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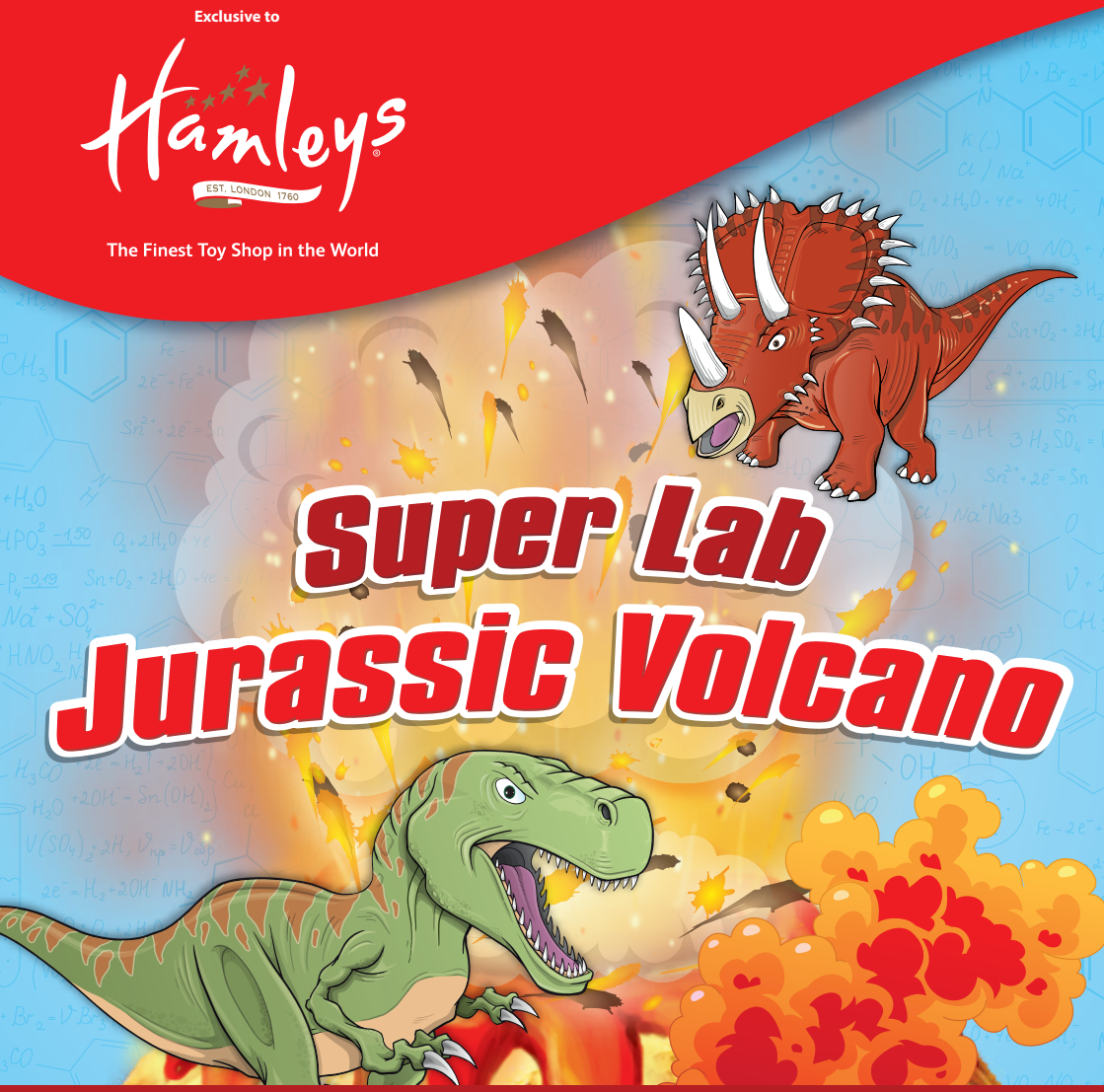


WARNING

Not suitable for children under 8 years old. For use under adult supervision. Contains some chemicals which present a hazard to health. Read the instructions before use, follow them and keep them for reference. Do not allow chemicals to come into contact with any part of the body, particularly the mouth and eyes. Keep small children and animals away from experiments. Keep the experimental set out of reach of children under 8 years old. Eye protection for supervising adults is not included. This image is for illustrative purposes only, some parts or colours may differ. Keep this information for future reference.

Super Lab
Jurassic Volcano

AVAILABLE ONLINE

Find out your educational booklets/experiments in:

FI DK NO SE CZ

www.hamleys.com/explore-SuperSciencelabkits.irs

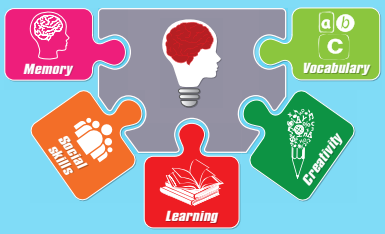
Dear parents and guardians

Through play, children develop different cognitive skills. Scientific studies show that when we are having fun or making discoveries during an experiment, a neurotransmitter called Dopamine is released.

Dopamine is known to be responsible for feelings like motivation, reward and learning and that's why experiences are related to positive feelings. So, if learning is a positive experience, it will stimulate the brain to develop various skills.

Therefore, Science4you aims to develop educational toys that combine fun with education by fostering curiosity and experimentation.

Find out below which skills can be developed with the help of this educational toy!



The educational feature is one of the key strenghts of our toys. We aim to provide toys which enable children's development of physical, emotional and social skills.

Science4you

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London, United Kingdom
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CURRICULUM GOALS
Key stage 1 and 2

This book was produced in accordance with the curriculum goals of Natural Sciences and Physical Chemistry subjects of the following key stages:
Science: KS1 and KS2.

Super Lab
Jurassic Volcano

Índex

SAFETY RULES

- Read these instructions before use, follow them and keep them for reference.
- Keep young children, animals and those not wearing eye protection away from the experimental area.
- Always wear eye protection.
- Store this experimental set out of reach of children under 8 years of age.
- Clean all equipment after use.
- Make sure that all containers are fully closed and properly stored after use.
- Ensure that all empty containers and/or non-reclosable packaging are disposed of properly.
- Wash hands after carrying out experiments.
- Do not use any equipment which has not been supplied with the set or recommended in the instructions for use.
- Do not eat, drink or smoke in the experimental area.
- Do not allow chemicals to come into contact with the eyes or mouth.
- Do not replace foodstuffs in original container. Dispose of immediately.
- Throw away any food used during the experiments.

Warning. This set contains gypsum powder.

- Do not place the material in the mouth.
- Do not inhale dust or powder.
- Do not apply to the body.

GENERAL FIRST AID INFORMATION

In case of eye contact: Wash out eye with plenty of water, holding eye open if necessary. Seek immediate medical advice.

If swallowed: Wash out mouth with water, drink some fresh water. Do not induce vomiting. Seek immediate medical advice.

I**n case of inhalation:** Remove person to fresh air.

In case of skin contact and burns: Wash affected area with plenty of water for at least 10 minutes.

In case of doubt, seek medical advice without delay. Take the chemical and/or product together with the container with you.

In case of injury always seek medical advice.

Write the telephone number of the local poison centre or hospital in the space provided. They may be able to provide information on countermeasures in case of poisoning.

In case of emergency dial

USA 911 | UK 999 | Australia 000 | Europe 112

LIST OF CHEMICALS SUPPLIED

Chemical Substance	Molecular Formula	CAS number
Sodium bicarbonate	**$NaHCO_3$**	**144-55-8**
Gypsum (calcium sulfate)	**$CaSO_4 \cdot 2\,H_2O$**	**7778-18-9**

DISPOSAL OF USED CHEMICALS

When you need to dispose of chemical substances, it is necessary to make reference to national and/or local regulations. In any case you sure never throw chemicals into sewers and garbage. For more details please refer to a competent authority. For disposal of packaging make use of the specif collections points.

