain what is happening? What can you see?		
	In this picture it shows day time because the sun is shining at blutack	When the light is shining just past the blutack, that means it is evening. ✓
	In this picture it shows evening because the sun is only light up half of it. ✓	When the light is shining past the blutack, that means that it is night time. ✓
	In this picture it is showing night time because the earth has turned away from the sun.	

Children meeting the objective would be able to explain that at night the 'blutack' person is not shone upon, or is faced away from the sun due to the Earth turning on its axis.

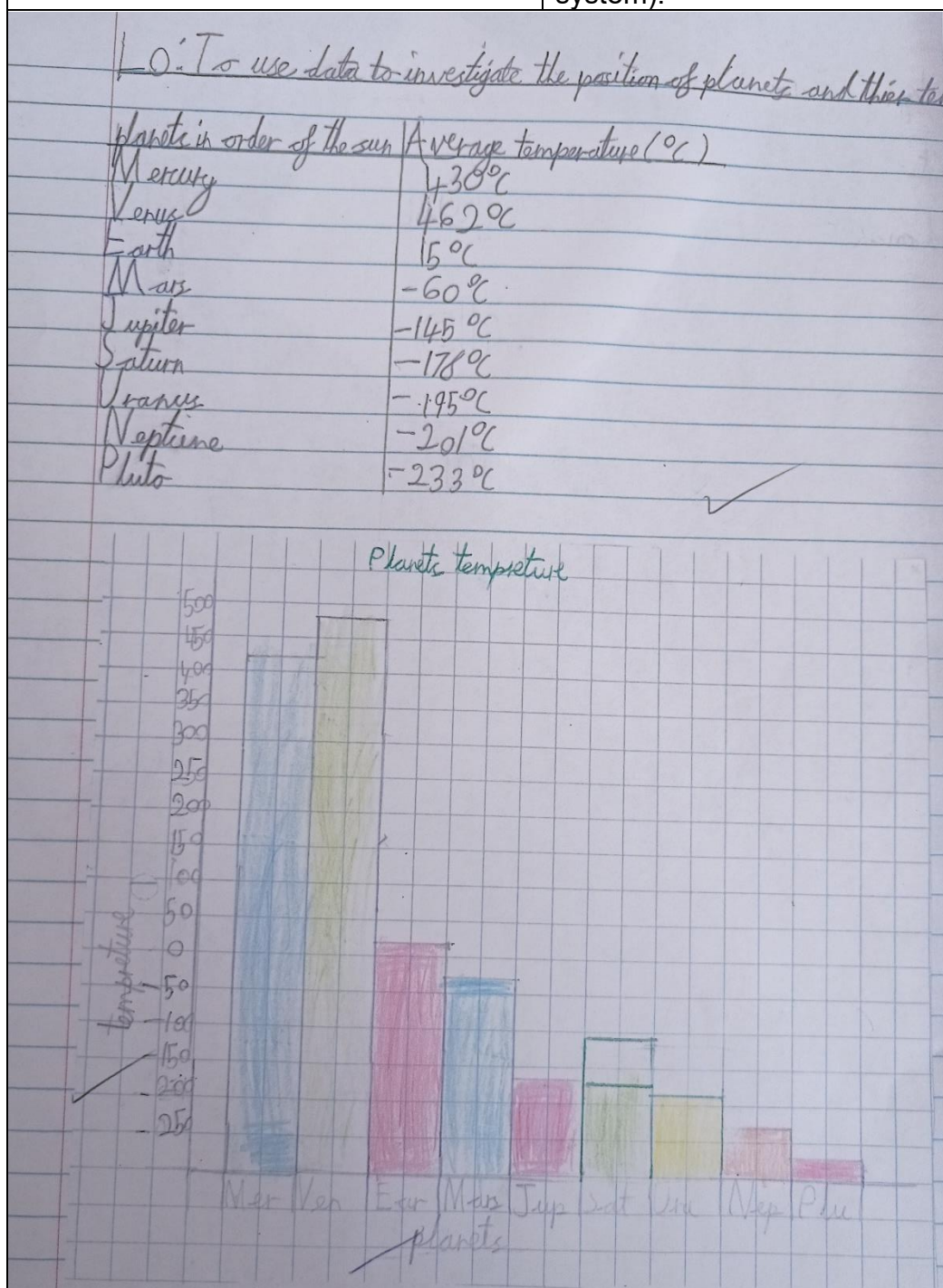
Topic: Earth and space	Year 5 Age 9-10	Title: Day night explanation
Working Scientifically		Science content explain the apparent movement of the sun across the sky in terms of the Earth's rotation and that this results in day and night
		

Children were asked to draw and write about the causes of day and night.

Children meeting the objective would be able to show in diagrams or words recognition that the Earth spins on its axis and this is why we experience day and night.

