Research
Based
Curricula

Exploring Soils: A living treasure

Key Stage 3 Environmental Science

2021

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Contents

Getting Started

Subject Learning

Study Skills, Tips and Guidance

About this pack

Who is this pack for?

- This pack was created for all students, regardless if this is your best subject or your worst.
- It's not graded or marked by your teacher. It's a chance to explore the subject and learn in a new way that's different to the classroom.
- Each pack is written by a student at the University of Reading who is researching this topic and has special knowledge on the subject. When they were your age they knew nothing about it either!
- By completing their mini-course, you will find out why it's interesting and you will build your skills that help you improve at school.

So... why complete this pack?

- Learn new cool areas of a subject that you won't cover in the classroom
- Sharpen your academic skills, like short essay writing and interpreting data
- Experience what it's like to explore a subject freely
- Better understand what you enjoy and don't – it will help you make decisions about your future studies and career choices!

What's in this booklet?

Your RBC booklet is a pack of resources containing:

- ✔ More about how and why study this subject
- ✔ Four 'resources' each as a lesson with activities
- ✔ A final assignment to gauge learning
- ✔ Extra guidance throughout about the university skills you are building
- ✔ End notes on extra resources and where to find more information

Meet the author

Name: Nerea Ferrando Jorge

Area of Study and Degree: Environmental Science PhD

University: University of Reading

Where I am from?

I'm originally from a warm, coastal city called Valencia, in Spain. However, I consider myself to be a global citizen, having lived in multiple countries such as USA, Finland, Australia, and now, for the past 8 years, in the United Kingdom.

At school I studied...

I have a mixed background, with a Bachelor in Environmental Science and in Fine Arts. Now, I'm completing a doctorate at the University of Reading, specializing in Soil Science.

I think my subject is awesome because...

Why soil you may wonder? The soil underneath our feet represent a relatively under-explored, complex world. Over time, we are learning that soil is the foundation of life because it benefits and supports virtually all plants and animals. Without it, life as we know it wouldn't exist! That's why our world is called 'Earth' which means ground or soil.

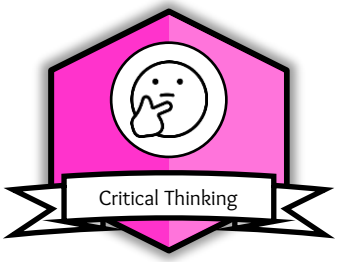
A resource that inspires me...

The study of Science is important for understanding the world around us and discovering new things. I decided I wanted to a scientist from an early age. I was inspired by watching nature documentaries. One of my favourite was The Crocodile Hunter. In it, Steve Irwin, shared his immense passion and contagious enthusiasm for wildlife.

People I really admire are...

Now, Sir David Attenborough is also my role model. He is one of the leading voices to defend the natural world. You may have heard of some of his documentaries like *Breaking Boundaries* or *Blue Planet*.

Building Your Skills



Research-Based Curricula packs challenge you to build your skills in this subject but also to be used across any of your school work.

Any time you see a badge, look out for a skill you'll be building!

These skills are the type of skills that teachers and universities look for as you progress, so see how many you know below.

Skills you may see and use in this pack:

