STEM
LEARNING

Assessment and progression in primary science

Cheshire and Wirral Science Learning Partnership

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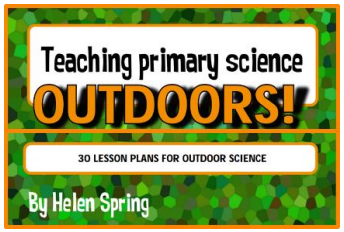
Intended Learning Outcomes

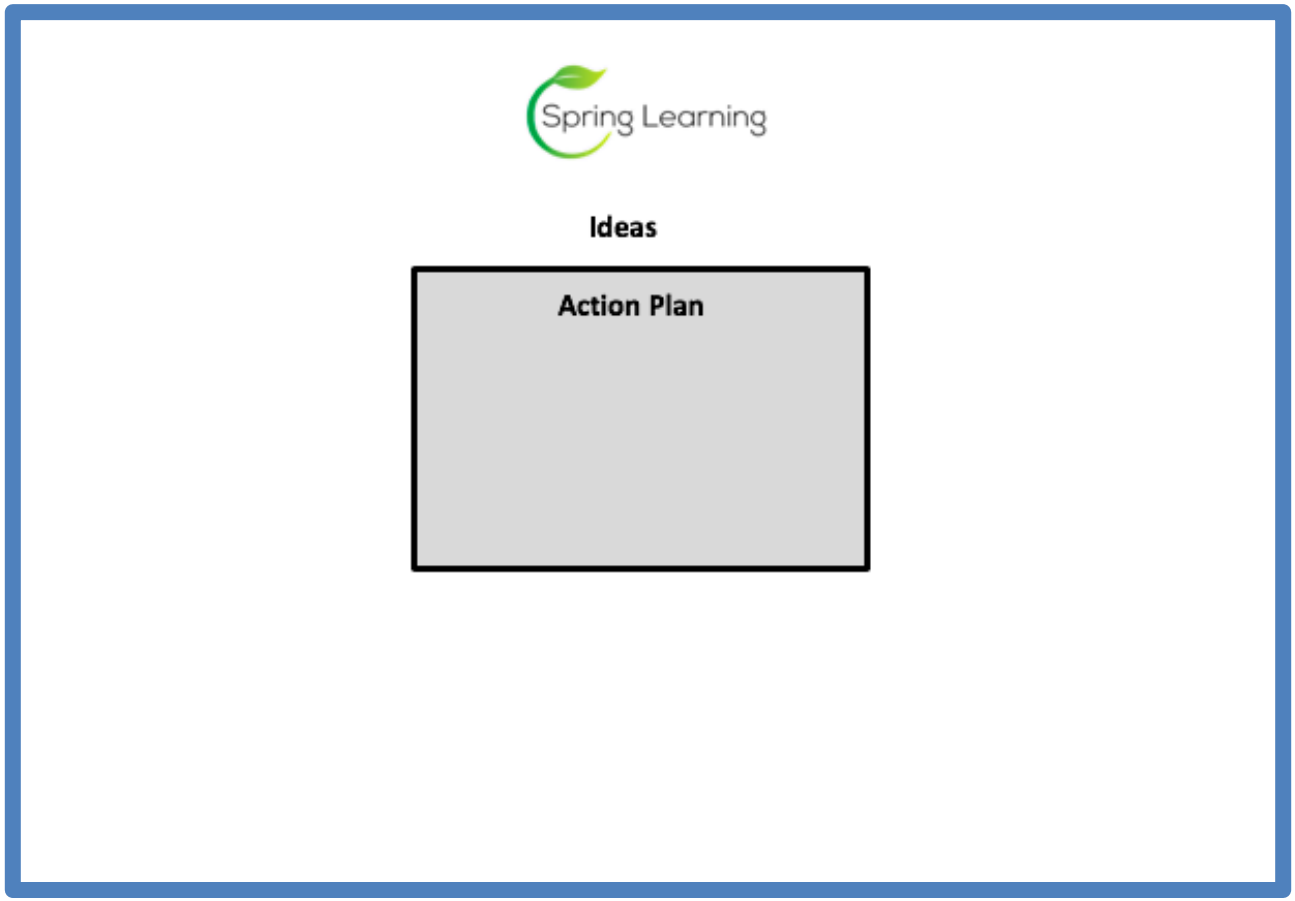
By the end of the session you will be able to:

- know the current national requirements for science assessment
- acquire a deeper understanding of progression
- use a range of AfL strategies effectively to promote children's learning
- discuss the purpose of assessment
- examine the distinction between tracking and assessment
- evaluate our schools' approaches to assessing primary science
- explore resources that will help us with assessment and tracking

Spring Learning



Action Planning



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Aims of the Primary Science Curriculum

Aims

The national curriculum for science aims to ensure that all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the **uses and implications** of science, today and for the future.

