



'Following Jesus, The Good Shepherd, in all we say and do'

OUR LADY IMMACULATE
CATHOLIC ACADEMY TRUST



THE GOOD SHEPHERD CATHOLIC PRIMARY
SCHOOL

SCIENCE
SUBJECT INTENT

2023 - 2024



'Following Jesus, The Good Shepherd, in all we say and do'

Curriculum Intent – SCIENCE

2023 - 2024

At The Good Shepherd Catholic Primary School, our children are
SCIENTISTS!

Our intent is to give every child a broad and balanced Science curriculum which enables them to confidently explore and discover what is around them, so that they have a deeper understanding of the world we live in.

We want our children to love science. We want them to have no limits to what their ambitions are and grow up wanting to be astronauts, forensic scientists, toxicologists or microbiologists.

To achieve this, it involves exciting, practical hands on experiences that encourage curiosity and questioning. Our aim is that these stimulating and challenging experiences help every child secure and extend their scientific knowledge and vocabulary, as well as promoting a love and thirst for learning.

We want our children to remember their science lessons in our school, to cherish these memories and embrace the scientific opportunities they are presented with!

At The Good Shepherd we are studying CUSP science. Through this, pupils become more expert as they progress through the curriculum, accumulating, connecting and making sense of the rich substantive and disciplinary knowledge.

1. **Substantive knowledge** - this is the subject knowledge and explicit vocabulary used to learn about the content. Common misconceptions are explicitly revealed as non-examples and positioned against known and accurate content. In CUSP science, an extensive and connected knowledge base is constructed so that pupils can use these foundations and integrate it with what they already know. Misconceptions are challenged carefully and in the context of the substantive and disciplinary knowledge. In CUSP Science, it is recommended that misconceptions are not introduced too early, as pupils need to construct a mental model in which to position that new knowledge.



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2. **Disciplinary knowledge** – this is knowing how to collect, use, interpret, understand and evaluate the evidence from scientific processes. This is taught.

Scientific analysis is developed through IPROF criteria. We call it '**Thinking Scientifically.**'

- 2.
 - identifying and classifying
 - pattern seeking
 - research
 - observing over time
 - fair and comparative testing
 -

'The scientist is not a person who gives the right answers; they are the one who asks the right questions.'

Claude Levi-Strauss



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Implementation

CUSP Science is built around the principles of cumulative knowledge. The effect of this cumulative model supports opportunities for children to associate and connect with significant periods of time, people, places and events.

What do we teach?

EARLY YEARS

The Early Years Foundation Stage Curriculum supports children's understanding of Science through the planning and teaching of '*Understanding the World.*' Children find out about objects, materials and living things using all of their senses looking at similarities, differences, patterns and change. Both the environment and skilled practitioners foster curiosity and encourage explorative play, children are motivated to ask questions about why things happen and how things work. Our children are encouraged to use their natural environment around them to explore. Children enjoy spending time outdoors exploring mini-beasts and their habitats, observing the changing seasons, plants and animals. During the spring term children have the unique first hand experience of hatching and caring for live chicks. Children regularly participate in cookery and baking sessions which allows them to experience changes in state as ingredients are mixed, heated and cooled.

KEY STAGE 1

Pupils study the **Seasons** and develop an early conceptual understanding of how day becomes night. An understanding of change over time connects to the study of **Plants**, including trees. This focus enables children to associate trees as belonging to the plant kingdom and notice the changes deciduous trees go through connected to the seasons.

Contrasting that study, pupils learn about **Animals, including humans**. Non-examples of plants are used to contrast the features of an animal.