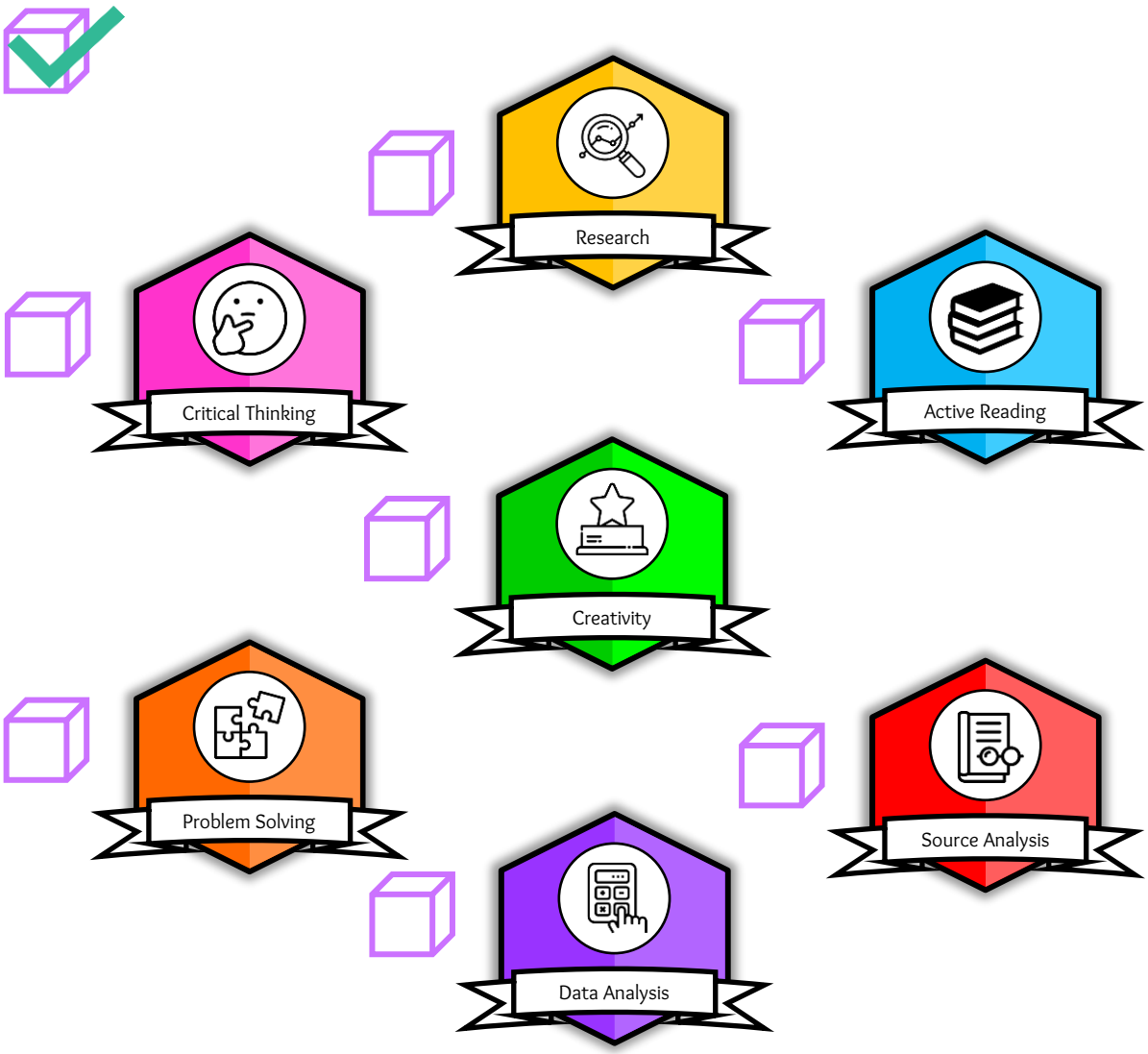
research	your ability to work on your own and find answers online or in other books
creativity	your ability to create something original and express your ideas
problem solving	your ability to apply what you know to new problems
source analysis	your ability to evaluate sources (e.g. for bias, origin, purpose)
data analysis	your ability to discuss the implications of what the numbers show
active reading	your ability to engage with what you are reading by highlighting and annotating
critical thinking	your ability to think logically to build an argument clearly

Psst! You can learn more about these skills in the Academic Study Skills section

Your Skills Badges

As you work through this booklet, you'll have the chance to build the skills you have read on the previous page.

Make sure to revisit this page once you have mastered each skill. Tick off each skills badge below once completed!



Look out for these badges in the Data Source, Activities and Further Reading sections of each Resource. If you complete a skill more than once, write the number of times you completed it next to the badge.

When you've earned all seven skills badges, you can discuss with your teacher how to further build your skills!

Glossary

Be sure to use this section as you go through your booklet. If you see an **emboldened** word, you can find the definition here. If you are still unsure about the meaning or use of the word, we encourage you to use a dictionary or ask a teacher. See page 10 to add your own words.

Term	Definition
Anthropedogenesis	The theory that adds human activities as a 6th factor of soil formation because of the scale and rate of transformations.
Carbon sequestration	A process by which carbon dioxide is removed from the atmosphere and stored.
Climate change	The long-term shifts in temperatures and weather patterns. These shifts may be natural, but since the 1800s, the burning of fossil fuels like coal, oil and gas have been the primary driver.
Decomposition	The process by which dead organic materials are broken down into simpler organic or inorganic matter. This recycles nutrients back to the soil.
Ecosystem	A community of plants, bacteria, animals, and fungi in a certain location, along with the non-living components of that environment.
Erosion	The wearing away of land or soil through one or more processes. The main causes of erosion include the actions of water, wind, translocation and geological.
Habitat	The natural home or environment of an organism.
Impermeable	Not permitting passage or penetration.
Parent material	The minerals and rocks that are slowly disintegrating to form the soil.
Photosynthesis	The process by which plants use sunlight, water, and carbon dioxide to create oxygen and energy.
Soil degradation	The decline in soil health caused by its improper use or poor management.

