



## Science Vertical Concepts

### 1. All material in the universe is made of very small particles

#### Nursery

- Talk about the differences between materials and changes they notice.
- Explore collections of materials with similar and/or different properties.

#### Year 2

- All the 'stuff' encountered in everyday life, including air, water and different kinds of solid substances is called matter
- Different materials are recognisable by their properties

#### Year 5

- When some materials combine, they do not change permanently and can be separated again
- Materials can be changed by heating and cooling

#### KS3

- The smallest piece of a material is called an atom. All materials, anywhere in the universe, living and non-living, are made of a very large numbers of these basic 'building blocks' of which there are about 100 different kind

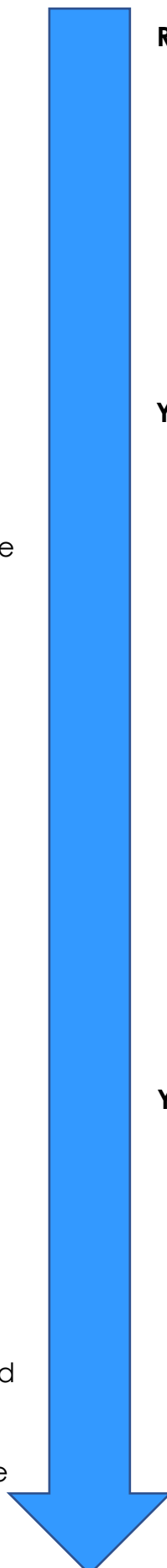
#### Reception

#### Year 4

- The amount of material does not change when a solid melts or a liquid evaporates
- If a material could be divided into smaller and smaller pieces it would be found to be made of pieces, particles, smaller than can be seen even with a microscope. These particles are not in a material; they are the material.

#### Year 6

- When some materials are combined, they form a new material with different properties to the original materials





## Science Vertical Concepts

### 2, Objects can affect each other at a distance

#### Nursery

- Magnets attract magnetic objects

#### Year 3

- Objects can have an affect on other objects even when they are not in contact with them. Light reaches our eyes, even though the light source may be far away
- The non-contact force of magnetism mean magnets can attract or repel other magnets

#### Year 5

- The non-contact force of gravity makes things fall to Earth
- There is gravitational force between all objects, but it is only felt when one or more of the objects has a very large mass

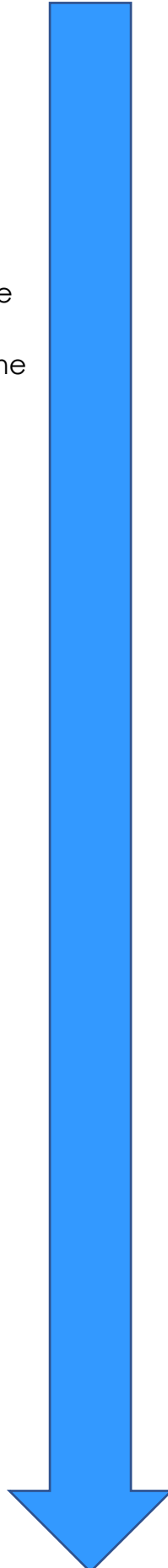
#### Reception

#### Year 4

- Sound comes from things that vibrate and can be detected at a distance from the source because the air or other material around is made to vibrate. Sounds are heard when the vibrations in the air reach our ears

#### KS3

- There is attraction and repulsion between objects that are electrically charged
- Visible light and other forms of radiation can travel through any empty space





## Science Vertical Concepts

### 3. Changing the movement of an object requires a net force to be acted on it

#### Nursery

- Explore and talk about different forces they can feel.

#### Year 3

- There is attraction and repulsion between objects that are electrically charged
- Visible light and other forms of radiation can travel through any empty space

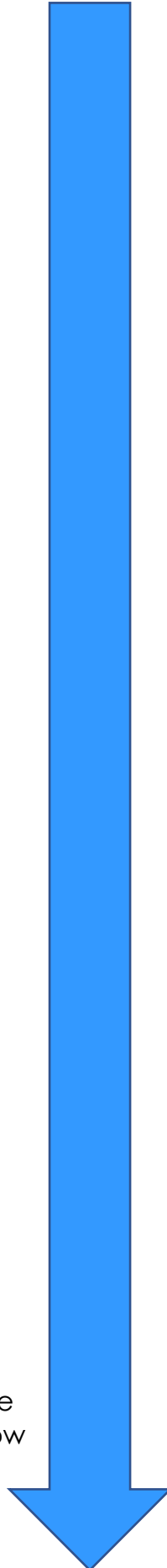
#### KS3

- How quickly an object's motion is changed depends on the force acting and the object's mass. The greater the mass of the object, the longer it takes to speed it up or slow it down (inertia)