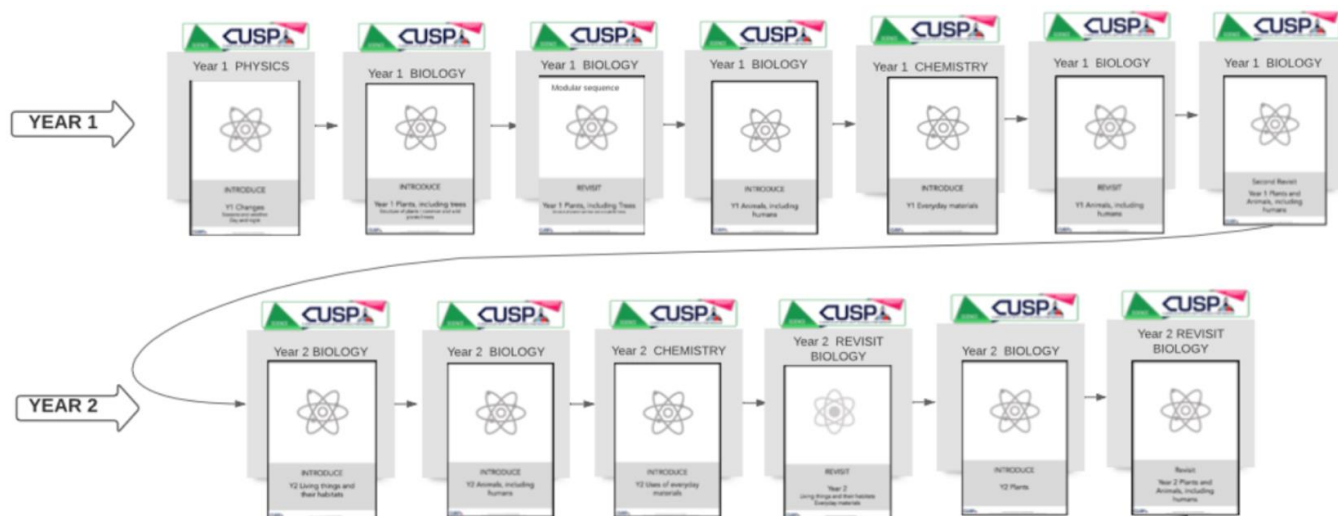
Pupils are introduced to **identifying and classifying materials**. Scientific terms, such as transparent, translucent and opaque are taught explicitly through vocabulary instruction and pupils make further sense by applying it to what they know and then to working and thinking scientifically tasks. This substantive knowledge is enriched by pupils' use of



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disciplinary knowledge through scientific enquiry.

Within the **study of Living things and their habitats** and **Uses of everyday materials** new substantive knowledge is constructed and made sense of through Working and Thinking scientifically tasks.



LOWER KEY STAGE 2

The unit on **Rocks** is studied and connected with prior knowledge from 'Everyday materials' in KS1. A study of **Animals, including humans** is built upon from KS1 and contrasts the physical features with the functions they perform, including the skeleton and muscles.

Rocks is revisited again to sophisticate and deepen pupils' knowledge, advancing their understanding.

Forces and magnets are introduced and connect with KS1 materials, including twisting, bending and squashing. Contact and non-contact forces are taught and understanding applied through Working and Thinking Scientifically. The abstract concept of **Light** is made concrete through knowing about light sources and shadows. **Plants** are studied to develop a more sophisticated understanding of their parts and functions, including pollination.

A study of **Living things and their habitats** pays close attention to classification and is