ADVICE FOR SUPERVISING ADULTS

Read and follow these instructions, the safety rules and the first aid information, and keep them for reference.

The incorrect use of chemicals can cause injury and damage to health. Only carry out those experiments which are listed in the instructions.

This experimental set is for use only by children over 8 years.

Because children's abilities vary so much, even within age groups, supervising adults should exercise discretion as to which experiments are suitable and safe for them. The instructions should enable supervisors to assess any experiment to establish its suitability for a particular child.

The supervising adult should discuss the warnings and safety information with the child or children before commencing the experiments.

The area surrounding the experiment should be kept clear of any obstructions and away from the storage of food. It should be well lit and ventilated and close to a water supply. A solid table with a heat resistant top should be provided.

KIT CONTENTS

Description:	Quantity:
1. Large measuring cup	2
2. Red food colouring	1
3. Sodium bicarbonate	1
4. Gypsum	1
5. Modelling clay	2
6. Protective goggles	2
7. Excavation block with dinosaur	2
8. Rolling pin	1
9. Gouache set (pack of 6)	1
10. Plastic spatula	1
11. Brushes	2
12. Wooden spatulas	2
13. Pasteur pipette	1

1. History of planet Earth

Since its formation that planet Earth is in constant change. Seas were formed, land masses changed its original places, mountains get raised due to the internal forces of the planet, the atmosphere composition got different and the first living beings start to develop.

Scientist do you want to know more about the planet Earth, its structure and its internal forces? Discover the curiosities we have for you in the following link:
www.science4youtoys.co.uk/jurassic-volcano

The first living beings were small cells that start transforming into bigger or more complex livings, due to evolution.

DID YOU KNOW...
That the oldest fossil that was discovered has about 4 billions years old and belongs to some bacterias?
These were cyanobacteria, capable of carrying out photosynthesis and, as so, to release oxygen to the atmosphere!
In this way, scientists believe that these bacteria had big importance in the develop of life, as we know it!

To tell the story of planet Earth, scientists divided it in different stages, that they called the **geologic time scale**.

The largest division is called **eon** which is divided in **eras** and these are divided in periods which are divided in **epochs**.

Image1. Living beings evolution.

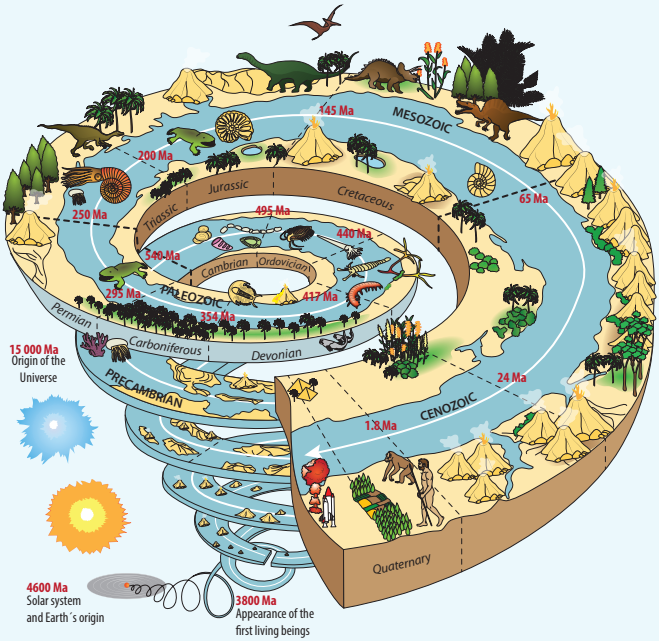


Image 2. Geologic time scale.

These divisions are related to the kind of life that characterized the planet in a specific time, such as the weather, habitats and, of course, the continents configuration at that time.

1.1. Dinosaur era

As you can see in image 2, our planet has its history divided in 4 stages: **Precambrian** éon, **Paleozoic** era, **Mesozoic** era and **Cenozoic** era (the nowadays era).

It is estimated that the dinosaur era began at about 250 millions of years ago (Mya). In the **Mesozoic era** we can distinguish 3 periods: Triassic, Jurassic and Cretaceous.

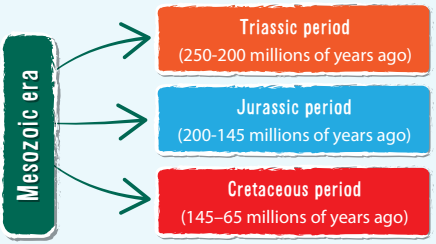


Image 3. The Mesozoic era division.

The first dinosaurs appeared in the Triassic period, however, it was in the Jurassic period that dinosaurs were on their peak, spread in the most varied habitats and adapted to the most diverse ecological niches, all over the planet.

At the same time that dinosaurs were appearing, growing and evolving, planet Earth was also suffering changes.

Triassic period

During this period, an enormous continent called Pangaea occupied the planet Earth. This big land mass stretched from pole to pole and its central zone was a huge desert.

Jurassic period

Pangaea start its division, originating 2 large continents: Laurasia at north and Gondwana at south. Weather became more humid, resulting in the spread of woodlands and dinosaurs starts to develop.

Cretaceous period

Both continents got completely separated.
The climate was characterised by dry and humid seasons and most of the space was occupied by forests. The first plants with flowers also appeared which in turn, led to the appearance of insects such as butterflies and bees.

But what were dinosaurs?

1.2. Dinosaurs

Dinosaurs probably were the most successful animals of the history of planet Earth.

DID YOU KNOW ...
That the name dinosaur comes from the Greek and means "terrible lizard"?

Image 4. Representation of dinosaurs in their habitat.

We can say that dinosaurs were very special reptiles!

Dinosaurs shared their habitat with other living beings.

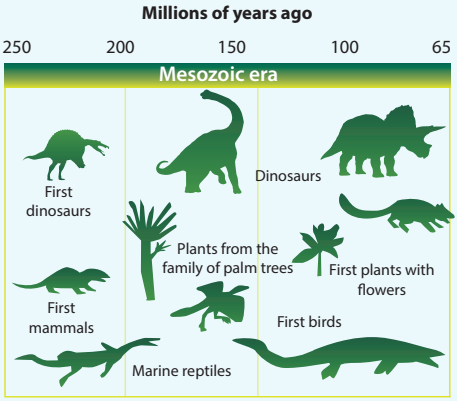


Image 5. Mesozoic era.

As you can see in image 5, there were many reptiles living in the Mesozoic era.

So why were dinosaurs special reptiles?

1 In opposite of what happens in the nowadays reptiles, scientists believes that they didn't depend totally on the environment to control their body temperature.

Dinosaurs' fossils show that dinosaurs had many blood vessels, like we see in nowadays mammals and birds.

An animal that depends on the environment to control their body temperature is called **poikilotherm**.
An animal that maintains its body temperature at a constant level, usually above that of the environment, by its metabolic activity is called **homeotherm**.

2 Dinosaurs' legs were located under their bodies, holding all their weight.

Nowadays reptiles have their legs laterally to its bodies.

3 However, like the majority of the nowadays reptiles, dinosaurs were oviparous and most had their body covered in scales.

An oviparous is an animal that gives birth by means of eggs which are hatched after they have been laid by the parent.

Image 6. Fossil of dinosaur eggs with embryos inside.

Scientist, do you want to know more about fossils? Find out the curiosities that we have for you in the followig link: **www.science4youtoys.co.uk/jurassic-volcano**

DID YOU KNOW …

That during the Mesozoic era, dinosaurs shared their habitat with other large reptiles?

There were, during this geological time, several marine and flying reptiles that, even sharing some characteristics with dinosaurs, didn't belong to the same animal family.

Image 7. Marine reptiles of the Mesozoic era.