Intent of assessment?

- Who is assessment for?

- Principles of Assessment
  - Effective assessment systems:
    - **Give reliable information to parents about how their child, and their child's school, is performing**
    - **Help drive improvement for pupils and teachers**
    - **Make sure the school is keeping up with external best practice and innovation**

View from Ofsted

Quality of education

Inspectors will make a judgement on the quality of education by evaluating the extent to which:

- teachers and leaders use assessment well, for example to help learners embed and use knowledge fluently or to check understanding and inform teaching. Leaders understand the limitations of assessment and do not use it in a way that creates unnecessary burdens for staff or learners.

from “The education inspection framework”
Published May 2019

Where are we now?

Thinking about these questions –

- What's happening in your class? And/or across your whole school?
- What approaches to assessment in science are you aware of? E.g. Are teachers using AfL strategies in science, what other science assessment is currently in place?
- How are end of year/KS assessments in Science currently made?
- Is any tracking or record keeping taking place?

Where are we now?

- Science remains a core subject, alongside English and Mathematics
- EYFS Profile
- Teacher Assessment Frameworks at the end of KS1
- Teacher Assessment Frameworks at the end of KS2
- Biennial sample science testing

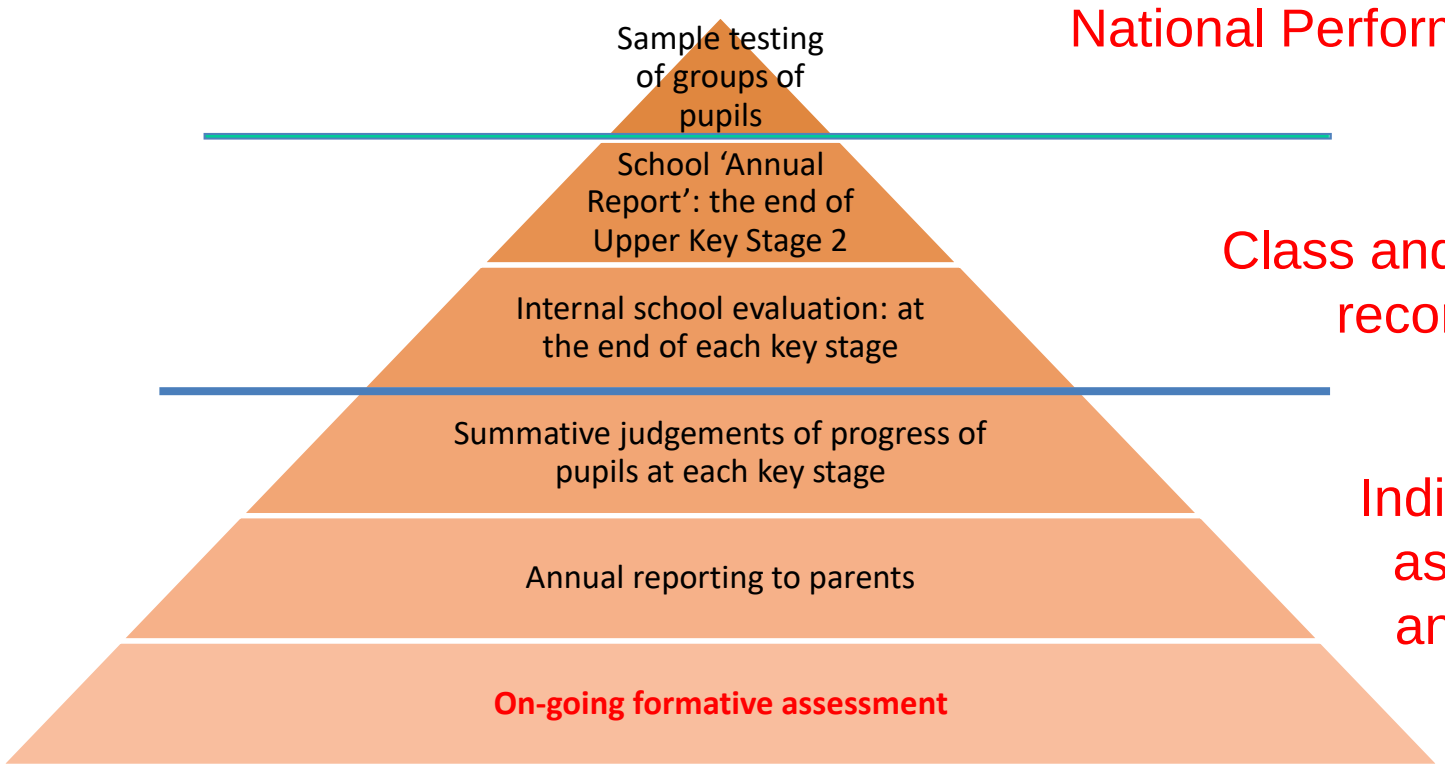
Biennial science sample testing

No science tests in summer 2020.