Student Key Words

Be sure to use this section as you go through your booklet. If you see an emboldened word, you can find the definition here. If you are still unsure about the meaning or use of the word, we encourage you to use a dictionary or ask a teacher. See page 10 to add your own words.

Term	Definition
Soil ecosystem services	The benefits provided by ecosystems that contribute to making human life both possible and worth living.
Soil fertility	The characteristic of a soil that enables it to sustain plant growth.
Soil food web	The food web shows the transfer of energy between species in an ecosystem.
Soil functions	The general abilities of soils to perform tasks such as nutrient cycling, temperature regulation, and habitat for organisms.
Soil horizons	The layers that form in the soil profile as a result of soil-forming processes such as weathering. A horizon is often highly visible and distinct.
Soil inorganic material	The part of soil that is made up of of rock. These materials are not carbon-based or part of a living organism.
Soil organic matter	The carbon-based material in soil that is living or was once living.
Soil profile	A vertical section of the soil from the surface downwards to the underlying rock. It is composed of distinct soil layers.
Soil sealing	The destruction or covering of the ground by an impermeable material like concrete.
Soil system	Dynamic and diverse ecosystems made up of soil, rocks, roots, animals, and other parts that interact together to provide integrated functions.
Weathering	The natural process that slowly breaks apart or changes rock. Heat, water, wind, living things, and other natural forces cause weathering.

Student Key Words

When you find words you don't recognise in a lesson, be sure to look up their definition. Use this page to write them down and make a note of their definition!

Term	Definition

Introduction to Subject Soil Science

The topics within this pack will include:

What makes soil, soil?

How is it formed?

Why is it important to take care of soil

What are the threats soil face

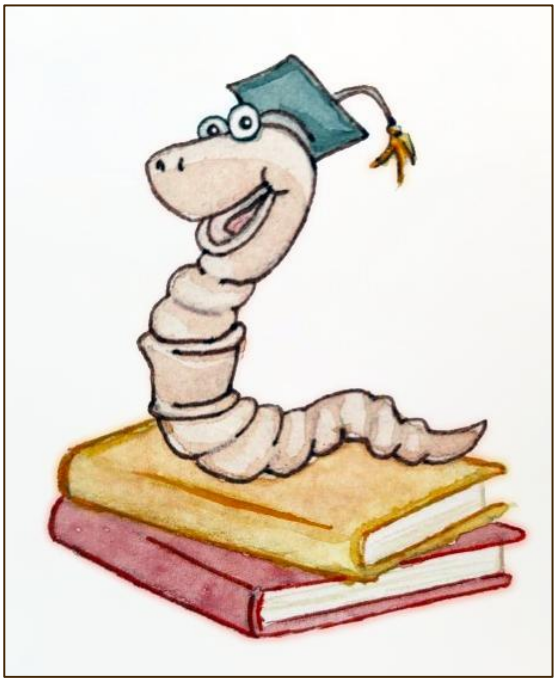
We see soil, walk on soil, and grow things in soil every day, but most people never recognize how important soil is.

Soil is not dirt! Explore the diverse wonders hidden under your feet with Dr. Wormsley, the earthworm.

Discover what soil is made up of, how it is formed, the creatures that live in it, and just how important it is in our everyday lives.

Being a soil scientist encompasses Biology, Ecology, and a variety of Earth and other Natural Resource Sciences. It focuses on understanding, managing, and improving land and water.

This coursebook and references should help you understand the complexity of soils and the risks they face.



Dr. Wormsley
The soil engineer

Resource One Overview

Topic	What is soil?
Key Stage 3 Subject Area	KS3 Science Unit 7C: Environment and feeding relationships Unit 8C: Microbes and disease Unit 8D: Ecological relationships Unit 8G: Rocks and Weathering Unit 8H: The rock cycle
Objectives	By the end of this resource, you will be able to: ✔ Identify the different components of soil ✔ Understand that soils is a system ✔ Describe the living part of soil
Instructions	1. Read the data source 2. Complete the activities 3. Explore the further reading 4. Move on to Resource Two

Resource One
Data Source

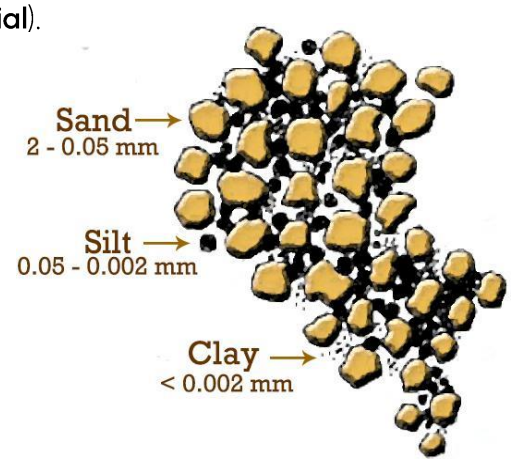
Section A

What is soil made up of?