1.3. Dinosaur classification

The classification of these animals is quite varied, as along millions of years they lived around the entire planet and acquired specific characteristics.

We can, however, divide dinosaurs in **2 large groups**, accordingly to the position of their pubic bone (pelvic zone – hips):

Saurischia: their pelvises were similar to those of lizards.
These could be **theropoda** (carnivorous animals that moved on 2 legs) or **sauropodomorpha** (herbivorous animals with a long neck and that moved on 4 legs).

Ornithischia: their pelvises were similar to those of birds and were mainly herbivorous.
These could be **thyreophora** (quadrupeds' animals with bone shields); **marginocephalia** (with small and sharp teeth, frill-headed and with bony horns) and **ornithopoda** (animals that could walk on 2 or 4 legs, which mouths were similar to those of ducks).

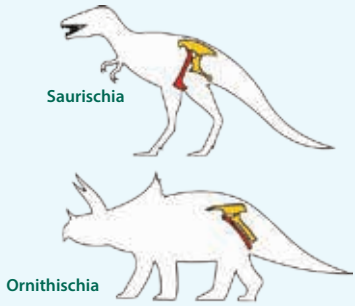


Image 8. Difference in the position of the pubic bone (in red) observed between both groups of dinosaurs – saurischia and ornithischia.

1.4. *Triceratops*

Triceratops was one of the most admirabe dinosaurs of the history!

Scientific name: *Triceratops horridus*
Diet: herbivorous
Size: 8 to 10 metres (26.2 to 32.8 feet) of length and 3 to 4 metres (9.8 to 13.1 feet) high
Weight: 4 to 6 tons
Classification: ornithischia, marginocephalia
Fossils: Canada and United States of America as we now know them, dating from the Late Cretaceous period

Image 9. *Triceratops.*

Triceratops were quadruped and herbivorous dinosaurs, that had some curious characteristics.

DID YOU KNOW ...
That the name *Triceratops* is derived from the Greek and means 'three--horned face'.

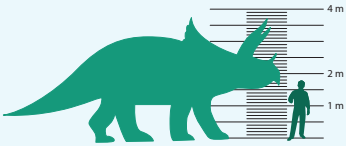


Image 10. Comparison between a 1.8 metre (5.9 feet) size man and a *Triceratops*.

DID YOU KNOW...
That scientists believes that *Triceratops*' ancestors probably walked on 2 legs? The posterior legs of *Triceratops* were longer than the anterior ones. Furthermore, were also very robust and muscled to support the weight of these dinosaurs.

Their **head** was one of its distinctive characteristics.

A *Triceratops* head could measure 1 to 2 metres (3.3 to 6.6 feet) and also had 3 horns, one right on top of the mouth and two above the eyes.

Triceratops also had a **frill** located on the posterior part of its head. This could measure up to 2 metres (6.6 feet).

Because of these characteristics, *Triceratops* belong to the **marginocephalia** group.

Image 11. Front view from a *Triceratops,* noting the size of their horns and frill.

Scientists believes that *Triceratops* used their horns to defend themselfs against their predators. Furthermore, probably they fighted with other animals of its species in mating rituals.

As an herbivorous animal, *Triceratops* had an excellent dentition.

These animals had almost 800 sharp teeth that could slide against each other! These facts indicate that the vegetation they ate should have been extremely fibrous, such as coniferous, palm and fern leaves and plants with flowers, very common in the Cretaceous period!

Image 12. *Triceratops*, teeth in detail.

Triceratops' mouth looked like a parrot's beak.
This is why their heads look like a mixture of a giant parrot and a rhinocero.

DID YOU KNOW…
That it's believed that *Triceratops* may have been one of the last living dinosaurs?
This theory is based on the *Triceratops* fossils found in the most recent sediments.

Tyrannosaurus rex (T-rex) must have been the main predator of *Triceratops*. It was possible to conclude this relation prey-predator by T-rex's fossilised faeces records that contained fragments of *Triceratops* head bony plates.

Scientist, do you want to know more about rocks and where to find fossils? So explore the curiosities we have for you in the following link:
www.science4youtoys.co.uk/jurassic-volcano

1.5. *Tyrannosaurus rex*

Tyrannosaurus rex (T-rex) is considered one of the most frightening carnivorous dinosaurs known.

DID YOU KNOW …
The name *Tyrannosaurus rex* comes from Latin in which *Tyrannosaurus* means 'tyrant lizard' and rex means 'king'?
This dinosaur was known as the 'King of Dinosaurs'.

Scientific name: *Tyrannosaurus rex*
Diet: carnivorous
Size: 12 metres (39.4 feet) of length and 4 to 6 metres (13.1 to 19.7 feet) high
Weight: 5 to 7 tons
Classification: saurischia, theropoda
Fossils: United States of America as we now know it, from the Late Cretaceous period

Image 13. *Tyrannosaurus rex.*

This biped animal had an anatomy that allowed smashing: it had a heavy and massive skull that could measure up to 1.5 metres (4.9 feet) and a jaw that could measure 1.2 metre (3.9 feet) of length!

Image 14. Comparison between a 1.8 metre (5.9 feet) size man and a *Tyrannosaurus rex.*

Their teeth had a conical shape similar to saws. It is thought that T-rex used them to drill and grab with strength its preys and then to strip off their meat with the strength of its neck muscles!

DID YOU KNOW ...
That scientists believe that this carnivorous animal could eat up to 230 kilograms (507.06 pounds) of meat at once?

These dinosaurs also had strong thighs and a powerful tail that was very useful when they went in higher speeds.

DID YOU KNOW ...
That the living animal that is more related to T-rex is the chicken?
Their feet had 3 big fingers similar to those of chickens.

Figura 15. Fossil of a T-rex' footprint.

However, their anterior legs were very small and had two fingers in these.

DID YOU KNOW ...
That the largest arm known of this species wasn't larger than an adult's forearm?
The arms of T-rex measured, in average, 1 metre (3.3 feet).

In fact, considering its morphology, T-rex, probably, wasn't able to invest in great hunting due to its short sized arms, which could had caused him serious difficulties in getting up, if fallen, during hunts.

Besides this, scientists believe that these animals had a great sense of smell, a characteristic found also on modern scavengers.

Image 16. Representation of a T-rex eating a *Triceratops*.

1.6. The dinosaur extinction

If these animals were so well succeeded, why they don't exist nowadays?

The dinosaur **extinction** happened at about 65 million years ago and led to the disappearance of most large reptiles' species that existed on Earth.

A mass extinction is a global phenomenon on which, over a period of time, several species of several taxa disappear, causing an alteration or a phenomenon which causes the disappearance of all individuals of one or more species.

But what is a mass extinction?

With so many theories to justify a massive event such as the dinosaur extinction, it was not always quite consensual the reason that led to its end.

The most common and accepted theory among the scientific community relates the **collision of an asteroid** with almost 2 kilometres (1.24 miles) of diameter, with our planet.

Image 17. Representation of the collision of an asteroid with planet Earth.

This collision initiated many and significant changes on our planet's conditions. It is believed that the collision originated long and intense **volcanic eruptions** which released gases and great amounts of dust that prevented the sun's entry in the atmosphere.

Image 18. Many volcanic eruptions conditioned the continuity of life on planet Earth.

This way, flora disappeared, conditioning the availability of food for herbivorous dinosaurs. In this way, there weren't food for the carnivouros too.

However, it was due to this mass extinction that new forms of life developed, like small mammals and all the living beeings we see nowadays.

2. Volcanoes

Volcanic landscapes are the consequence of the expression, in Earth surface, of the volcanoes activity.

Scientist, do you want to know more about landforms and geologic landscapes? So visit the following link and have fun!

www.science4youtoys.co.uk/jurassic-volcano

Volcanic activity is related to the internal dynamics of Earth. This expresses itself in volcanoes and seismic activities.