Sample of children tested summer 2022

- 10,000 children across English schools
- Five children selected by external administrator who visits schools
- Each child completes three short test booklets with Working Scientifically fully integrated
- Data is not used for league tables or fed back to schools (low stakes test)
- Collected at national level

Uses of assessment in school



National Performance

Class and school records

Individual pupil assessment and records

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What types of assessment happen in schools?

- **Formative** assessment – assessment for learning
- **Summative** assessment – assessment of learning

Jamboard

Sort these statements with formative and summative assessment in mind.

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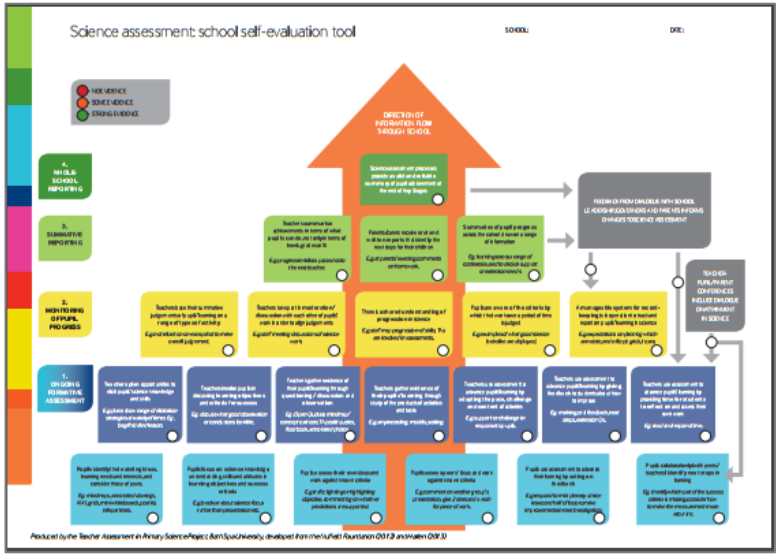
TAPS

(Teacher Assessment of Primary Science)

Supporting teachers to base assessment on ongoing formative assessment.