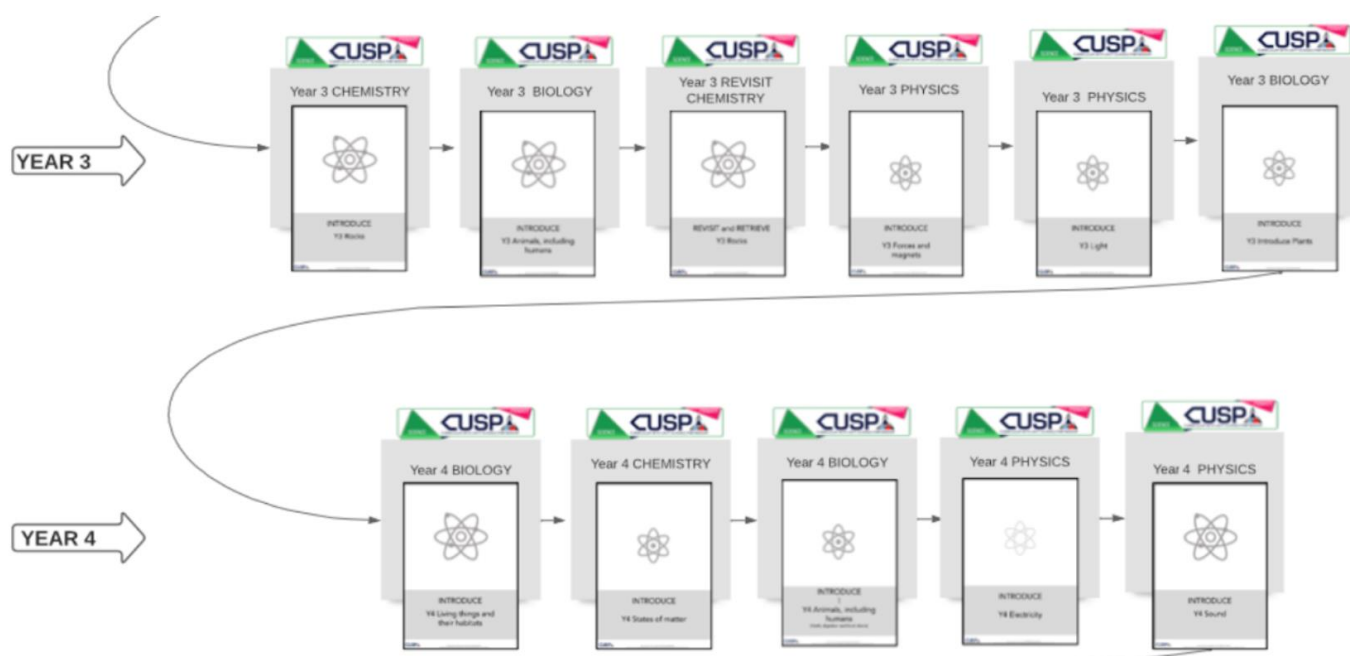
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directly taught using prior knowledge to ensure conceptual frameworks are secure. Animals, plants and environments are connected in this study with a summary focusing on positive and negative change.

Electricity is introduced and pupils acquire understanding about electrical sources, safety and components of a single loop circuit.

Animals, including humans focuses on the sequence of digestion, from the mouth to excretion.

States of matter and Sound are taught using knowledge of the particle theory. Practical scientific tasks and tests help pupils build a coherent understanding of the particle theory by applying what they know through structured scientific enquiry.



UPPER KEY STAGE 2

Pupils reuse and draw upon their understanding of states of matter in the study of **Properties and changes of materials**.

Change is also studied within **Animals**, including humans, focusing on growth and development of humans and animals.