Volcanoes are geological formations that consist of openings in the Earth's crust. They allow pockets of **magma** to reach the surface, derived from the asthenosphere.

Magma is the name of the melted rock with origin in the asthenosphere.

Scientist, you don't know what is the asthenosphere? So visit the following and take away your doubts!
www.science4youtoys.co.uk/jurassic-volcano

DID YOU KNOW …
That the word volcano comes from 'Vulcan'?
This was the name of the Roman god of fire.

Volcanoes are formed due to the release of magma to the lithosphere.

We can say that volcanoes are formed because of eruptions of lava and ashes that solidify and give rise to the volcano shape.

2.1. Structure of a model volcano

Volcanoes can have many shapes that vary because of the type of the materias that are expelled and because of the type of opening they have.

DID YOU KNOW …
That volcanoes can also be formed deep in the ocean?

It's quite impossible that there are two equal volcanoes, but all have the same general structure.

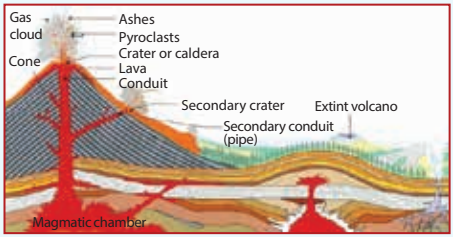


Image 19. Structure of a volcano.

The **magmatic chamber** is the place where the magma is located, the throat is its way out to the surface and the crater is from where all the materials are expelled from the volcano.

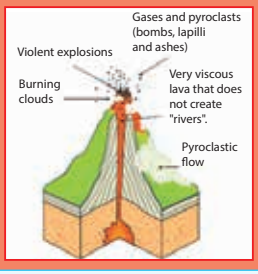
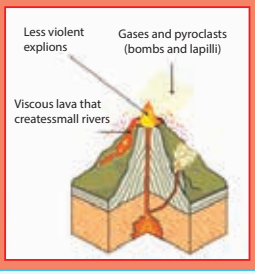
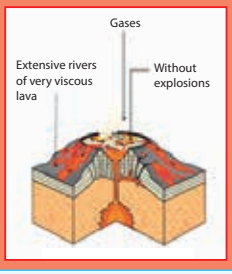
The **cone** is the reslt of the acumulation of the solid materials that are expelled during an eruption!

2.2. Types of volcanoes and eruptions

Volcanic eruptions can be the most beautiful but the most dangerous manifestations of the Earth's internal activity.

When magma reaches the Earth's surface can cause explosions, eartquakes, incandescent lava rivers and burning ashes falls.

Lava' characteristics are responsible for the type of volcanic activity and, as so, we can classify these in three main types, as you can see in the following table.

Caractheristics/ Eruption type	**Explosive**	**Mild explosive**	**Effusive**
Volcanic activity	**Volcanian**	**Strombolian**	**Hawaiian**
Lava viscosity	Very viscous	Fluid	Very fluid
Gas content	Rich	Poor	Very poor
Liquid and solid materials	Pyroclasts and formation of ash clouds (formed by incandescent gases and ashes that rolls down through the volcano hills, close to the ground).	Characterised by regular and constant explosions that launch incandescent lava into the air. The explosions are accompanied by rivers of lava and gas emissions.	Large lakes and rivers of lava; no pyroclasts.
Cone structure	High; the cone is very steep. 	High; the cone is very inclined. 	Short; the cone has smooth sides. 

Tabel 1. Volcanic eruptions characteristics.

a) Expelled materials by volcanoes

When magma reaches the Earth's surface, loses gases and lava is formed. When lava cools down, it gets solid and volcanic rocks are formed.

However, there are more materials that are expeled from a volcano.

Lava	**Material** that is expelled by volcanoes with temperatures between 600ºC (1112ºF) and 1200ºC (2192ºF). Its chemical characteristics are very variable, determining its viscosity. Lavas richs in iron and magnesium are more fluid than lavas rich in silica. Lava characteristics depends also of its contents in water and its temperature. They can be of three types: **Pahoehoe:** this is a very fluid type of lava. It is formed by the solidification of a very thin surface layer, under which the lava continues to flow. This causes the superficial layer to billowy and heaving. **Aa:** this name has derived from the sound people make when walking barefoot over the solidified deposits of this type of lava. This is because it is irregular and has sharp edges. It is a thicker lava that cools down and breaks into blocks due to the pressure exerted by the rest of the lava flow pushing against it. **Submarine lava (or pillow lava):** this type of lava cools down very fast due to its contact with the water, which gives it a very unique look, similar to pillows.
Gases	The **gas portion** of magma varies between 1% and 5% of its total weight. Of these gases, about 70-90% is steam. The most common gases are steam, carbon dioxide and sulphur dioxide.
Pyroclasts	**Rock fragments** that are launch through the air during a volcanic eruption. These are originated because of the lava' solidification or due to the cracking of the volcanic rock material. According to their shape, pyroclasts can be classified in: bombs, lapilli and ashes.  **Image 20.** Solid fraction of the volcanic materials expelled during an eruption. As you can observe in image 20, **bombs** are the bigger type of pyroclasts (>60 millimetres (mm)), followed by **lapilli** (2 to 60 mm). The smaller solid materials are the **ashes** (<2 mm).

Tabel 2. Expelled materials during a volcanic eruption.

2.3. Secondary volcanism

When the volcanc activity continues with softer charateristics, we say that a **secondary volcanism** is happening.

We can consider:

Fumaroles: Openings or fissures on the planet's surface, usually around a volcano, from where gases are released into the atmosphere.

Image 21. Fumarole, Azores (Portugal).

Hot springs and geysers: These emit steam and water at high temperatures. They are usually in the form of gushes caused by the heating of water contained in subterranean deposits.

2.4. Classification of volcanoes by activity

a) Active volcanoes

Volcanoes that can erupt. Most volcanoes erupt occasionally, remaining dormant for most of the time. There are very few constantly erupting volcanoes. The active period can last from a few hours to several years, while the dormant between eruptions may be months, years or even centuries.

b) Dormant volcanoes

Are those in a resting phase, which present sporadic evidence of secondary volcanism, such as hot springs or fumaroles.

c) Extinct volcanoes

These are volcanoes that have been active in the past but currently do not present any indication they could become active again.

To be considered as an extinct volcano, it can't show any activity during several centuries.

When it's activity is extint or the volcanoes are dormant it's common that **calderas** are formed. These are the result of large eruptions, where there was a total or partial collapse of the volcanic structure, leaving a huge crater.

Image 22. Caldera de Tambora (Isla de Sumbawa) Indonesia.

2.5. Volcanoes in the United Kingdom

It's been about 60 million years since there was an active volcano in Britain but there are beautiful landscapes that were formed as the result of volcanic activity.

One example is the Giant's Causeway, 40,000 basalt columns stretching into the sea, some 12 metres (40 feet) high that were formed by lava pushing up through fissures in the ground.

Image 23. Giant's Causeway.

The reason why there isn't any volcano activity for about 60 million years in Britain is that it is now in a tectonically quiet part of the world.

Most volcanoes occur near the edges of the Earth's tectonic plates but Britain is now a long way from such geologically active areas.

Curiosities

Do you know were to find much more curiosites about the Jurassic Volcano?

Look for them in the following link:

www.science4youtoys.co.uk/super-lab-jurassic-volcano

3. Experiments

Don't forget to put your protective goggles every time they are showned in the material list!

Material included in the kit.

Attention Scientist! It is very important to wash all the materials before and after performing each experiment. You must also be careful with your clothes and keep your face in a safe distance from the experiments, in order to avoid that any product gets into your eyes!

At the end of the experiments it is essential to always wash your hands, such as real scientists do!

Have fun, scientist!