#### Reception

#### Year 5

- An object on Earth pulls the Earth as much as the Earth pulls the object, but because the Earth's mass is much bigger, we observe the motion of the object
- The downward force of gravity on an object on the Moon is less than that on Earth because the Moon has less mass on Earth





## Science Vertical Concepts

### 4. The total amount of energy in the Universe is always the same, but energy can be transformed when things change or are made to happen

#### Year 1

- Things around us can be made to change or happen. We can pull objects behind us or push them across the table

#### Year 5

- Many processes and phenomena are explained in terms of energy exchanges
- Energy cannot be created or destroyed. When energy is transferred from one object to others, the total amount of energy in the universe remains the same; the amount that one object loses is the same as the other objects gain

#### KS3

- Objects have energy because of their chemical composition, their movement, their temperature, their position in a gravitational or other field, or because of compression or distortion of an elastic material.

#### Reception

#### Year 2

- All living things need food to give them energy
- The arrows in a food chain show where energy is being transferred from and to

#### Year 4

- The arrows in a food web show where energy is being transferred from and to
- Things around us can be made to change or happen. We can turn on a light bulb and make it brighter or dimmer.

#### Year 6

- Across the world, the demand for energy increases as human populations grow and modern lifestyles require more energy, particularly electrical energy.



## Science Vertical Concepts

### 5. The composition of the Earth and its atmosphere and the processes occurring within them shape the Earth's surface and its climate

#### Year 1

- Plants grow in soil
- The weather can change rapidly. Different seasons have different weather patterns

#### Year 3

- Much of the solid surface of the Earth is covered in soil, which is a mixture of pieces of rock of various sizes and the remains of organisms. Some soil also contains air, water and some nutrients.
- There are many different kinds of rock with different composition and properties.
- Beneath the Earth's solid crust is a hot layer called the mantle. The Earth's crust consists of a number of solid plates which move relative to each other, carried along by movements of the mantle. The formation of mountains, earthquakes and volcanic activity are likely to occur at these cracks (see **Geography Year 3 Spring: Mountains and Volcanoes and Year 4 Summer: Earthquakes**)
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#### Reception

- Some plants have flowers

#### Year 2

- There is air all around us on Earth

#### Year 5

- There is less and less air further away from the Earth's surface; space is a vacuum
- The action of water wears down rock gradually into smaller pieces (see **Geography, Year 5 Spring: Investigating water**)
- Light from the Sun warms the Earth's surface and the heat is trapped by the Earth's air. This is known as the greenhouse effect (see **Geography, Year 5 Summer: Climate across the world**)

#### KS3

- Weather is determined by conditions of the air. The temperature, pressure, direction and speed of the movement and the amount of water vapour in the air combine to create the weather.
- Radioactive decay of material inside the Earth since it was formed is its internal source of energy.



## Science Vertical Concepts

### 6. Our solar system is a very small part of one of millions of galaxies in our universe

#### Year 1

- Daytime is when the Earth is facing the Sun; nighttime is when the Earth is facing away from the Sun.

#### Year 5

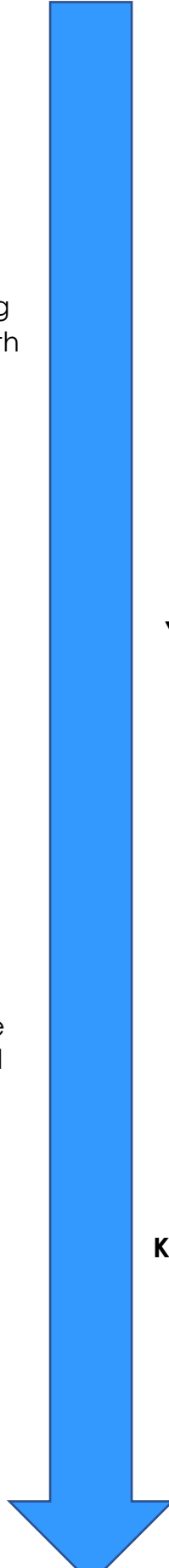
- Our Sun is one of many stars that make up the Universe.
- The distances between us and the bodies in solar system is huge, and even bigger in the Universe

#### Year 3

- The moon reflects light from the sun

#### KS3

- The tilt of the Earth's axis gives rise to seasons.
- The movements of galaxies suggest that the Universe is expanding from a past state called the 'big bang', towards a future that is still unclear





## Science Vertical Concepts

### 7. Organisms are organised on a cellular basis

#### Year 1

- Living things, including humans, react to their surroundings with their senses

#### Year 2

- Living things grow, need, water, air and food, react to their surroundings, move, get rid of their waste, reproduce