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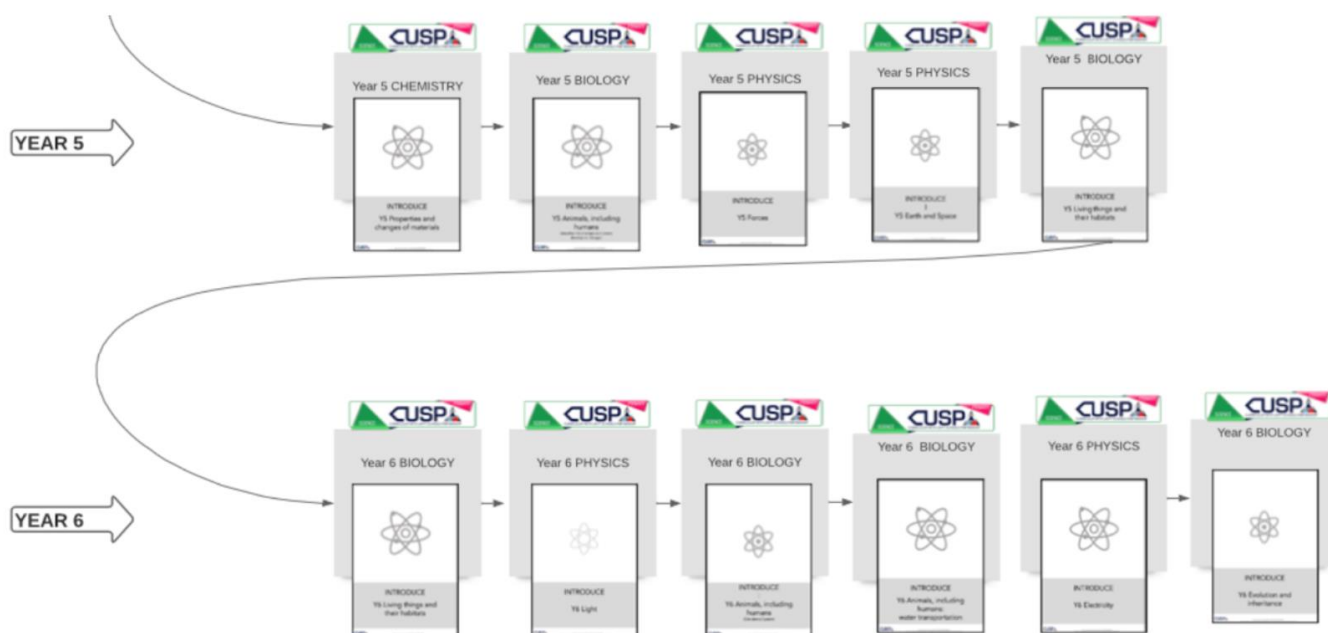
Earth in Space develops the conceptual understanding of our place in the universe.

A study of Forces sophisticates the substantive knowledge acquired in KS1 and LKS2. Enhancing this study of Forces, pupils learn about Galileo Galilei 1564 - 1642 (considered the father of modern science).

Living things and their habitats focuses on differences in life cycles of living things and how they reproduce. This study also contrasts previous scientific thinking.

A further study of **Living things and their habitats** enables pupils in UKS2 to revisit and add to their understanding of classification through the taxonomy created by Carl Linnaeus. More complex animals are studied.

Light is revisited and taught with advanced substantive knowledge. This is physics study with a focus on the properties of light, not the biology of the eye.





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How do pupils learn?

- Class timetables have been built to ensure a broad and balanced curriculum.
- Subjects have been blocked in a spaced retrieval model to support catch up and to build the frequency of science and wider curriculum subjects. This maximises learning time.

Working scientifically

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An essential component to CUSP lessons is the systematic and coherent approach that we embed focusing on the six phases of a lesson.



Connect



Explain



Example



Attempt



Apply



Challenge



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Overview of Knowledge

Each unit includes an overview for the teacher which details the big idea that pupils will be studying, prior knowledge, skills to be taught and common misconceptions.

Knowledge Organisers

Dual coded knowledge organisers contain core information for children to easily access and use as a point of reference and as a means of retrieval practice. .



SCIENCE

INTRODUCE

States of Matter

Year 4

Summer Term

Pupils should be taught to:

- 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

Previous learning



Year 3

Light

Forces and magnets

Year 4

Geography

Water Cycle

Year 4

Sound

Electricity

Ask relevant questions	Set up simple, practical enquiries and comparative and fair tests	Make accurate measurements using standard units, using a range of equipment, e.g. 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, bar charts and tables	Report on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions	Use results to draw simple conclusions and suggest improvements, new questions and predictions for setting up further tests	Identify differences, similarities or changes related to simple, scientific ideas and processes



Misconceptions – learning traps pupils can fall into

✗ Not true	Teach this ✓
Particles in a liquid are further apart than particles in a solid.	For a long time, pupils have been taught that particles in liquid are drawn further apart than in a solid. • Particles in liquid remain in contact with each other. • They exist in a more random formation, overlapping in a 3D model. The knowledge organiser outlines this graphically.
Water droplets on the outside of a cold can of drink have come from the inside.	Water vapour in the air condenses when it meets the cold can and turns into water droplets.