Experiment 1
Build your Jurassic Volcano

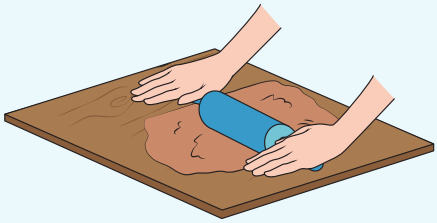
What you will need:

- Modelling clay
- Rolling pin
- Large measuring cup
- Brush (long) and gouaches
- Chopping board

Steps:

1. Start by preparing your experiment area: choose a wide table where you can place the materials you need.

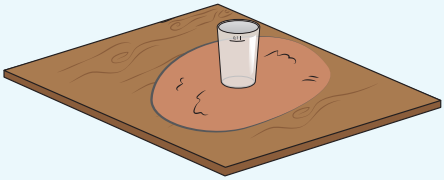
2. Open one of the modelling clay packages and create a base for your volcano: place the modelling clay on the chopping board and flatten it with the rolling pin.



3. Make sure the base gets a circular shape.

4. Turn the clay over and roll out it as well, so that both sides are flattened. If you see any imperfection on the clay, use your fingers to press on them.

5. Now, place your large measuring cup on your modelling clay base made. The cup will be the mould for your volcano.

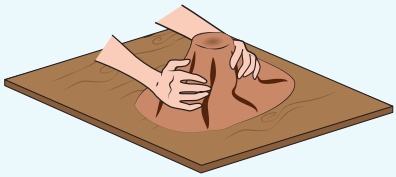


6. Now you need to make the walls for your volcano. Open the second package of modelling clay and, once again, mould the clay in a circular shape.

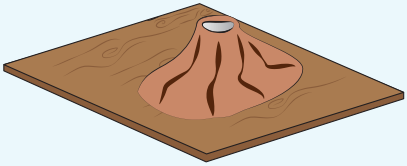
7. With the rolling pin and your fingers, flatten the clay.

8. This circle you are creating has to be larger than the first one. In this case, the clay has to cover the cup and then be attached to the base of the volcano, in order to create a cone.

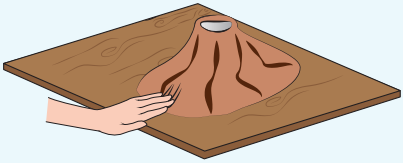
9. When the cup is completely covered, with the right diameter, attach it to the base of the volcano with you fingers.



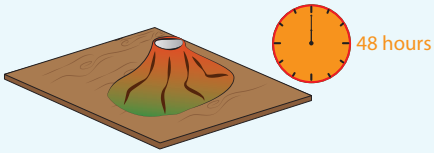
10. Remove the modelling clay from the top of the volcano (where the opening of the cup is located), in order to make the crater. **Attention:** make sure you have enough clay to cover the rim of the cup.



11. In all the stages of building your volcano, you must always make sure that the clay is even: you must pass your fingers on it to join the clay, mainly between the base and the walls of the volcano. If you notice that the modelling clay is drying, wet your fingers and pass them on the clay.



12. Leave your volcano to dry on the chopping board for about 48 hours. Now it is time to paint your volcano with the paintbrush and gouaches!



13. When it is dry, your volcano is ready to use.

Explanation:
Some materials we use in our everyday life come from nature. The modelling clay that you have used in this experiment is from plant origin, this is to say, it comes form a plant: bamboo.

DID YOU KNOW...
That bamboo is the giant-pandas' favourite food?

Image 1. Giant-panda eating bamboo.

For sure you have heard about other types of modelling clay, for example play dough or clay.

Play dough has a property which doesn't let it dry. Clay, on the other hand, is a material rich in water and that is why it is so mouldable. So that the clay becomes solid and a hard structure, all the water in it has to evaporate. This is why clay needs to be cooked in a stove.

The great advantage of the modelling clay you've used in this experiment is that it only needs to dry in open air to become solid.

Apart from this, when dry, you can wet the modelling clay and it doesn't lose its initial structure.

Experiment 2
The eruption of a volcano

Let's see your volcano erupting. Can you see which type of eruption it is?

What you will need:

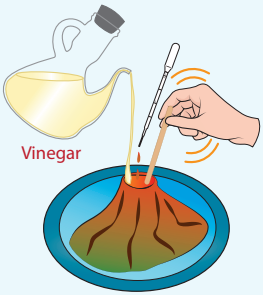
- Jurassic Volcano (built in experiment 1)
- Pasteur pipette
- Red food colouring
- Plastic spatula
- Wooden spatula
- Sodium bicarbonate (baking soda)
- Large measuring cup
- Vinegar
- Wheat flour
- Deep dish

Steps:

1. Start by placing the Jurassic Volcano on the deep dish.

2. Fill in the volcano with vinegar.

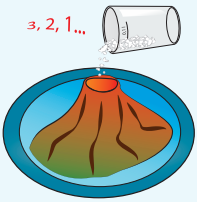
3. With the Pasteur pipette, add some drops of red food colouring and with the wooden spatula stir well.



4. With the plastic spatula, add 3 spoons of wheat flour to the volcano mould and stir well, until the flour is dissolved in the vinegar.

5. With the plastic spatula, add 5 spoons of sodium bicarbonate (baking soda) to the large measuring cup.

6. Start a countdown and pour the content into the volcano.



7. Observe what happens.

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:

In this experiment you can simulate what happens during an **effusive** eruption through a chemical reaction.

The chemical reaction you have just seen is an **acid-base** reaction.

Vinegar has in its composition an acid, **acetic acid**. Baking soda is a base.

This way, when mixed with an acid, baking soda ($NaHCO_3$) decomposes and releases gas (carbon dioxide), in the following chemical reaction:

$$NaHCO_3 + Acid \rightarrow Na\text{-}Acid + CO_2 + H_2O$$

In this reaction, we get as reaction products, salt (Na-Acid) that dissolves in water (H_2O) and carbon dioxide (CO_2) that, for being a gas, bubbles in the liquid.

In this experiment, flour helps to simulate lava as it makes it smooth.

Experiment 3
Another way to erupt

What you will need:

- Pasteur pipette
- Red food colouring
- Plastic spatula
- Jurassic Volcano (built in experiment 1)

- Wooden spatula
- Sodium bicarbonate (baking soda)
- Lemon
- Flour
- Large measuring cup
- Water
- Deep dish
- Cup
- Absorbent paper

Steps:

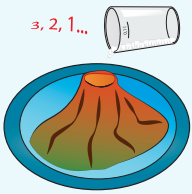
1. Start by placing the Jurassic Volcano on the deep dish.

2. Now squeeze a lemon into a cup to obtain all the juice. Then, pour this juice into the volcano.

3. With the Pasteur pipette, add to the lemon juice some drops of red food colouring. Finally, add 1 spoon of flour and mix with the wooden spatula until it is completely dissolved.

4. Clean up the large measuring cup with absorbent paper and with the spoon of the plastic spatula, add 5 spoons of baking soda to the large measuring cup.

5. Make a countdown and pour the content into the volcano.



6. Observe what happens!

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:

In this experiment you are using the same scientific knowledge as in experiment 2.

In this case the reaction happens between the citric acid and the baking soda.

What is citric acid?

Citric acid is one of the main ingredients of citrines, such as orange, lemon, lime and many others.

Image 2. Citrines.

Experiment 4
A stickier lava

In this experiment you will learn how to turn your lava more viscous (stickier) and observe the differences between a more viscous lava and one more fluid.

What you will need:

- Pasteur pipette
- Red food colouring
- Plastic spatula
- Wooden spatula
- Baking soda
- Jurassic Volcano (built in experiment 1)

- Large measuring cup
- Vinegar
- Washing-up liquid
- Deep dish

Steps:

1. Start by placing the Jurassic Volcano on the deep dish.

2. Fill in the volcano with vinegar.

3. With the Pasteur pipette, add to the vinegar some drops of red food colouring. Stir the liquids well, using the wooden spatula.