https://pstt.org.uk/resources/curriculum-materials/assessment

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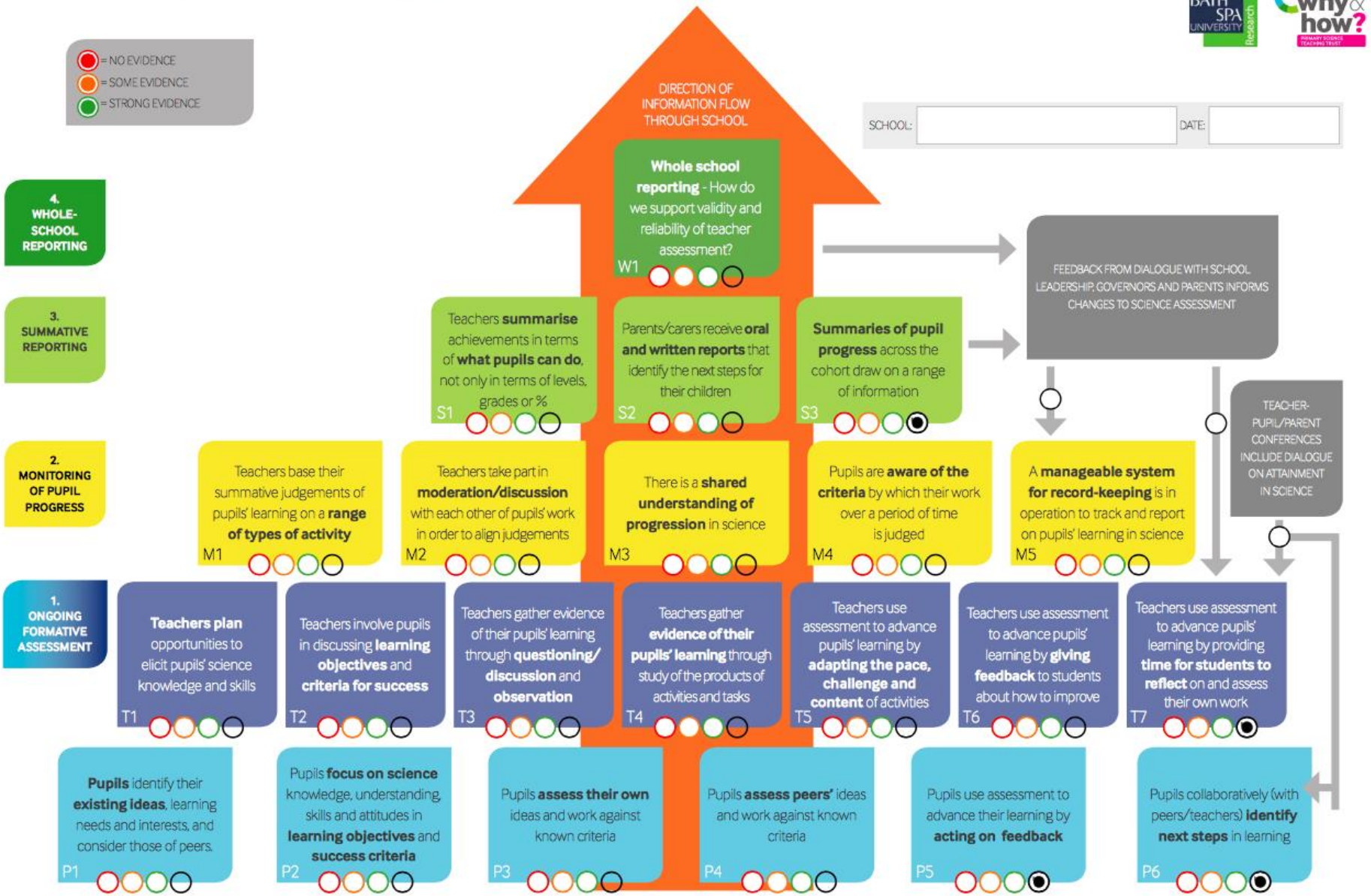

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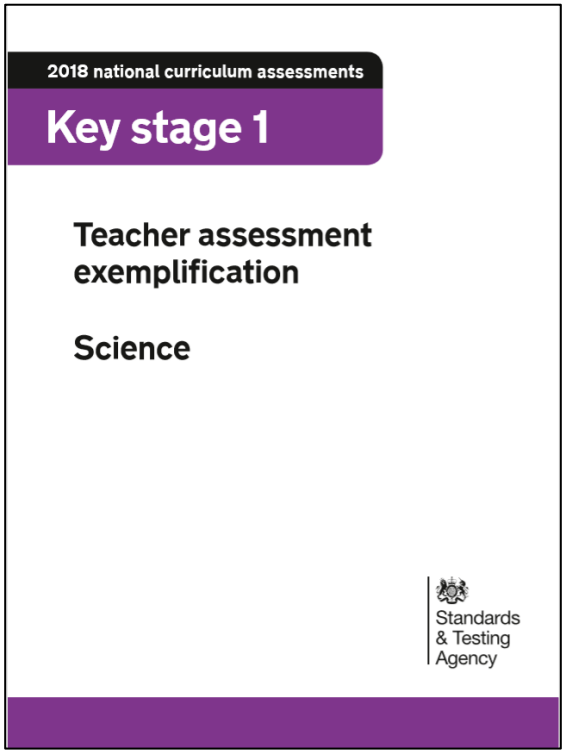
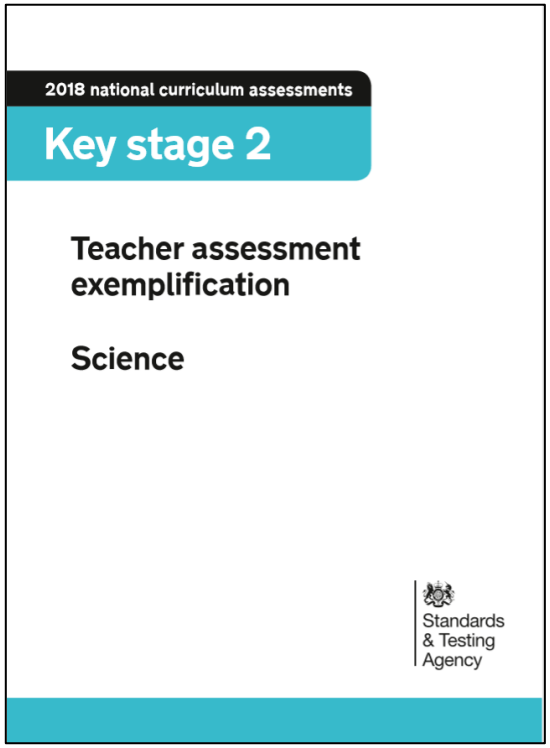
Exemplification materials – published December 2018