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 Science study

INTRODUCE
States of matter 

Year 4 Summer Term

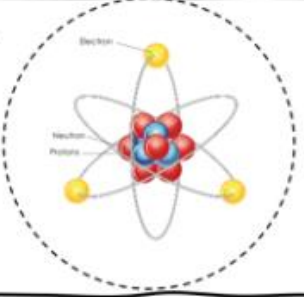
matter
something that takes up space, despite its size or composition
ice
water
air

state
one of the distinct ways **matter** exists
solid
liquid
gas

How we measure temperature 
Celsius
unit of measurement for temperature °C
100°C = water boils
0°C = water freezes 

The science of PARTICLES
ALL **matter** is made from
atoms
smallest known part of any material
particle

atoms are made of
protons (+)
neutrons
electrons (-)



solid

has its own shape
• it can't flow
• has a fixed volume
• particles **very close** and have a fixed position
tricky ones
a football is a solid
sand is a solid
fabric is a solid

liquid

takes the shape of the container
• can flow
• has a fixed volume
• particles **very close but not fixed**
water is a liquid
blood is a liquid

gas

will escape from a container
• can flow
• no fixed volume
• particles **moving apart** quickly
water vapour is a gas
air is a mixture of gases
carbon dioxide is a gas

evaporation
example
water heated by the sun 
rises up as **water vapour**
turns into a gas
water **evaporates**

condensation
example
water vapour 
cools and **condenses**
gas returns to a liquid
water droplets form 



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Mapping of Knowledge

The **sequence of learning** makes **clear essential and desirable knowledge**, key questions and task suggestions for each lesson and **suggested cumulative quizzing questions**.



Science study

INTRODUCE
States of matter



Year 4 Summer Term

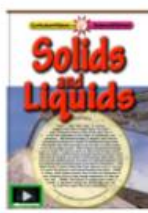
Suggested foundational knowledge that is essential to teach

Suggested lesson	Learning question	Cumulative question					
1. ESSENTIAL	What is matter? What does 'state' mean?	1 - 3					
2. ESSENTIAL	What are solids, liquids and gases?		4 - 6				
3. ESSENTIAL	Melting : how do materials change state?			7 - 9			
4. ESSENTIAL	Evaporating : how do materials change state?				10 - 12		
5. ESSENTIAL	Condensing : how do materials change state?					13 - 15	
6. DESIRABLE	Summary: how do materials change their state of matter?						

If you find you need to consolidate or focus pupil learning, you can select one or two of these working scientifically lessons.