4. Add to the volcano 3 spoons of washing-up liquid. Stir carefully, so you don't create foam.

5. With the plastic spatula, add 5 spoons of baking soda to the large measuring cup.

6. Make a countdown and pour the content into the volcano.

7. Observe what happens!

ATTENTION: when you have finished, throw away all food products used during the experiment.

Explanation:

In this experiment, once again, you've made the volcano erupt, thanks to a chemical reaction that releases carbon dioxide. However, contrarily to what happens to the flour, the washing-up liquid releases foam, making it more consistent, this is to say more viscous or sticky.

This happens because the foam that is created, mixed with the liquid, is dragged by the bubbles of CO_2 that are created in the chemical reaction.

Experiment 5
A faster eruption

Do you want to observe the release of gases during a volcanic eruption? Then try out this experiment!

What you will need:

- Pasteur pipette
- Red food colouring
- Plastic spatula
- Wooden spatula
- Baking soda
- Jurassic Volcano (built in experiment 1)
- Large measuring cup
- Vinegar
- Deep dish

Steps:

1. Start by placing the Jurassic Volcano on the deep dish.

2. Fill in the volcano with vinegar.

3. With the Pasteur pipette, add to the vinegar some drops of red food colouring. Stir well the liquids using the wooden spatula.

4. With the plastic spatula, add 5 spoons of baking soda to the large measuring cup.

5. Make a countdown and pour the content of the cup into the volcano.

6. Observe what happens!

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:
In this experiment you can make your volcano erupt, thanks to the chemical reaction that releases carbon dioxide. However, in this case, as you are not using any product that gives fluidity or viscosity to the lava, you can observe a phenomenon called **efferescence**: release of gases in a liquid.

The gas also can drag part of the liquid that is in the volcano, allowing the volcano to erupt.

Experiment 6
Water volcano

Have you ever noticed that when you drink a hot drink, the first sips seem hotter then the following ones? Do you want to know why? So perform this experiment and find out!

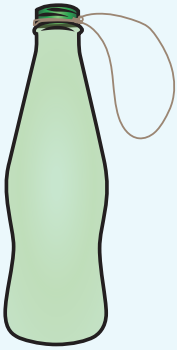
ATTENTION: ask an adult for help.

What you will need:
- Small and transparent glass bottle
- Large and transparent glass flask (2 times grater than the glass bottle)
- String or wool
- Red food colouring
- Pasteur pipette
- Scissors
- Ruler or measuring tape

Steps:
1. Measure, with the ruler or measuring tape, 30 centimetres of string (or wool). Then, ask an adult to cut it with the scissors.

2. Tie one of the ends around the small bottle's opening, leaving the other end loose.

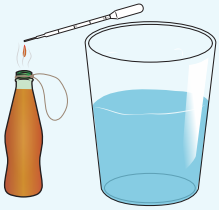
3. Tie the other end to the string that's attached around the opening of the bottle, creating a handle.



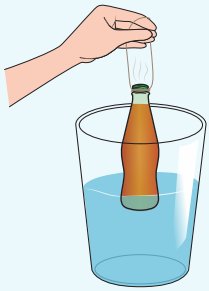
4. Fill with cold water ⅔ of the large flask.

5. Now ask an adult to fill completely the small bottle with hot water from a tap.

6. With the Pasteur pipette, add to the small bottle some drops of red food colouring.



7. Hold the small bottle by the handle and dip it slowly in the flask with cold water. Pay attention and keep the bottle upright. Observe what happens.



Explanation:
In this experiment you can observe that when dipping the small bottle in cold water, the hot water is expelled, as if it was magma erupting from a volcano, rising very fast to the top of the flask.

When the water is heated it expands, this is to say, it occupies more space. Water then becomes lighter (less dense) than cold water, so it rises to the surface of cold water.

Density is one of the chemical properties most studied, and it is the mass per unit volume of a body and varies with temperature and pressure.

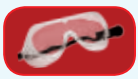
$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Experiment 7
Mini geyser

Have you ever seen a geyser erupting?
With this experiment you will experience one!

ATTENTION: ask an adult for help.

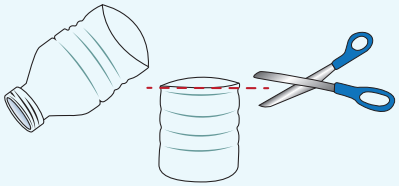
What you will need:



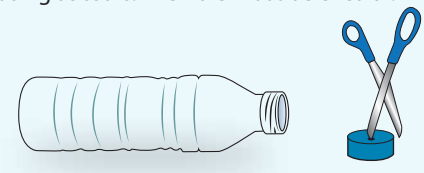
- Cold carbonated water
- Small plastic bottle
- Large plastic bottle
- Scissors
- Straw
- Play dough or a portion of modelling clay
- Warm water

Steps:

1. Ask an adult to cut a large bottle in half, in order to create a container.

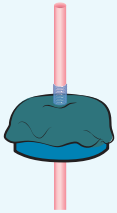


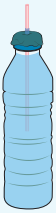
2. With the help of an adult, take the lid off the small bottle and make a hole in its lid, using scissors. The hole must be circular.



3. Insert the straw in the hole of the lid.

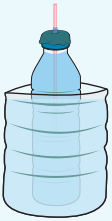
4. In order to make sure that the bottle is sealed, add some play dough between the lid and the straw, around the hole.





5. Fill to the top the small bottle with **cold** carbonated water and put the lid on.

6. Ask an adult to fill the plastic container with hot water from the tap and place it in the kitchen sink.



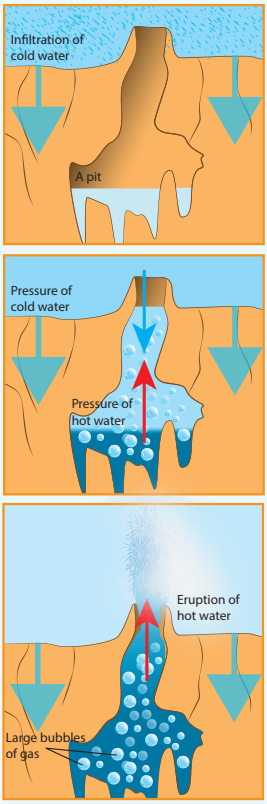
7. Carefully, place the small bottle in the container.

8. The excess water overflows, but what happens to the straw?

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:
A geyser is a geologic phenomenon in which a release of a column of water to the exterior of Earth happens.

We know that in the inside of the Earth is very hot, so the water that is infiltrated and accumulated inside becomes hot as well. When this water is pressured by the surface water, an ascendant force is created, becoming stronger than the cold water, ending up rising.



When rising, the bubbles of hot gas make the water column jump out such as a cork stopper from a bottle, creating a geyser.

In this experiment, the straw represents the pit of the geyser, the cold water represents the water that fills the pit and the hot water represents the high temperatures inside the Earth.

When we put together both containers, the gas from the carbonated water is heated, increasing its volume, dragging the gas bubbles up through the straw, simulating a geyser.

Experiment 8
A stronger geyser

Such as in the previous experiment, in this one you will observe the incredible strength of a geyser.

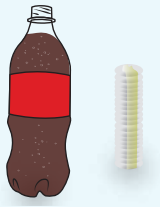
Attention!
This experiment must be performed in a wide space!

ATTENTION: ask an adult for help.

What you will need:
- 1.5 L bottle of a *Coca-cola* (preferably diet)
- One package of *Mentos*
- Sticky tape
- Scissors

Steps:
1. Place the bottle on a flat and stable surface.

2. Open the *Mentos* package and think of a way to put them all at the same time in the bottle. To make it easier you can create a cylinder with the *Mentos*, one on top of each other, attached with sticky tape on the sides. Use the scissors to cut the sticky tape.