Soil is a complex mixture of different things, both living and non-living.

The five key ingredients that make up soil are:

1. Broken bits of rock. These soil minerals are divided into three size classes: sand, silt, and clay particles (**inorganic material**).

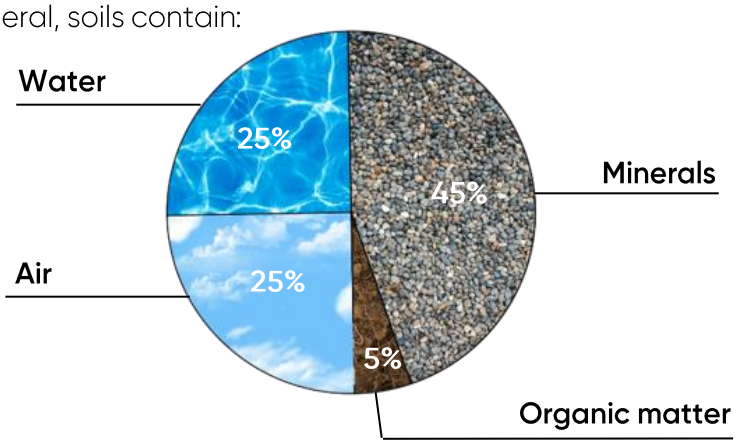


Figure

Three classes of soil minerals

2. **Organic matter** that is made up of dead animals and plants in different stages of **decomposition**.
3. Uncountable living organisms, e.g. earthworms, ants, bacteria, or fungi.
4. Air, e.g. soil gases including carbon dioxide, oxygen and nitrogen.
5. Water.

In general, soils contain:



Soil ingredients react with one another in different combinations, making soil one of our planet's most dynamic and important natural resources.

Resource One
Data Source

Section B

Soils are big, dynamic systems

Soil is not a stagnant mass of different ingredients. Just like a water body, soil also form big, three-dimensional (3-D) natural bodies on the Earth's surface.

A soil body contains soil, rocks, roots, animals, and among other things that are always interacting with one another. It acts as one big **soil system** with integrated **soil functions** or services that are greater than the sum of their parts.

A soil body is dynamic or always changing in response to environmental conditions. It is very slowly moving, changing and growing all the time. It changes on a day-to-day basis as the soil wets or dries, and over time. As soil ages, it forms and piles up in distinct layers as things get added, moved, and taken away.

Scientists can learn about the life of a soil and its characteristics by studying these layers or **soil horizons**.

Figure (above)

Soil profiles from different regions

World Soil Museum, The Netherlands. https://cls-led.com/project/world-soil-museum/

The World Soil Museum, found in the Netherlands, has preserved a wide variety of soils from different regions. The vertical section of the soil which shows the different layers is called a **soil profile**.

Resource One
Data Source

Section C **Soil as a living entity**

Soil is not dirt! Soil is teeming with life.

There can be more creatures in a teaspoon of healthy soil that there are people in the entire planet.

Until recently, we had very little understanding of the living organisms found in soil. Now we are learning that soil is an extremely diverse and complex living **ecosystem**. It offers a rich **habitat** or home for a wide range of life.

Active Reading

Soil life varies in size: from bacteria and fungi which require powerful microscopes to see them, up to larger animals that burrow underground, such as moles and rabbits, that spend part of their time in soil.

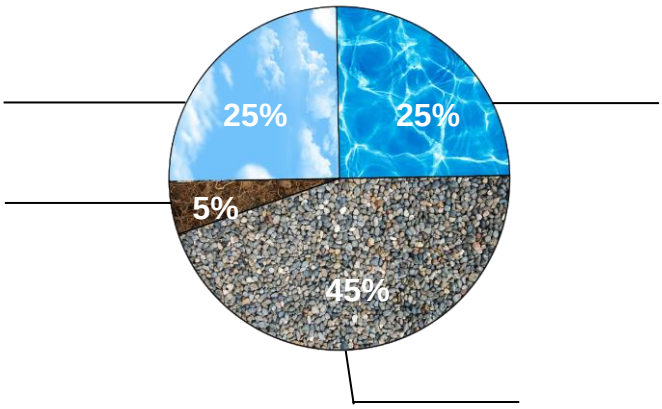
In fact, soil is the most biologically diverse part of our planet. More than a quarter of all species on Earth are estimated to spend at least some of their life in soil.