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Using the PLAN matrices

States of matter (Y4)

Download Y4 matrices | Download examples

Prior learning

- Distinguish between an object and the material from which it is made. (Y1 - Everyday materials)
- Identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock. (Y1 - Everyday materials)
- Describe the simple physical properties of a variety of everyday materials. (Y1 - Everyday materials)
- Compare and group together a variety of everyday materials on the basis of their simple physical properties. (Y1 - Everyday materials)
- Identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses. (Y2 - Uses of everyday materials)
- Find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. (Y2 - Uses of everyday materials)

Future learning

- Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets. (Y5 - Properties and changes of materials)
- Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution. (Y5 - Properties and changes of materials)
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating. (Y5 - Properties and changes of materials)
- Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic. (Y5 - Properties and changes of materials)
- Demonstrate that dissolving, mixing and changes of state are reversible changes. (Y5 - Properties and changes of materials)
- 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. (Y5 - Properties and changes of materials)

Year	4	Topic	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.

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Using PLAN exemplification materials

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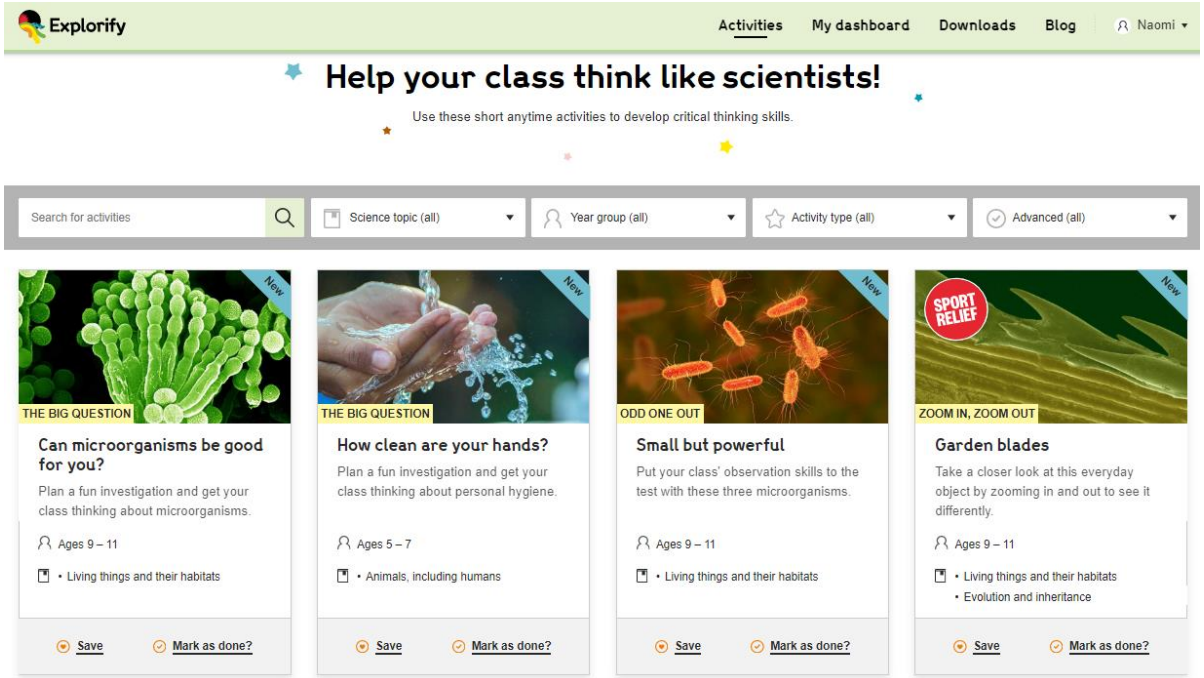
Supporting resources



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Supporting resources

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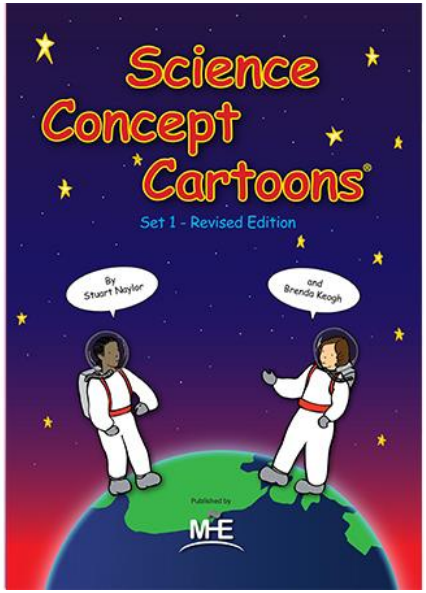