Resources and video books








States of Matter

Free and very useful – www.reachoutcpd.com



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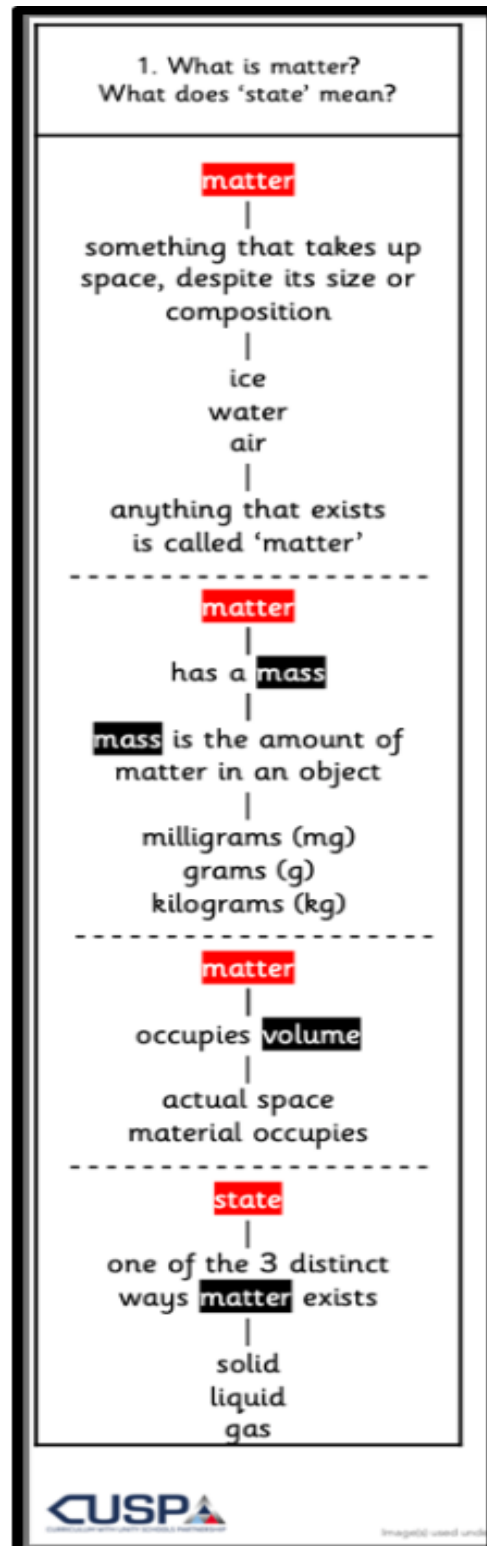


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Knowledge notes

Knowledge notes are an elaboration in the core knowledge found in knowledge organisers.

Knowledge notes focus pupils' working memory to the key question that will be asked at the end of the lesson. It reduces cognitive load and avoids the split-attention effect.





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Retrieval Practise

Retrieval practise is planned into the curriculum through spaced learning and interleaving and as part of considered task design by the class teacher. Teaching and learning resources are provided for class teachers so they can focus their time on subject knowledge and task design.

Vocabulary

The units are supported by **vocabulary modules** which provide both resources for teaching and learning vital vocabulary and provide teachers with Tier 2 and 3 vocabulary with the etymology and morphology needed for explicit instruction details relevant idioms and colloquialisms to make this learning explicit. We aim to provide a high challenge with low threat culture and put no ceiling on any child's learning, instead providing the right scaffolding for each child for them to achieve.



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Y4 States of matter

Vocabulary Essentials: Teacher Guide

Prior vocabulary knowledge



Words I should know

heat, cool, temperature, change, freeze
compare, materials, properties

Roots, prefixes, suffixes and spelling rules

-tion
-ing

Vocabulary for explicit instruction



Tier 2 multiple meaning or high frequency

permanent	existing all the time
particle	a very small piece of something
solid	a substance that is neither a gas nor a liquid
liquid	a substance that flows freely and is not a solid or a gas
gas	a substance that is neither a solid nor a liquid
vapour	small drops of liquid in the air

Tier 3 subject specific

evaporate	turn from liquid into vapour
condense	turn from vapour into liquid
melt	to become a liquid as a result of heating
matter	the physical substance that everything is made up of
state	the physical condition that a thing is in
volume	the amount of space that an object or substance fills

Etymology and morphology for explicit instruction



Prefix / Suffix / Root	Meaning	Examples
part	bit, fragment	particle, partial, particular
re	again, back	reverse, reversible, return

Relevant idioms and colloquialisms



cooking on gas	to make rapid progress or perform well
out of gas	completely exhausted or having no energy
be in/get into a state	to become excited or anxious

Moving beyond



composition
disperse
reversible, irreversible



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Impact

The impact of this curriculum design will lead to outstanding progress over time across key stages relative to a child's individual starting point and their progression of skills.