Other than moles and rabbits, can you think of larger animals that spend part of their time in soil?

Resource One Activities

Activities

1. Fill in the spaces for the basic components of a typical soil.



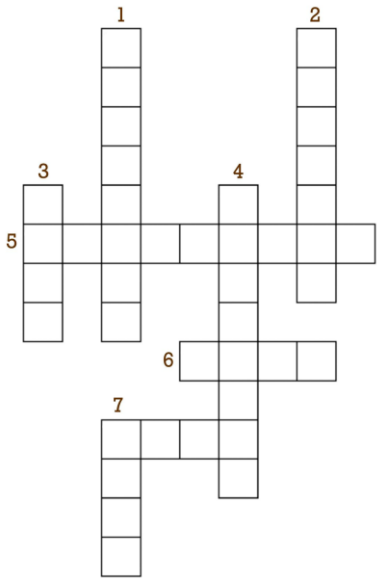
Critical Thinking

2. What is the difference between soil and dirt?
3. Our soils host how much of the world 's biodiversity? Select one.

- A fifth
- Half
- A quarter

Problem Solving

4. Fill in the jigsaw puzzle using what you've read!



Downwards

1. Another name for the many layers in the soil.
2. A type of matter that is composed of dead plants and animals.
3. Medium soil particle size.
4. The name for the many pieces of soil that come in different sizes.
5. The largest of the soil particle sizes.

Across

6. Type of material that is composed of rocks, minerals, and water.
7. What we get under our fingernails.
8. It has many layers.

Resource One
Further Reading

Explore

What are soils made of?

Use the Soil Shake Up experiment to find out how much sand, silt and clay are in a soil sample.

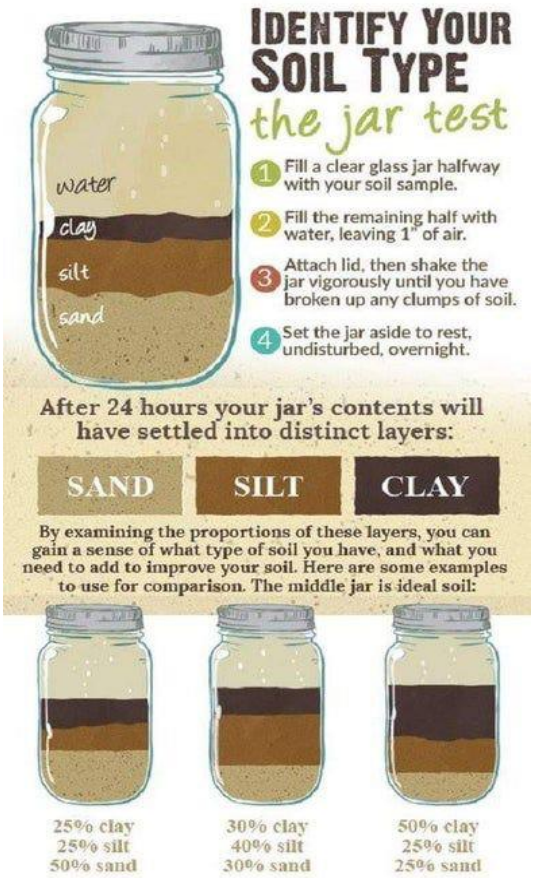
In this video, you will learn about the composition of the soil with a simple experiment that separates the soil particles into layers. You will learn how to classify the soil as sand, silt, or clay.

All you need is a jar with a lid, a handful of soil, and water.

Figure

Gardeners edge jar test experiment

https://www.pinterest.es/pin/487444359655913405/



References

Image Sources

- World Soil Museum, The Netherlands. https://cls-led.com/project/world-soil-museum/
- Gardeners edge jar test experiment: https://www.pinterest.es/pin/487444359655913405/

Resource Two Overview

Topic	How are different soils formed?
Key Stage 3 Subject Area	KS3 Science Unit 8G: Rocks and Weathering Unit 8H: The rock cycle Unit 9M: Investigating scientific questions
Objectives	By the end of this resource, you will be able to: ✔ Describe the different soil forming factors ✔ Understand the different types of soil ✔ Explain how humans are affecting soil development
Instructions	1. Read the data source 2. Complete the activities 3. Explore the further reading 4. Move on to Resource Three