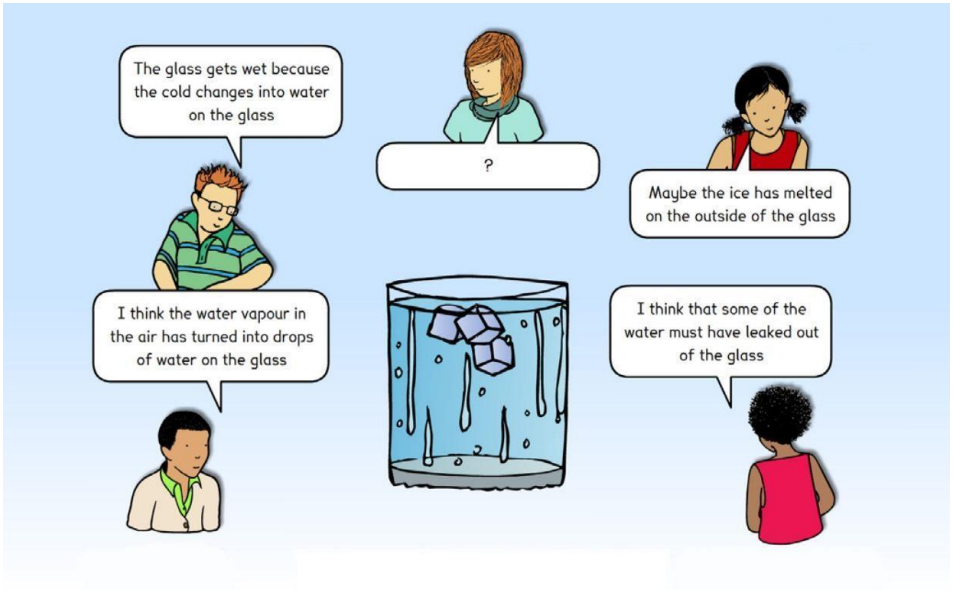

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Planning for Assessment

1. Find out what the children already know. Formative assessment.
2. Teaching and learning
3. Check what the children have learnt. Formative assessment.
4. Teach them the bits they didn't know / consolidate. Provide extra challenge…
5. Summative assessment.

Planning for Assessment

Year	3	Topic	Animals, including humans

- 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.

WHAT PUPILS NEED TO KNOW OR DO TO BE SECURE

Show understanding of a concept using scientific vocabulary correctly

Key learning	Possible evidence
Animals, unlike plants which can make their own food, need to eat in order to get the nutrients they need. Food contains a range of different nutrients – carbohydrates (including sugars), protein, vitamins, minerals, fats, sugars, water – and fibre that are needed by the body to stay healthy. A piece of food will often provide a range of nutrients. Humans, and some other animals, have skeletons and muscles which help them move and provide protection and support.	• Can name the nutrients found in food • Can state that to be healthy we need to eat the right types of food to give us the correct amount of these nutrients • Can name some bones that make up their skeleton, giving examples that support, help them move or provide protection • Can describe how muscles and joints help them to move
Key vocabulary	
Nutrition, nutrients, carbohydrates, sugars, protein, vitamins, minerals, fibre, fat, water, skeleton, bones, muscles, support, protect, move, skull, ribs, spine, muscles, joints	

Common misconceptions

Some children may think:

- certain whole food groups like fats are 'bad' for you
- certain specific foods, like cheese are also 'bad' for you
- diet and fruit drinks are 'good' for you
- snakes are similar to worms, so they must also be invertebrates
- invertebrates have no form of skeleton.