#### Year 3

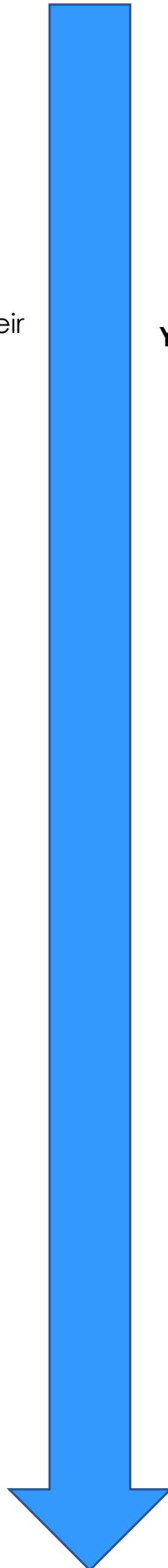
- Living things need water, air, food, a way of getting rid of water and an environment that stays within a particular temperature range.

#### Year 6

- Micro-organisms are organisms that are so small that we cannot see them with our eyes alone

#### KS3

- All living organisms are made of one or more cells, which can only be seen through a microscope
- All the basic functions of life – growth, reproduction, extracting energy from food – are the results of what happens inside cells
- Cells are often aggregated into tissues, tissues into organs, and organs into organ systems





## Science Vertical Concepts

### 8. Organisms require a supply of energy and materials for which they are often dependent on or in competition with other organisms

#### Year 1

- Plant seeds and care for growing plants.
- Understand the key features of the life cycles.

#### Year 1

- There is a wide variety of living things, including plants and animals

#### Year 3

- Plants make their own food using sunlight, carbon dioxide and water

#### KS3

- Decomposers are essential (alongside producers and consumers) for a stable ecosystem.

#### Reception

- There is a wide variety of living things, including plants and animals

#### Year 2

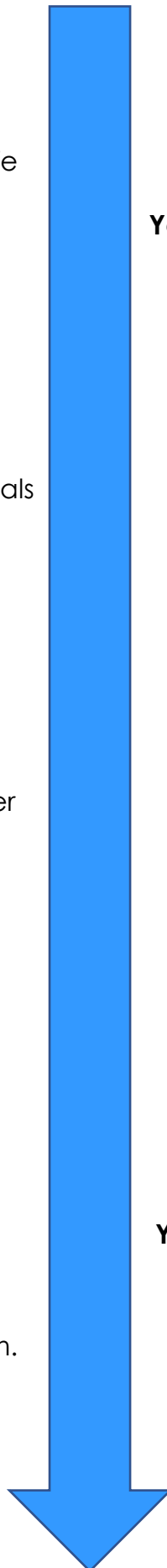
- All living things need energy for food, as well as air, water and certain temperature conditions.
- Most plants make their own food
- Animals need food, which comes by eating plants (herbivores) or by eating animals (carnivores), which have eaten plants or other animals.
- Plants and animals are dependent on each other.
- Organisms are adapted to their environment. If conditions in a habitat change, organisms may not be able to survive.

#### Year 4

- Animals are ultimately dependent on plants for their survival.
- The relationships among organisms can be represented as food chains and food webs.

#### Year 6

- In any given ecosystem there is competition among species for the energy and materials they need to live.







## Science Vertical Concepts

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

#### Nursery

Young animals grow into adult animals

#### Reception

Young animals grow into adult animals

#### Year 2

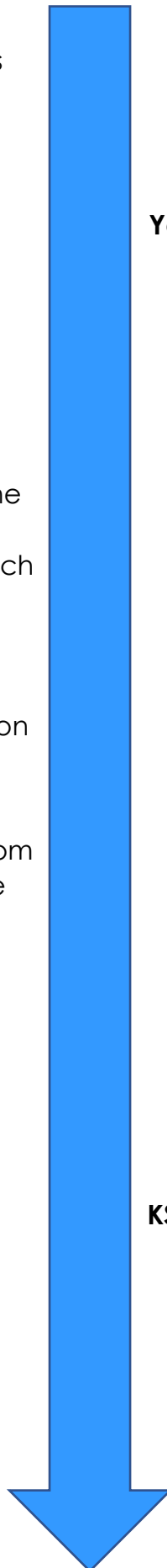
- Plants and animals reproduce (have offspring)

#### Year 5

- Organisms produce offspring of the same kind, but in many cases offspring are not identical with each other or with their parents.
- Plants and animals, including humans, resemble their parents in many features because information is passed from one generation to the next.
- Not all information is passed on from one generation to the other in the same way; some skills and behaviour have to be learned

#### KS3

- In a human body, most cells contain 23 pairs of chromosomes. These provide information that is needed to make more cells in growth and reproduction.
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## Science Vertical Concepts

### 10. Diversity of organisms, living and extinct, is the result of evolution