Resource Two
Data Source

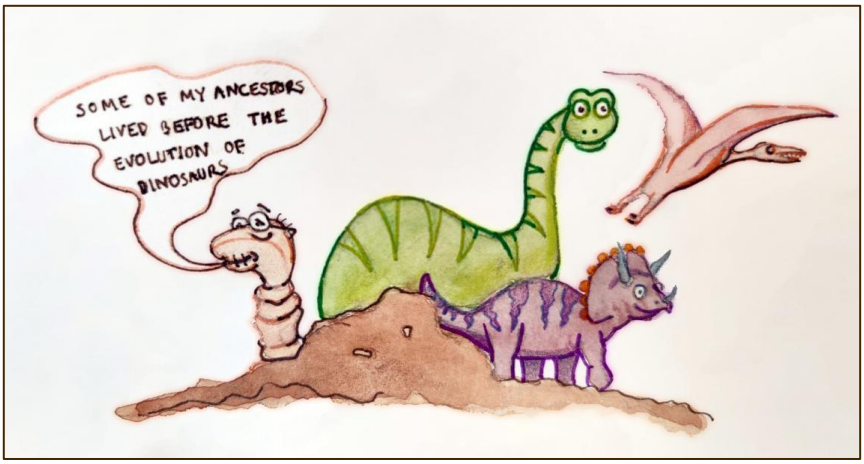
Section A

How are soils formed?

It can take anywhere from 100 to 300 years for just one centimeter of soil to develop.

Soil is mostly made of big rocks that are slowly broken down into smaller pieces over a long period of time.

Soil formation has been going on for billions of years, and new soils continue to form every day. However, this is an extremely slow process.



Active Reading

Source Analysis

Other than time, there are 4 other factors that interact to help produce soil:

1. The **parent material** or the basic rock from which soil is formed.
2. Climate, specifically temperature and rainfall, increase the amount of **weathering** or break down of **parent material**.
3. Topography or the shape of the landscape affects the amount of soil and rock that is removed or **eroded** by wind, water and ice. It also effects how water moves into the soil.
4. Living things like plants and animals help soils develop. For example, by making or contributing to the formation of **organic matter**.

The ingredients must be mixed and then 'baked' or allowed to decompose or weather over a long period of time before you can call it soil.

You can think of soil like making a cake.

Resource Two
Data Source

Section B

Why are there different soils?

There are thousands of soil types!

Soils differ from one part of the world or even within a landscape because of how and where they were formed or 'grew up'.

Active Reading

It is the way soil forming factors interact with one another in various combinations that gives us the great variety of soils we see today.

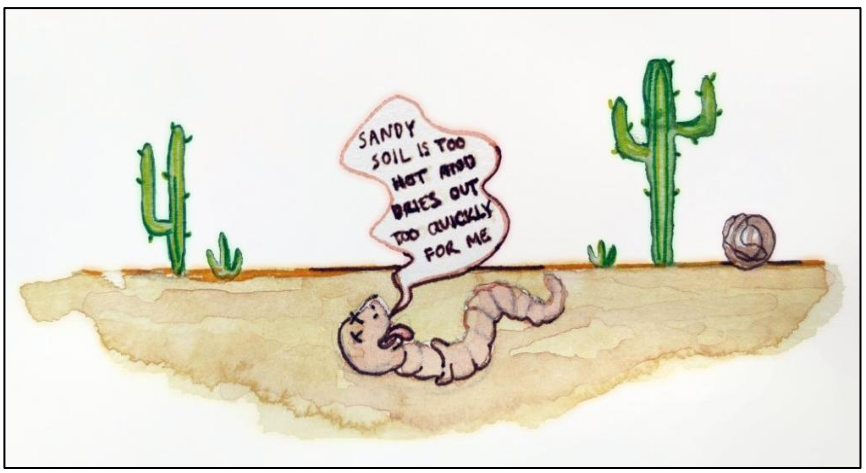
As a result, the appearance and the characteristics of soils vary from place to place.

Soils can be deep, shallow, new, old, bright red, yellow or even blue.

For example, desert soils are very different to the tropical rainforest soils:

How do you think the appearance of desert soils and tropical soils differ?

1. **Desert soils** are formed in areas with extremely low-rainfall and very high temperature. They support very little vegetation.
2. **Tropical soils** form in areas with high annual rainfall and temperature, thus have higher levels of **organic matter** to support plants.



Resource Two
Data Source

Section C

The human factor in soil formation

Human activities in the last centuries have caused major changes to the land and soil. Now, over 50% of all land on earth, that is not covered by ice, has been changed by humans.

This is why some scientific researchers suggested an extra category for soil formation: humankind or **anthropedogenesis**.

While natural soil formation is a slow process, humans can directly or indirectly affect soils in a very short time span. These can be helpful or harmful for soil development.