Children will therefore be expected to leave The Good Shepherd reaching at least age-related expectations for Science. Our Science curriculum will also lead pupils to be enthusiastic learners, evidenced in a range of ways, including pupil voice and their work.

How do we know what the children have learned?

- Questioning
- Pupil Book Study talking about learning with the children
- Talking to teachers
- Low stakes 'Drop-in' observations
- Quizzing and retrieval practise
- Feedback and marking
- Progress in book matches the curriculum intent

Example of quiz

The screenshot shows a Socrative quiz interface. At the top left is the Socrative logo. To the right are fields for 'Name', 'Date', and 'Score'. The title 'Year 4 States of matter' is centered. Below the title are two questions. Question 1 asks 'Matter is...' with three multiple-choice options: (A) a very small thing, (B) oxygen in the air, and (C) something that takes up space, regardless of its size. Question 2 asks 'All matter is made from atoms.' with two true/false options: (T) True and (F) False. To the right of the questions is a diagram of an atom with a central nucleus containing red and blue spheres, and a dashed circular orbit with three yellow spheres. Labels 'Proton', 'Neutron', and 'Electron' point to the corresponding parts of the atom.

socrative

Name _____
Date _____
Score _____

Year 4 States of matter

1. Matter is...

(A) a very small thing.
(B) oxygen in the air.
(C) something that takes up space, regardless of its size.

2. All matter is made from atoms.

(T) True
(F) False



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Pupil Book Study Tells us:

1. What impact is our CURRICULUM having?

What effect is the curriculum architecture having?

2. Does teaching support LONG-TERM LEARNING?

Is the evidence-led practice really being deployed at a classroom level, or is it superficial?

3. Do tasks enable pupils to THINK HARD and CREATE LONG-TERM MEMORY?

4. How impactful are tasks, and do they help pupils to think hard and generate learning?

Friday 28th April 2023

Life cycles: what's the difference between an **invertebrate** and a **vertebrate**?

Kingdom = Animal
Phylum = Arthropod
Class = Insect

- invertebrates
- sexual reproduction
- eggs laid outside of the mother
- new **larva** hatch
- larva feed and grow
- transform into a **pupa**
- a biochemical change occurs
- larval body broken down and reformed into an adult
- hatch from pupa as an adult

LIST AND MATCH WHAT IS **DIFFERENT**

NOTICE AND DEDUCE WHAT IS **DIFFERENT**

Kingdom = Animal
Phylum = Vertebrate
Class = Bird

vertebrates
sexual reproduction
lay eggs with hard shells
most eggs kept warm in a nest
an **adult** grows from fertilised eggs
unfertilised eggs don't produce chicks
chicks hatch from hard egg
chicks grow more feathers
mature into adults

Lays eggs. Eggs keep warm, embryo grows

Chicks hatch

Chicks grows into adult

Young grows more feathers

The eggs are made by the ladybird

evolved from pupa now a ladybird

The eggs hatch and a turning into pupa

evolving into a ladybug

explaining ocelyn says: Metamorphosis means change, so something birds and insects have in common is that they both change through

Friday 19th May 2023

Maria Sibylla Merion

Maria was born on 2nd April in 1647 at Frankfurt, Germany. At a very young age she was interested in insects. Maria's stepfather was an artist and taught her how to paint her stepfather's name were Jacob Marrel. Maria had a wealthy upbringing so she had a good education. She would spend most of her time collecting bugs and drawing them. At that time people would believe that insects were a spawn of the devil or were from dust rather food or mud. Regardless of her sex she kept on doing what she loved and became one of the first female scientists. In 1675, she published her first book volume full of illustrations of plants and flowers. It was very unusual

Friday 19th May 2023

Maria Sibylla Merion

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1. Egg This is the first stage of a butterfly. They will hatch by being an egg. Most butterflies will have laid

