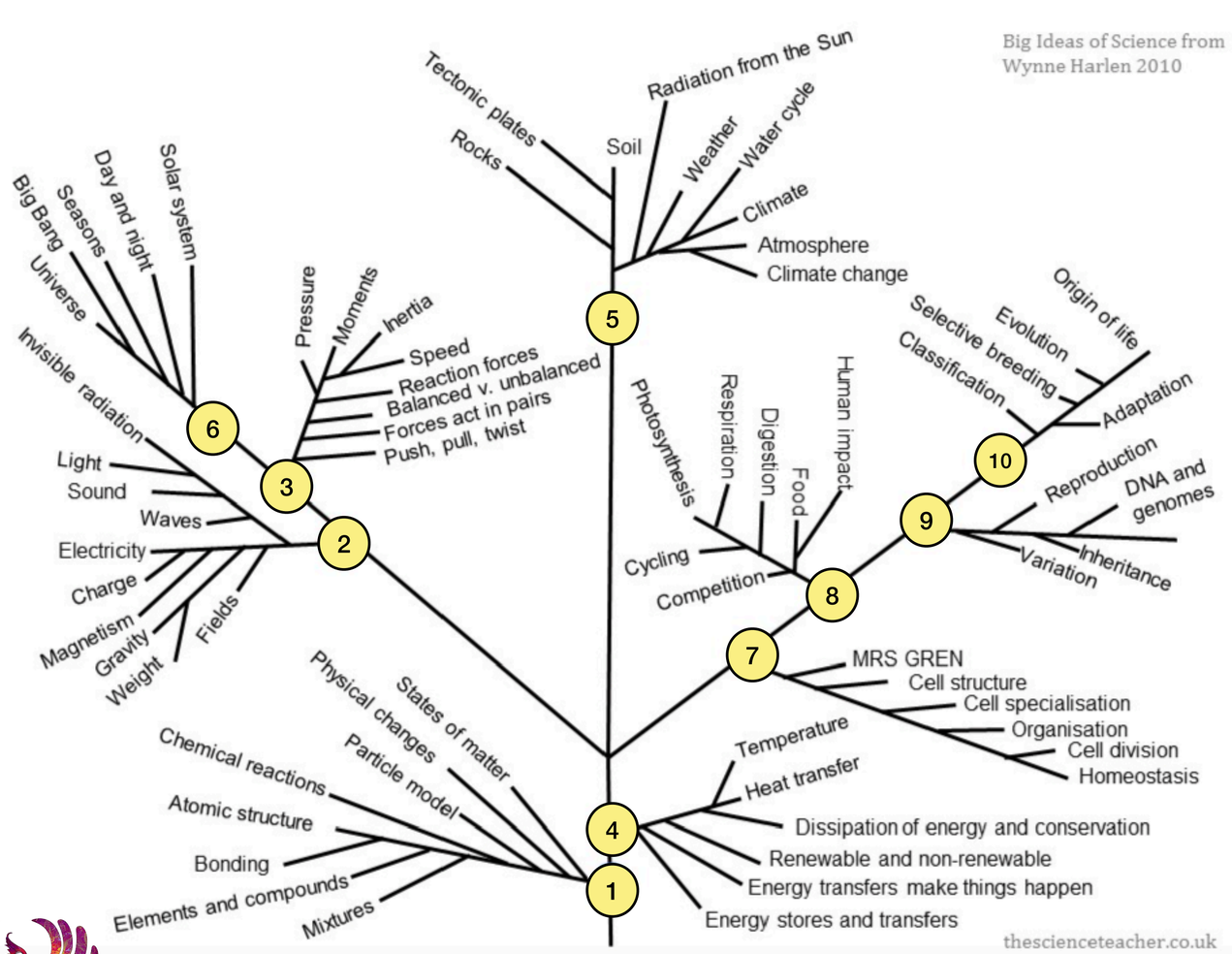
The 10 Big Ideas of Science Education

'Knowledge with meaning leads to 'Big Idea' thinking'



https://thescienceteacher.co.uk/big-ideas/

'Thinking well requires knowing facts. When we organise facts, they become something broader - knowledge. Organised knowledge with lots of connections is more likely to support successful recall.'