For example, covering soil permanently in cities for buildings and roads causes a partial or total loss of soil. This is known as **soil sealing**. This is because artificial materials like concrete are **impermeable** and suffocate the soil organisms.

Figure

Soil sealing in Europe

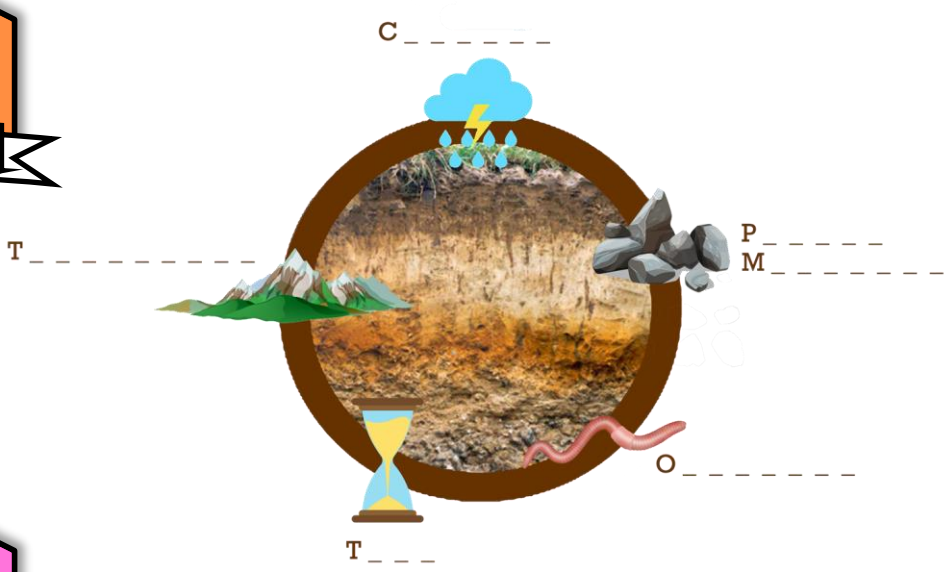
FAO, 2015

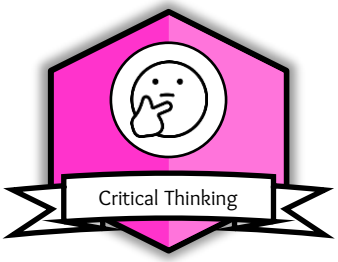
https://www.fao.org/3/au885e/au885e.pdf

Resource Two Activities

Activities

1. What are the 5 natural soil forming factors? Fill in the blanks.





2. Describe how soil is formed in your own words.
3. Discuss why **soil sealing** is a problem?

Resource Two
Further Reading

Explore

Bake a soil cake!

This science craft uses different types of cake to model the layers or **soil horizons** that make up soil.

Watch this video and snack your way through this fun project.

Figure

Soil Cake

https://www.kiwimagonline.com/cake-soil-layers/

Read about the different soils found in England and Wales. There are over 700 types despite its small size compared to other countries! Think about how soils might vary in other parts of the world.

References

Image Sources

- https://www.fao.org/3/i6470e/i6470e.pdf
- Soil sealing. FAO, 2015: https://www.fao.org/3/au885e/au885e.pdf
- Soil cake: https://www.kiwimagonline.com/cake-soil-layers/

Resource Three Overview

Topic	Why are soils important?
Key Stage 3 Subject Area	KS3 Science Unit 7C: Environment and feeding relationships Unit 7I: Energy resources Unit 8C: Microbes and disease Unit 8D: Ecological relationships Unit 9C: Plants and Photosynthesis Unit 9G: Environmental chemistry
Objectives	By the end of this resource, you will be able to: ✔ Explore the soil food web ✔ Understand that soil provides many services ✔ Understand that soil is a resource we cannot live without
Instructions	1. Read the data source 2. Complete the activities 3. Explore the further reading 4. Move on to Resource Four