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Planning for Assessment

Apply knowledge in familiar related contexts, including a range of enquiries	
Activities	**Possible evidence**

• Classify food in a range of ways.
• Use food labels to explore the nutritional content of a range of food items.
• Use secondary sources to find out the types of food that contain the different nutrients.
• Use food labels to answer enquiry questions e.g. How much fat do different types of pizza contain? How much sugar is in soft drinks?
• Plan a daily diet to contain a good balance of nutrients.
• Explore the nutrients contained in fast food.
• Use secondary sources to research the parts and functions of the skeleton.
• Investigate patterns asking questions such as:
  ▪ Can people with longer legs run faster?
  ▪ Can people with bigger hands catch a ball better?
• Compare, contrast and classify skeletons of different animals.
	• Can classify food into those that are high or low in particular nutrients
	• Can answer their questions about nutrients in food, based on their gathered evidence
	• Can talk about the nutrient content of their daily plan
	• Use their data to look for patterns (or lack of them) when answering their enquiry question
	• Can give similarities e.g. they all have joints to help the animal move, and differences between skeletons

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Progression in Working Scientifically

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Assessing Working Scientifically

Overview of TAPS plans for Focused Assessment of Working Scientifically

(Any focus can be chosen for open-ended enquiries, these are only suggestions)

	Plan		Do		Review	
	Ask Qs and plan enquiry	**Set up enquiry**	**Observe + Measure**	**Record**	**Interpret + Report**	**Evaluate**
KS1 (age 5-7) *Develop close obs*	Ask simple Qs and recognise that they can be answered in different ways*.	Perform simple tests.	Observe closely, using simple equipment.	Gather and record data to help in answering questions.	Identify and classify. *Use appropriate scientific language to communicate ideas.*	Use their observations and ideas to suggest answers to questions.
Y1 TAPS plans	Materials: reflection tests	Materials: floating and sinking	Plants: structure	Seasons: seasonal change	Animals inc Humans: animal classification	Animals inc Humans: body parts
Y2 TAPS plans	Materials: waterproof	Materials: rocket mice	Plants: compare growth	Living things: woodlice habitats	Living things: nature spotters	Animals inc Humans: handspans
Lower KS2 *(age 7-9)* *Develop systematic approach*	Ask relevant questions and use different types* of scientific enquiries to answer them.	Set up simple practical enquiries, comparative and fair tests.	Make systematic and careful observations and, where appropriate, take accurate measurements using standard units, using a range of equipment, including thermometers and data loggers.	Gather, record, classify and present data in a variety of ways to help in answering questions. Record findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables.	Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions. Identify differences, similarities or changes related to simple scientific ideas and processes.	Use results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions. Use straightforward scientific evidence to answer questions or to support their findings.
Y3 TAPS plans	Animals inc Humans: investigating skeletons	Forces: shoe grip Forces: strongest magnet	Plants: measuring plants	Light: making shadows Forces: cars down ramps	Rocks: rock reports	Plants: function of stem Forces: balloon rockets
Y4 TAPS plans	Sound: investigating pitch	Materials: drying materials	Materials: measure temperature	Living things: local survey	Electricity: conductors Sound: string telephones	Animals inc Humans: teeth (eggs) in liquids
Upper KS2 *(age 9-11)* *Develop independ-ence*	Plan different types* of scientific enquiries to answer *their own questions,* including recognising and controlling variables where necessary.	Use test results to make predictions to set up further comparative and fair tests.	Take measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate	Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs.	Report and present findings from enquiries, inc conclusions and causal relationships, in oral and written forms such as displays and other presentations, *using appropriate scientific language*.	Explain degree of trust in results. Identify *and evaluate* scientific evidence *(their own and others')* that has been used to support or refute ideas or arguments.
Y5 TAPS plans	Materials: dissolving Materials: nappy absorbency	Materials: insulation layers	Animals inc Human: growth survey Forces: spinners	Materials: sugar cubes Space: craters	Materials: champion tapes Living things: life cycle research	Forces: aquadynamics
Y6 TAPS plans	Electricity: bulb brightness	Animals inc Humans: heart rate	Light: investigating shadows	Living things: outdoor keys	Living things: invertebrate research	Evolution: fossil habitats Evolution: egg strength

Types of enquiry including: observing changes over time, noticing patterns, grouping and classifying, comparative and fair tests, using secondary sources.

(English 2013 National Curriculum statements, *additions from Interim Teacher Assessment framework 2016-7)*

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Moderation

- **Does moderation of science work / judgements take place in your school?**
- **How?**
- **What are the benefits of moderating science work?**

Tracking Progress

YEAR 3 SCIENCE ASSESSMENT RECORD							
To judge that a pupil is working at the expected standard in science, teachers need to have evidence which demonstrates that the pupil meets all of the 'working scientifically' statements and all of the 'science content' taught in the final year of the key stage. Where possible, teachers should draw on assessments that have been made earlier in the key stage to make their judgement against this framework.	name	name	name	name	name	name	name
Working Scientifically: working at the expected standard (LKS2 NC requirements)							
asking relevant questions and using different types of scientific enquiries to answer them							
setting up simple practical enquiries, comparative and fair tests							
making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers							
gathering, recording, classifying and presenting data in a variety of ways to help in answering questions							
recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables							
reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions							
using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions							
identifying differences, similarities or changes related to simple scientific ideas and processes							
using straightforward scientific evidence to answer questions or to support their findings							
Science Content: working at the expected standard (Y3 NC requirements)							
identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers (Y3 Plants)							