2. Larva This is a caterpillar and is the first stage of a butterfly. They will eat anything and is the first stage of a butterfly. They will eat anything

3. Pupa This is a cocoon or a pupa. This is also the process for becoming a butterfly. You can call this a cocoon or a pupa. The caterpillar will curl itself up and become a butterfly

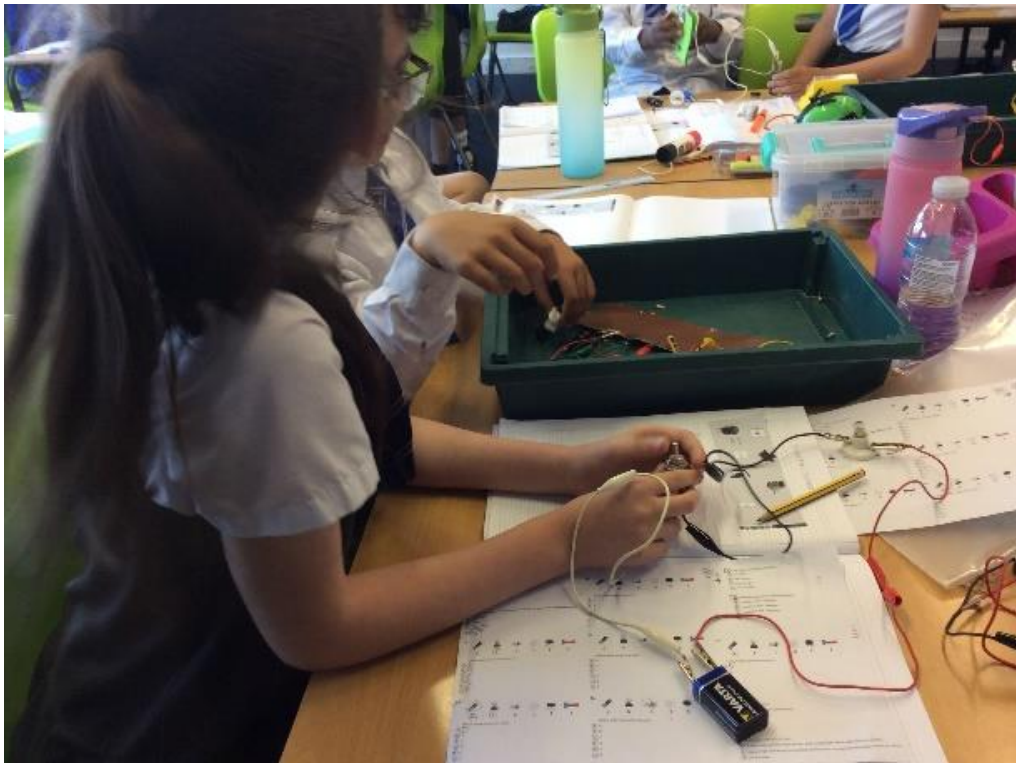
4. Adult This is the final stage of a butterfly. They will fly and reproduce.

Justifying Maria Merion is respected both as a scientist and as an artist. It is more important to be a good scientist than a good artist. Do you agree or disagree with this statement?



'Following Jesus, The Good Shepherd, in all we say and do'

Examples of Learning



Today in **Science** we investigated circuits.





'Following Jesus, The Good Shepherd, in all we say and do'

Learning about habitats in Year 5 **science**, we ventured outside to our local area to look for different types of habitats. Some of us used magnifying glasses to look closer at bugs on the trees.



Year 6 Scientists explored activities involving static electricity. They rubbed inflated balloons backwards and forwards on a woolen jumper before holding it a short distance away from hair, coarse pepper grains, water running from a tap or a second charged balloon hanging freely. They were able to explain the effects they observed in terms of items with different charges attracting each other while those with similar charges push away from one another.



'Following Jesus, The Good Shepherd, in all we say and do'