3. Open the bottle and put all the sweets inside.

4. Now, move away form the bottle.

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:
Carbonated drinks contain a high amount of dissolved carbon dioxide, in balance and under pressure, ready to escape. This way, when we open the bottle, the gas escapes to the outside.

When we put *Mentos* into the soft drink bottle, the bubbles of carbon dioxide start appearing at the surface of the sweets. All these bubbles are created so fast that they drag the drink out of the bottle.

When we add sweets to a soft drink, we are creating a kind of release nuclei of carbon dioxide (which is dissolved).

This happens because these sweets are porous and rough. When we add any porous object to a liquid with gas (for example, salt) we can observe a higher release of CO_2.

These sweets also have a surfactant (a compound that can change the surface properties of a liquid) that decreases the tension between the molecules of a soft drink. This way, it allows creating larger bubbles.

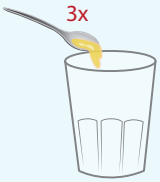
Note: the outcome of this experiment is better with a diet soft drink because it also has surfactants (the sweetener used to replace sugar).

Experiment 9
The formation of planet Earth

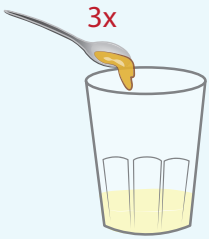
In this experiment you will understand the reason why the inside of Earth is made up of several concentric layers, that don't get mixed.

What you will need:
- Tall transparent cup
- Water
- Cooking oil
- Honey
- Tablespoon

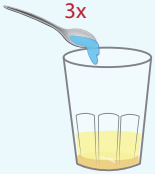
Steps:
1. Add three spoons of cooking oil to the cup.



2. Now add three spoons of honey to the cup. Do not let the honey slide down on the walls of the cup.



3. Finally, add three tablespoons of water to the cup.



4. Observe what happens!

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:

When performing this experiment you must have observed that, even though you have poured the cooking oil in first, it stayed on top.

Apart from this, you could observe that these three liquids don't get mixed.

Do you remember what density is? It was described in experiment 6.

The explanation is the same; the three liquids do not get mixed because they have **different densities**.

During the formation of the planet Earth, a similar process happened.

Materials like iron and nickel are quite dense and, as so, moved to the inside of Earth, such as what happened with the honey from the experiment (it went to the bottom of the cup).

Unlike these ones, the less dense materials tend to rise to the surface, creating the Earth's crust, such as what happened with the oil.

The mantle of our planet was created by materials with medium density that, regarding our experiment, was water.

Experiment 10
The internal structure of planet Earth

As you already know, planet Earth is made of concentric layers. With this experiment we will create a model of its internal structure.

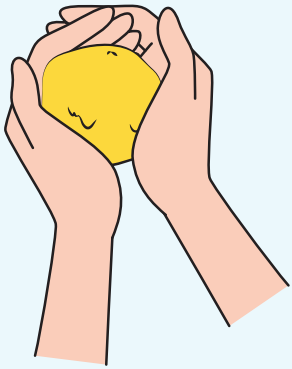
ATTENTION: ask an adult for help.

What you will need:

- Play dough in three different colours
- Toothpicks
- Paper sheets
- Scissors
- Sticky paper
- Knife
- Rolling pin
- Chopping board

Steps:

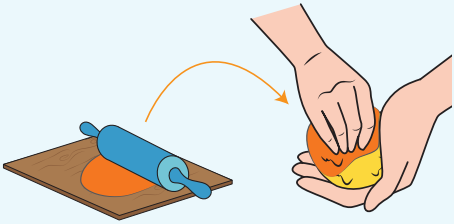
1. Start by choosing one of the colours of the play dough and with your hands make a ball with it.



This ball represents the core!

2. On the chopping board and using the rolling pin, flatten play dough of a different colour. Make sure it doesn't turn out too thin.

3. Put this layer around the core.

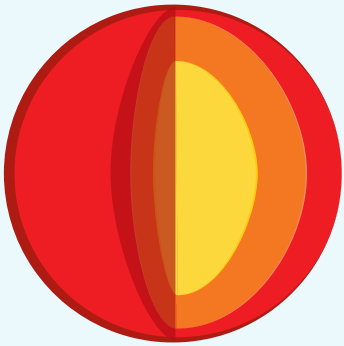


This layer represents the mantle!

4. Repeat steps 2 and 3 for the third play dough colour.

This layer represents the crust!

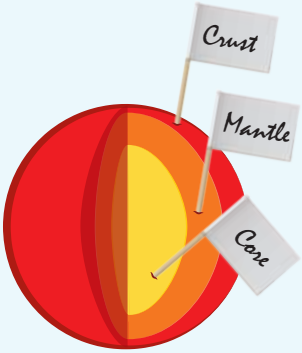
5. Now ask an adult to cut with the knife ¼ of the ball. This way, you will be able to see the 3 layers in different colours.



6. In three pieces of paper, write the name of each layer of the Earth.

7. Use the sticky tape to attach each piece of paper to a toothpick.

8. Stick each toothpick in the matching layer.



Explanation:
With this experiment you can recreate the planet Earth, with its different layers.

Scientist, do you want to learn more about the layers of the planet Earth? Check the online content of the Jurassic Volcano!
www.science4youtoys.co.uk/jurassic-volcano

Experiment 11
The formation of the atmosphere of Earth

Have you ever wondered how the atmosphere of Earth was created? This experiment will help you understand it!

What you will need:

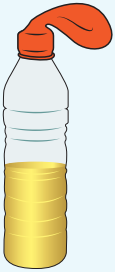
- Small plastic bottle
- Plastic spatula
- Balloon
- Funnel
- Vinegar
- Baking soda
- Large measuring cup

Steps:
1. Fill in the large measuring cup with 100 millilitres (ml) (0.1 litres) of vinegar.

2. Then, pour the vinegar into the plastic bottle.

3. With the help of the funnel and the spoon of the plastic spatula, add 4 spoons of baking soda to the balloon.

4. Now attach the balloon's opening to the opening of the bottle, without letting the baking soda fall out of the balloon.



5. Finally, lift the balloon and let the baking soda fall, getting mixed with the vinegar.

6. Observe what happens!

ATTENTTION: when you finish the experiment throw away all used food.

Explanation:
Such as in previous experiments, when mixing vinegar with baking soda, carbon dioxide is released.

The gas rises, filling in the balloon.

This phenomenon exemplifies what happened during the formation of the atmosphere of Earth. When it formed, planet Earth had an intense volcanic activity that released great amounts of gases and smoke, which started to accumulate, creating the **primitive atmosphere**.

In this experiment, the gases released started accumulating in the balloon, exemplifying this phenomenon.

Experiment 12
The formation of the Earth's continents

Do you want to understand how the different continents were formed? With this experiment you will know how!

ATTENTION: ask an adult for help.

What you will need:
- World map, encyclopaedia or images of continents
- Flexible tube with about 1 metre
- Large basin
- Piece of styrofoam
- X-acto knife
- Marker

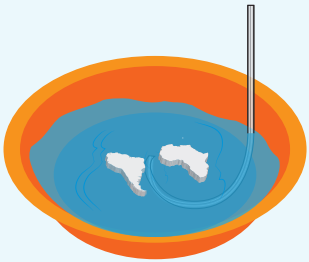
Steps:
1. With the help of the images, draw on a piece of styrofoam the African and South American continents.

2. Ask an adult to help you cut, using the X-acto, the pieces you have drawn.

3. After cut, try fitting them. Do they fit as in a puzzle?

4. Fill the basin with water and place the pieces to float.

5. Place one of the ends of the tube under the puzzle and blow slowly through the other end.



6. Observe what happens!

Explanation:

The continents as we now them today are the result of the separation of the supercontinent called Pangaea.

With this experiment you can see that the occidental coast of Africa fits perfectly in the oriental coast of South America.