NB. Children may need to do this in a variety of ways to develop their understanding,

Topic: Earth and space	Year 5 Age 9-10	Title: Planet position research
Working Scientifically Do: record data using tables and bar graphs (research)		Science content (In the context of: describe the relative movements of the other planets in the solar system).



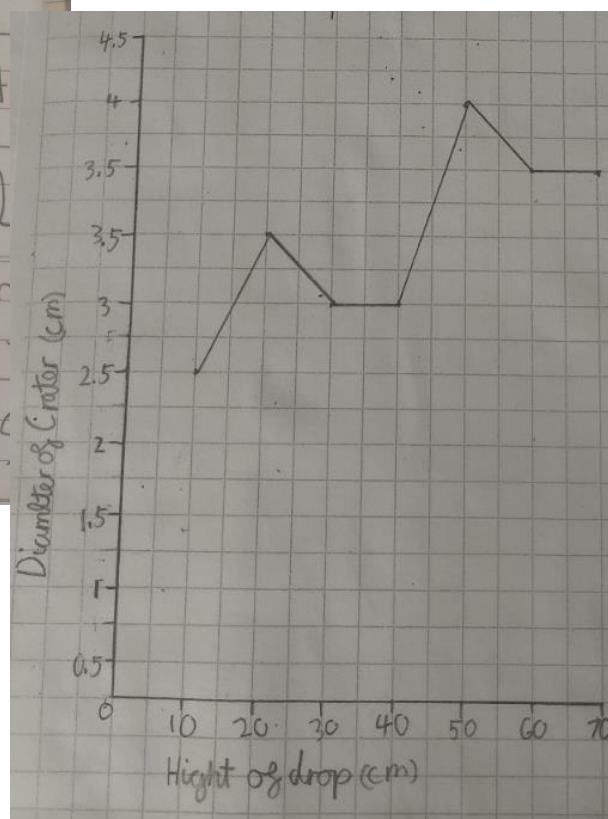
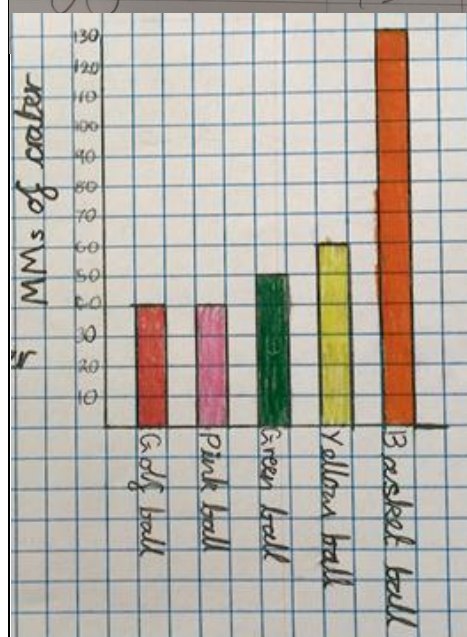
Children were asked to research the average temperatures on different planets (this class agreed to include the dwarf planet of Pluto to add further data for discussion of any patterns found).

Children meeting the objective would be able to present their findings clearly in a table and/or graph.

Topic: Space or Forces	Year 5 Age 9-10	Title: Craters results
Working Scientifically Do: record results using tables and/or line graphs (comparative and fair testing)		Science content (in the context of effects of gravity)

Height of drop (cm)	Depth of crater (mm)			mean average
20	7	8	10	8.3
30	12	10	10	10.6
40	15	12	12	13
50	14	14	14	14
60	11	12	13	12
70	14	13	15	14
80	15	15	15	15

Children dropped balls in a tray of sand to model crater formation on the moon. They chose to change the height of the drop or the size of ball. They chose to measure the diameter or depth of the crater.



Children meeting the objective would be able to record their results in a table and/or an appropriate graph.

Key Stage 2: Electricity

Teaching of the National Curriculum (NC) leads to a summative teacher assessment judgement against the Teacher Assessment Framework (TAF) of 'meeting' or 'not yet meeting'. These exemplification materials provide examples of the kinds of things pupils could do in class to support ongoing assessment.

NC Year 4: Electricity

Pupils should be taught to:

- Identify common appliances that run on electricity
- construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers
- identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery
- recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit
- recognise some common conductors and insulators, and associate metals with being good conductors.

NC Year 6: Electricity

- associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit
- compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches
- use recognised symbols when representing a simple circuit in a diagram.