(Why Don't Students Like School?, Daniel Willingham)

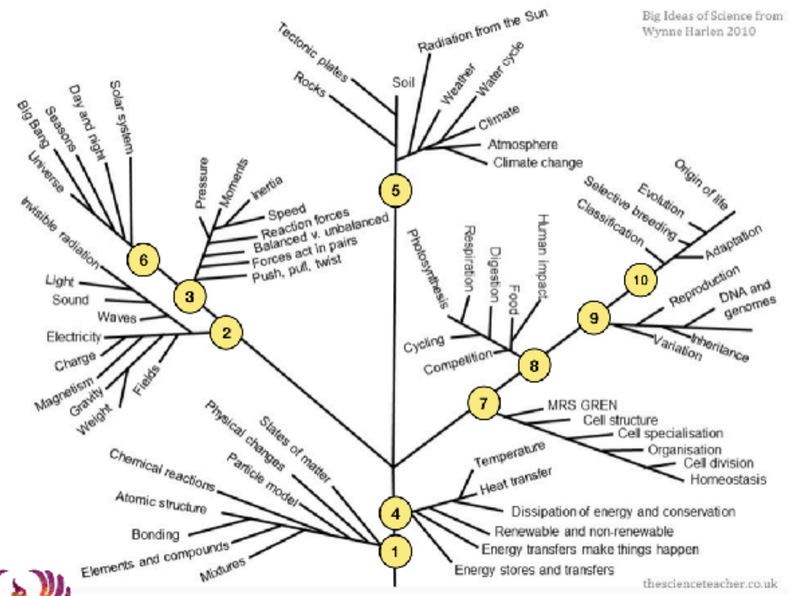
The 10 Big ideas of Science Education

1. All matter in the universe is made up of very small particles.
2. Objects can affect other objects at a distance.
3. Changing the movement of an objects requires a net force to be acting on in.
4. The total amount of energy in the universe is always the same but can be transferred from one energy source to another during an event.
5. The composition of the earth and its atmosphere, and the processes occurring within them, shape the earth's surface and its climate.
6. Our solar system is a very small part of one of billions of galaxies in our universe.
7. Organisms are organised on a cellular basis and have finite life span.
8. Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.
9. Genetic information is passed down from one generation of organisms to the next.
10. The diversity of organisms, living and extinct, is the result of evolution.

How have the 10 Big Ideas of Science helped shape our science curriculum?

We teach science through concepts developed using the 10 Big Ideas of to Science.

Connected concepts leading to 'Big Idea' thinking.



The 10 Big Ideas of Science Education	Key Concept	Second Order Concept
1. All matter in the universe is made up of very small particles.	**Chemistry**	**Materials**
2. Objects can affect other objects at a distance.	**Physics**	**Forces** (Non-contact)
3. Changing the movement of an objects requires a net force to be acting on in.	**Physics**	**Forces** (Contact)
4. The total amount of energy in the universe is always the same but can be transferred from one energy source to another during an event.	**Physics**	**Energy**
5. The composition of the earth and its atmosphere, and the processes occurring within them, shape the earth's surface and its climate.	*N/A*	*Not taught at Primary Level Education*
6. Our solar system is a very small part of one of billions of galaxies in our universe.	*N/A*	*Not taught at Primary Level Education*
7. Organisms are organised on a cellular basis and have finite life span.	**Biology**	**Alive** (Structure and Function)
8. Organisms require a supply of energy and materials for which they often depend on, or compete with, other organisms.	**Biology**	**Survive and Thrive**
9. Genetic information is passed down from one generation of organisms to the next.	**Biology**	**Reproduction**
10. The diversity of organisms, living and extinct, is the result of evolution.	**Biology**	**Diversity**

Information

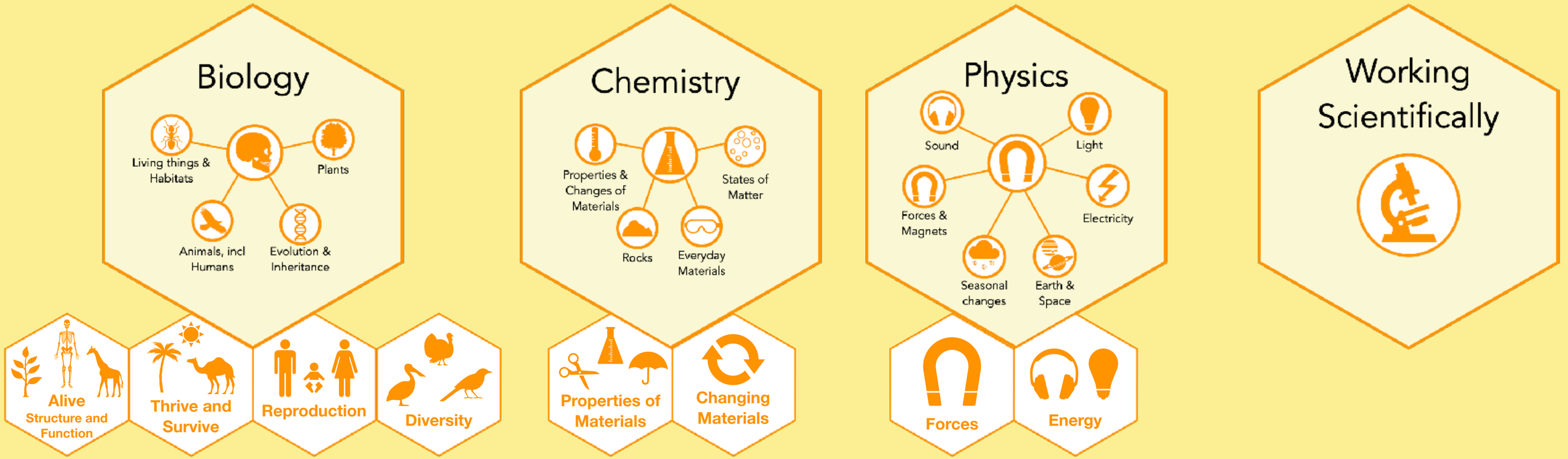
Isolated facts that can have no organisational basis or links