When blowing through the tube you are simulating the convection currents that led to the separation of Pangaea and caused the continuous distance of the continents.

Experiment 13
Formation of a mini mountain

Mountains are a relief-like structure and their formation is related to the movement of tectonic plates.

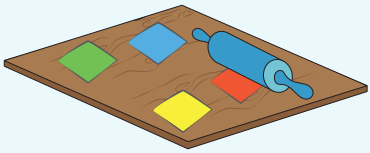
Scientist, do you want to know more about relief structures and tectonic plates? Check the online content of the Jurassic Volcano
www.science4youtoys.co.uk/super-lab-jurassic-volcano

What you will need:

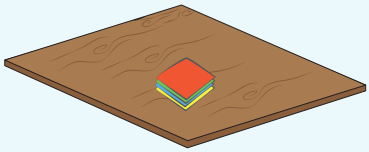
- Play dough in four different colours
- Rolling pin
- Chopping board

Steps:

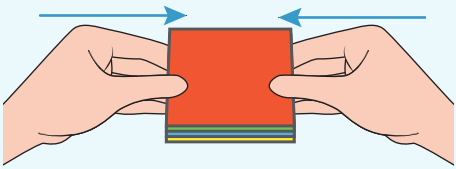
1. On the chopping board and using the rolling pin, mould the play dough into rectangles. Make a rectangle for each colour.



2. Pile the 4 rectangles, forming one single block.



3. Place your hands on the sides of the block and squeeze it.



Explanation:
Most of the highest mountains come from wrinkle ridges of the Earth's crust. In this experiment you will simulate the formation of a mountain.

This effect happens when two tectonic plates collide and lift the surface. In turn, in the compressed layers, folds that can break are created, originating the peaks of the mountains.

Experiment 14
Searching for fossils: *Triceratops* and *Tyrannosaurus rex*

What you will need:
- Excavation block with dinosaur
- Brush (small - excavation tool)
- Newspaper sheet or towel
- Large measuring cup

Steps:
Prepare the excavation area:
1. Use a wide table.

2. Remove from the excavation area all the unnecessary materials.

3. Place a newspaper sheet under the excavation block you are going to use.

4. Be careful and excavate with a safe distance from your body, so that dust doesn't get into your eyes. Use protection for your clothes.

Start excavating:
1. Choose one of the excavation blocks.

2. Observe your small brush - the excavation tool: on one side you have a brush and on the other side you have a chisel.

Brush Chisel

3. Carefully, start excavating using the chisel.

4. Keep pressing the excavation block with the chisel until it starts cracking.

5. Clean the dust in excess with the brush.

6. When you start seeing your dinosaur, be careful to not damage it.

7. At the end, clean your dinosaur with the brush.

8. Can you identify the dinosaur you've found fossilised?

Note: every time you excavate a block be careful and try to not waste the gypsum you are removing from the mould. If gypsum falls to the newspaper sheet, collect it and put it in the measuring cup. At the end of the excavation, collect all the gypsum and place it in the cup. Do not throw away the plastic mould. You will need these materials for the next experiment.

Explanation:
In this experiment you act as a real palaeontologist searching for fossil remains.

Fossils are found in outcrops of sedimentary rocks.
When these outcrops appear, scientists use their materials to look for fossils, always very carefully to not damage them.

DID YOU KNOW...
That geologists can determine the relative age of the strata that create the sedimentary rocks, as they form succeeding horizontal layers of sediments, forming a **stratigraphic column?**
If the strata are conserved in their original position, then each stratum is older than the ones on top and more recent than the ones below it. This phenomenon is called **law of superposition**.

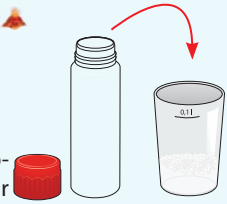
Fossils, in turn, help geologists to determine the relative age of rocks.

In your excavation blocks you can find *Triceratops* or *Tyrannosaurus rex*.

Experiment 15
The fossilisation process of dinosaurs

In this experiment and in the following ones you will see, in a simple way, how fossils are formed in nature.

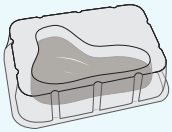
What you will need:
- Gypsum from the previous experiment
- Plastic mould of the excavation block
- Dinosaur
- Gypsum
- Plastic spatula
- Large measuring cup
- Water
- Wooden spatula



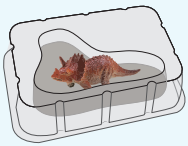
Steps:
1. Add half of the gypsum content of your kit into the large measuring cup (1/3 of the cup volume). Add also the gypsum from the previous experiment.

2. Add water to the cup, until the gypsum becomes soft and liquid. Stir it well with the wooden spatula and make sure you get a consistent fluid. If you see that the gypsum starts solidifying in the cup, add more water and stir it again.

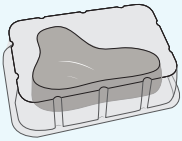
3. Pour some of this liquid gypsum into the plastic mould of the excavation block.



4. Then place the dinosaur over this layer of gypsum.



5. Now, pour the rest of the gypsum over the dinosaur until it is completely covered. If the gypsum gets stuck to the cup, use the plastic spatula to remove it and add it to the mould. Make sure the mould is completely filled.



6. Leave the mould in a dry place where it can catch some sun, for two or three days.

7. After this time, the gypsum must be dry and hard, due to the evaporation of water. You will now have a mould with a kind of rock with the dinosaur inside.

At the end, remember to wash all the materials in order to remove all the gypsum remains.

8. Whenever you want to, you can become a palaeontologist and excavate your mould to find a dinosaur (you just need to repeat experiment 14).

Explanation:
In a simple way, in this experiment you have recreated what happens in the formation of a fossil.

After they die, living beings start disappearing through earth covers, mud or sand (in this case, gypsum), this is to say, through sediment layers.

This is how the fossilisation process happens.

Scientist, do you want to know more about the fossilisation process? Check the online content of the Jurassic Volcano!
www.science4youtoys.co.uk/super-lab-jurassic-volcano

Experiment 16
Fossil preservation

ATTENTION: ask an adult for help.

What you will need:
- Solid glycerine
- Bowl proper for microwaves
- Tray of a matchbox
- Oven mitt
- Plate
- Microwave
- Two small leaves from a plant
- Knife

Steps:

1. Place one of the leaves in the matchbox and another on a plate.

2. Ask an adult to cut with the knife small pieces of glycerine into the bowl.

3. Ask an adult to help you heat the glycerine in the microwave until it is completely melted. Be careful to not let it boil.

4. With the help of an oven mitt, pour the liquid glycerine into the matchbox and into the plate, covering the leaves.

5. Wait a few hours and then observe the results.

Explanation:
In this experiment you've created a fossil, by preservation. Glycerine works as an impermeable material that protects the living being.

These are the rarest fossils, however of extreme importance because they allow observing more characteristics of the fossilised being.

Experiments

Hello Scientist!

Did you have fun and want to learn more? You can find more two experiments in the following link:

www.science4youtoys.co.uk/super-lab-jurassic-volcano

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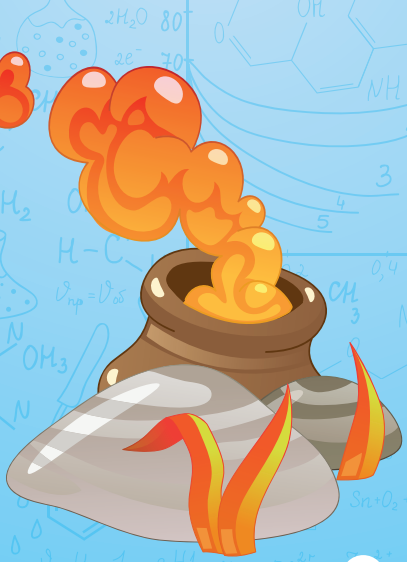

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