KS2 TAF expected standard: Science content for electricity

The pupil can:

- use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it; and use recognised symbols to represent simple series circuit diagrams [year 6]

KS2 TAF expected standard: Working scientifically*










The pupil can, using appropriate scientific language from the national curriculum:

- describe and evaluate their own and others' scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources
- ask their own questions about the scientific phenomena that they are studying, and select the most appropriate ways to answer these questions, recognising and controlling variables where necessary (i.e. observing changes over different periods of time, noticing patterns, **grouping and classifying things, carrying out comparative and fair tests**, and finding things out using a wide range of secondary sources)
- **use a range of scientific equipment** to take accurate and precise measurements or readings, with repeat readings where appropriate
- **record data and results using scientific diagrams and labels**, classification keys, tables, scatter graphs, bar and line graphs
- **draw conclusions**, explain and evaluate their methods and findings, communicating these in a variety of ways
- raise further questions that could be investigated, based on their data and observations.

**The working scientifically objectives will be taught in conjunction with science content. Statements exemplified in this topic are in bold.*

Topic: Electricity	Year 4 Age 8-9	Title: Conductor or insulator
Working Scientifically Do: use a range of scientific equipment, record data using scientific tables (group and classify)	Science content Y4 NC: recognise some common conductors and insulators, and associate metals with being good conductors KS2 TAF: use simple apparatus to construct and control a series circuit	

Children were asked to create a simple circuit to test whether everyday materials would conduct electricity.

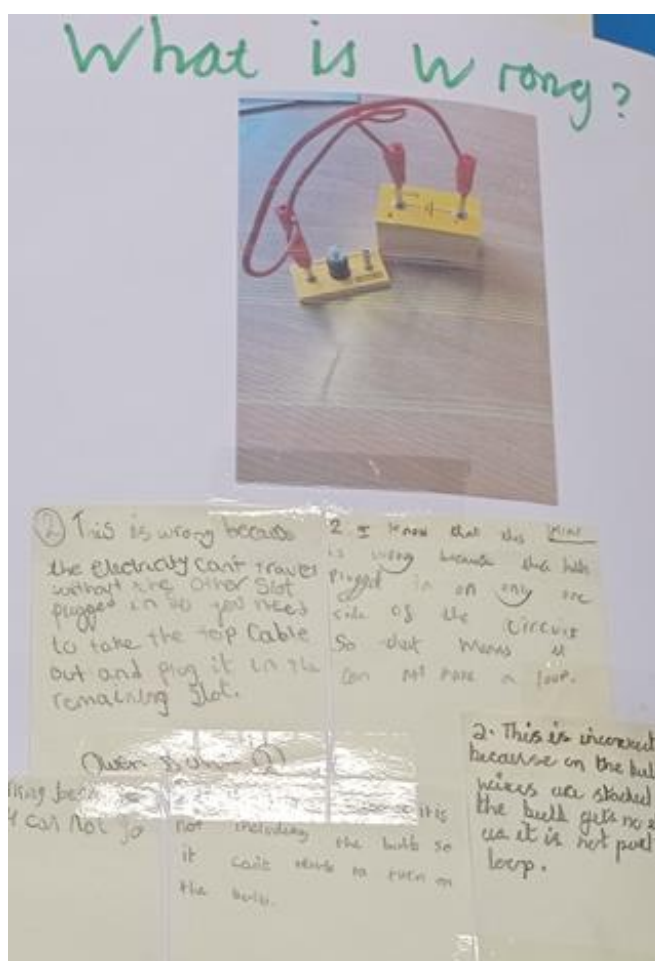
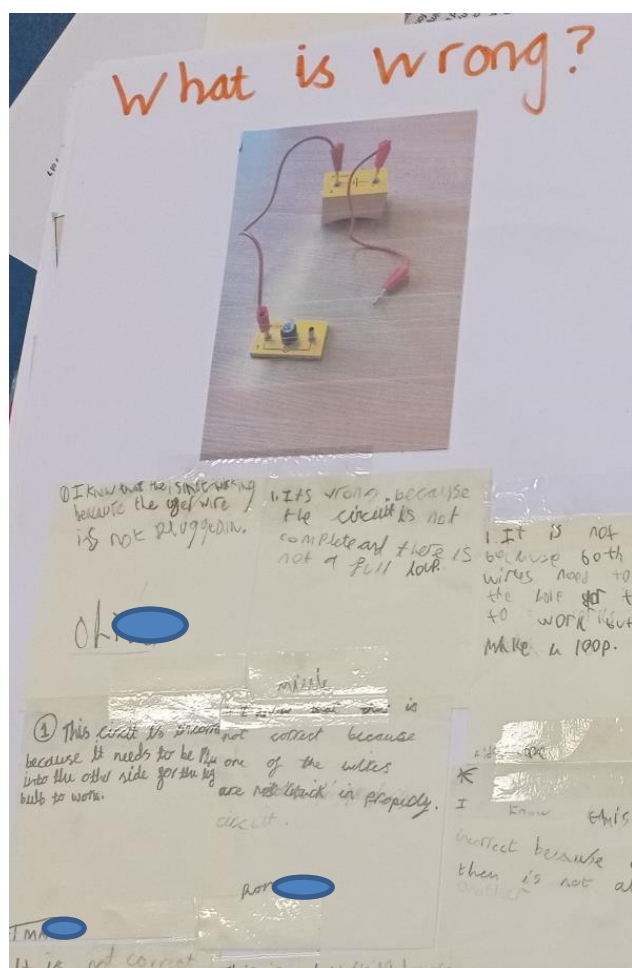
item 	picture 	prediction: conductor or insulator?	result: conductor or insulator?
coin		Conductor	conductor
tin foil		conductor	conductor
wooden spoon		insulator	insulator
Sharpener		Conductive	Conductive on the metal
Scissors		Conductive	conductor
Paper clip		Conductive	con
metal wire		conductive	con