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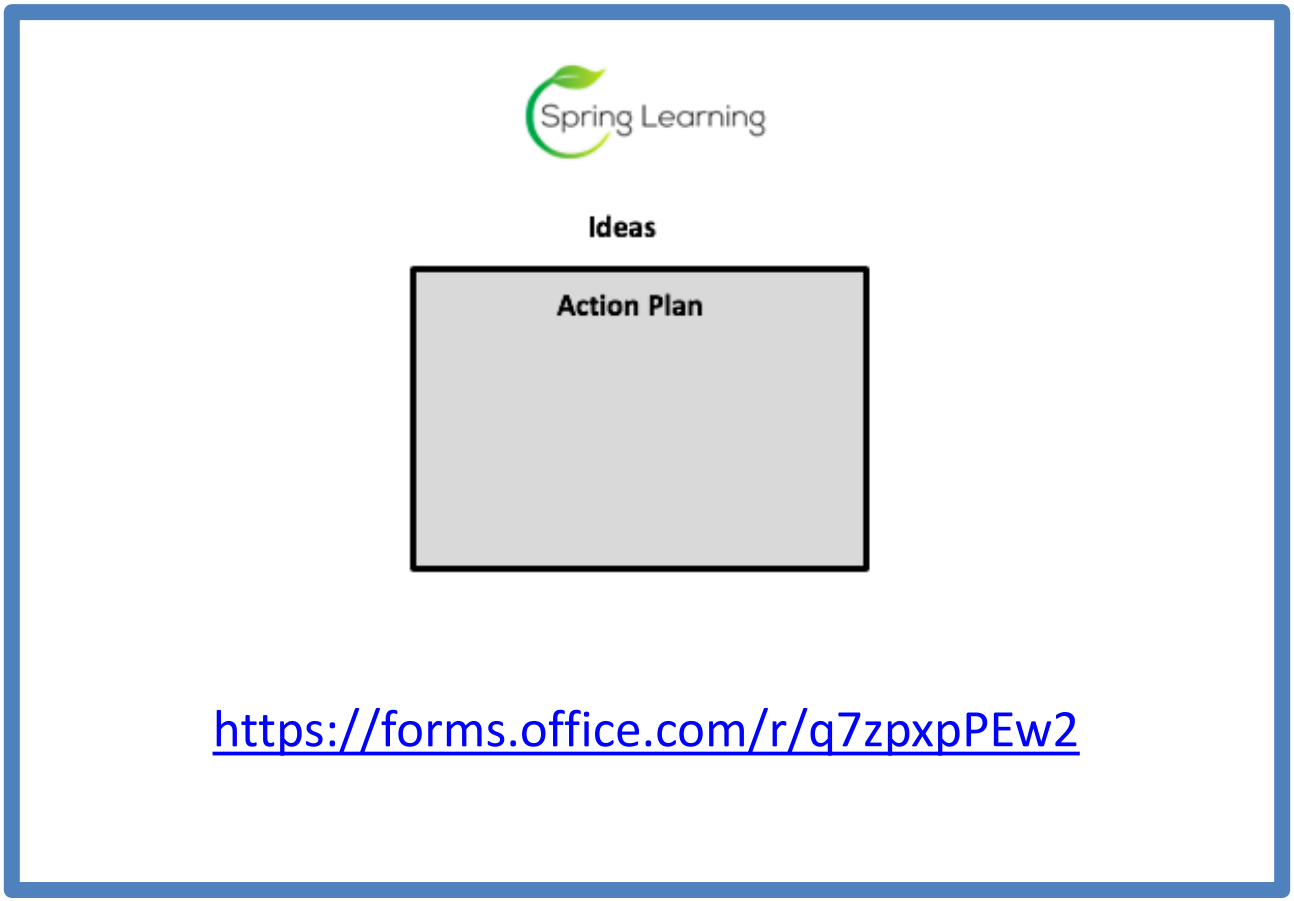
Next steps

- **Reflect** on assessment information at national level, the direction of travel indicated and implications for schools
- **Consider** the latest OFSTED perspective on assessment priorities for schools
- **Review** the quality of teacher assessment in your school; the confidence of your colleagues and their awareness of progression in terms of children's learning.

Action Planning and evaluations



https://forms.office.com/r/q7zpxpPEw2

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