Schema

Knowledge organised in a meaningful way - memories (emotional), concepts, knowledge

Key Concepts

Key concepts identify the content or focus areas of study



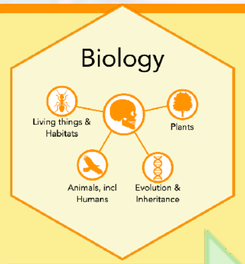
Second Order Concepts

Second-order concepts: these shape the key questions asked in a subject and organise the subject knowledge

The Story of Science

How do the 'Big Ideas' and concepts link together?

Biology



Big Idea

Organisms are organised on a cellular basis and have a finite life span

What does it mean to be alive?

Alive
Structure & function

Living things have a structure which enables a living function

How to stay alive?

Big Idea

Organisms require a supply of energy and materials for which they often depend on, or compete

Survive & Thrive

Living things need energy to power those functions to survive and thrive.

How to ensure species stays alive?

Big Idea

Genetic information is passed down from one generation of organisms to another

Reproduction

As livings age and grow, they pass through stages in which structure and functions develop enabling reproduction. This allows species to continue to thrive and survive.

How to ensure species survive?

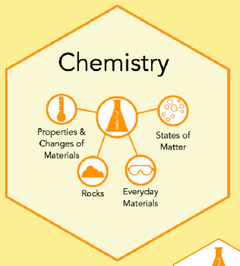
Big Idea

The diversity of organisms, living and extinct, is the result of evolution

Diversity

Living things adapt and evolve their structure and function over many years to ensure longevity of species surviving and thriving.

Chemistry



The structure and function of living things and materials have similarities and differences. These enable us to group them and identify individual types.

Big Idea

All matter in the Universe is made of very small particles.

Properties of Materials
Structure and function

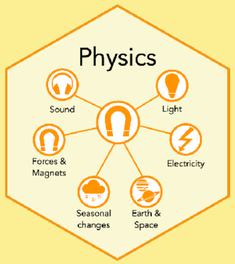
Materials have properties which enables function and therefore a use.

Objects have mass

Changing Materials
Properties

If you change the material's properties (structure) you change its use (function)

Physics



Big Idea

Objects can affect other objects at a distance

Forces describe how objects affect each other

Big Idea

Changing the movement of an object requires a net force to be acting on it

Big Idea

The total amount of energy in the universe is always the same but can be transferred from one energy store to another during an event

Forces
Non-contact

Non-contact forces attract and repel

Forces
Contact

Contact forces oppose each other (resist)

Changing the quantity of energy can affect the work done

Force causing movement → Work done

An unbalanced force causes a change in movement

Energy is the capacity to do work

Energy enables things to function and transforms from one form to another

Science

Science is a body of knowledge and a process that allows us to explain and understand the world around us.

Biology

Substantive knowledge in key concepts

Alive
Function and Structure

- Plants
  - Identify species
  - Identify parts and their function
  - Life processes
- Animals
  - Identify species
  - Identify parts and their function
  - Life processes

Thrive and Survive
Nutrition and Growth

- Plants
  - Conditions for healthy growth
  - Habitats
  - Food chains
- Animals
  - Conditions for healthy growth
  - Habitats
  - Food chains

Reproduction

- Plants
  - Life cycles
- Animals
  - Life cycles

Diversity

- Plants & Animals
  - Evolution and adaptation

Chemistry

Properties of Materials

- Objects
- Materials
- Properties
- Suitability
- States of matter

Changing Materials

- Physical changes
- Fossils
- Soils
- Changing state
- Water cycle

Physics

Forces

- Non-contact
  - Magnetism
  - Gravity
  - Solar System
  - Movement of Earth
- Contact
  - Twist, push, pull
  - Friction resistance
  - Gearing

Energy

- Seasonal changes
- Light
- Sound
- Electricity