Children meeting the objective would be able to recognise some common conductors and insulators, and associate metals with being good conductors.

Topic: Electricity	Year 4 Age 8-9	Title: Circuit mistakes
Working Scientifically describe and evaluate their own and others' scientific ideas		Science content describe how the circuit may be affected when changes are made to it

Children were asked to explain on post-its what was wrong with the circuits.



Example comments on the post-its:

"This is incorrect because one of the wires is not attached to the bulb so it's not in a loop."

"It's wrong because the circuit is not complete and there is not a full loop."

"This is wrong because the electricity can't travel without the other slot plugged in."

Children meeting the objective would be able to identify the importance of a complete circuit for the bulb to light.

Topic: Electricity	Year 6 Age 10-11	Title: Circuit diagrams
Working Scientifically		Science content use recognised symbols to represent simple series circuit diagrams

How are circuits drawn using universal symbols?

These cells connected, It needs a negative and a positive.

Cell Switch (open)

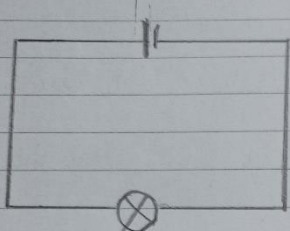
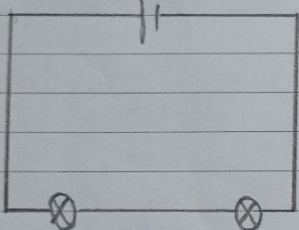
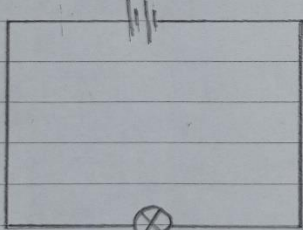
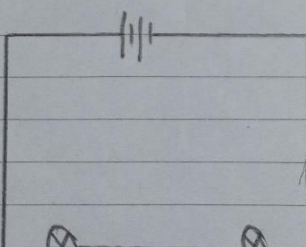
Battery Lamp Wire Bulb

Children were asked to correctly redraw the circuit diagrams (having been given some that contained mistakes).

Children meeting the objective would be able to spot the errors in the diagrams and redraw them correctly.

Topic: Electricity	Year 6 Age 10-11	Title: Circuit results
Working Scientifically Do: record data and results using scientific diagrams and labels (comparative and fair tests)	Science content use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it; and use recognised symbols to represent simple series circuit diagrams	

Thursday 4th November 2021 - I can change one component and then record any differences to the circuit.

Circuit Diagram.	What happened.
	The bulb is very bright I used a 1.5 volt battery.
	Both of the bulbs were dim the 1.5 volt battery wasn't powerful enough.
	The battery/cell was overpowered making the bulb even brighter and I used 2x 1.5 volt batteries which made a 3 volt battery.
	The battery/cell had enough power supplying the bulbs with enough power to shine.

Children were asked to make a simple circuit and investigate what happened when changing one component.

Children meeting the objective would be able to systematically investigate and record the effect of changes to their circuit.

Children were asked to make a simple circuit and investigate what happened when changing one component.

Children meeting the objective would be able to systematically investigate and record the effect of changes to their circuit.

Topic: Electricity	Year 6 Age 10-11	Title: Changing circuits
Working Scientifically Review: draw conclusions (comparative and fair testing)		Science content use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it



When we added the cell to our circuit, the light was dim because of the lack of power that the cell gave off.



When we added 2 cells to our circuit, the light was still dim but a bit brighter because than the circuit with 1 cell.



When we added 3 cells to our circuit, the light got brighter but it was still a little dim. The power that the 3 cells gave off was normal.



When we added 4 cells to our circuit, then the light turned really bright brighter than before because there was more energy flowing through the circuit.



When we added 5 cells the light was really bright because of how much of the energy used in the circuit.

Why did this happen?
This happened because the more battery cells there were the more energy was produced

Children were asked to make a simple circuit and investigate what happened when more components were added, photographing the results. The following lesson, they were asked to describe how the circuit had been affected.

Children meeting the objective would be able to systematically investigate and explain how they had changed their circuit.