Resource Three
Data Source

Section A

The soil food web

Active Reading

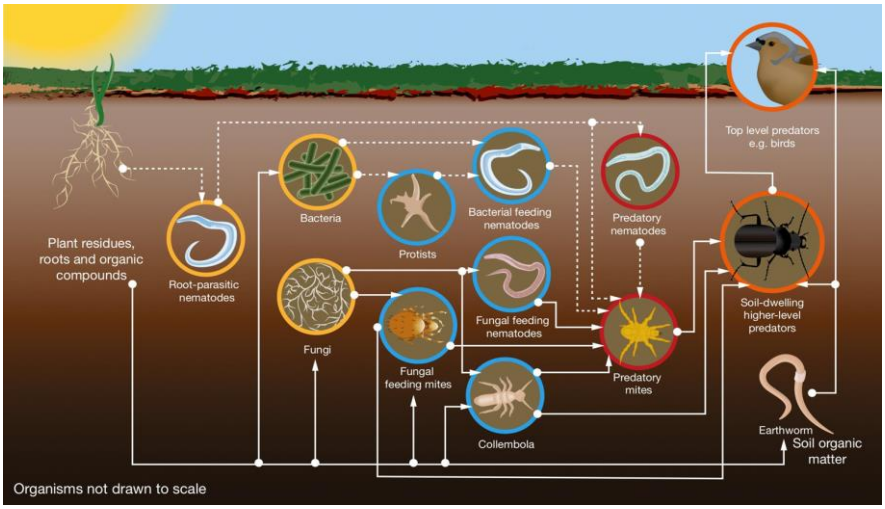
Just like above the ground, the diverse group of organisms that live in soil interact closely with each other to form a complex **food web**.

It is made up of millions of bacteria, fungi, soil insects, worms, plants and larger animals like rabbits and moles that live either all, or part of their life in soil.

Figure

Diverse organisms that form a food web in soil

https://projectblue.blob.core.windows.net/media/Default/Imported%20Publication%20Docs/SoilFoodWeb_WEB1420_280219.pdf



Can you think of larger animals that mix soil with Organic Matter as they burrow through soil?

The **soil food web** is fuelled by organic materials like plants or its products which 'feed' all the soil organisms.

As soil organisms eat, grow, and move through the soil, they continuously perform various tasks or **soil functions** that are needed to build and develop a healthy **ecosystem**.

For example, much like human engineers, earthworms change the structure of their environments as they burrow through the soil. They also mix soil with **organic matter**, improving its **fertility** or ability to sustain plant growth.

A diversity of life in the soil is important for all landscapes, from your small backyard garden to ancient forests.

Resource Three
Data Source

Section B

What benefits does soil provide?

Active Reading

Soil, and the diversity of creatures living in it, perform several tasks or **soil functions** that support life, such as clean water and air, and healthy plants.

The benefits that soils offer people are called **soil ecosystem services**. They are the basis for almost every part of our well-being, including our health, security, and economy.

Figure

Ecosystem services

https://www.fao.org/3/ax374e/ax374e.pdf

Research

For example, did you know that soils are essential in the fight against **climate change**?

Soils store or **sequester** more carbon under our feet than the atmosphere and all forests combined. In fact, they are responsible for removing about 25% of the world's carbon emissions from our atmosphere each year.

Resource Three
Data Source

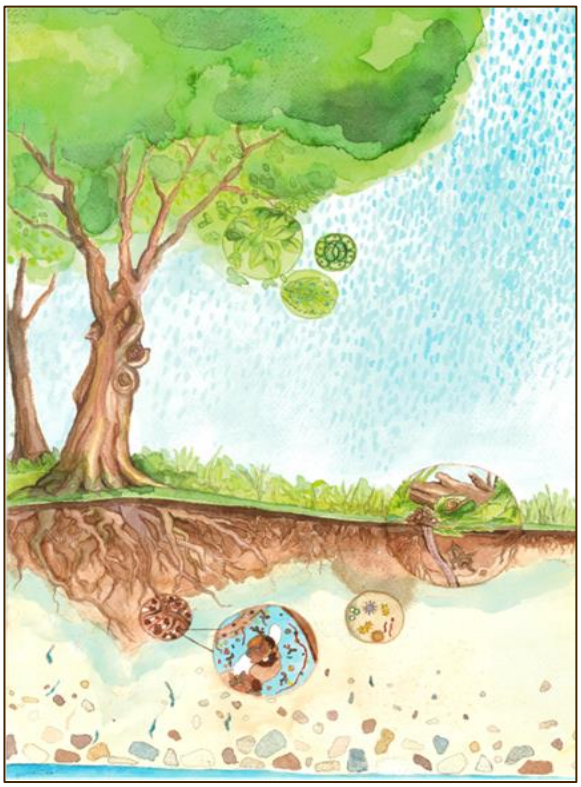
Section C

Soil - a precious resource

Together with air and water, soil is one of the world's most important natural resources.

We all know we need air to breath and water to drink, but why do we need soil?

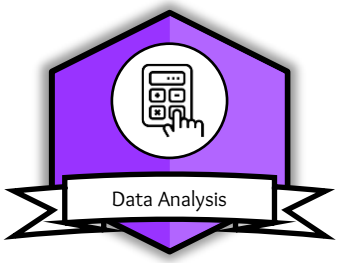
Right away, the first answer that comes to mind is that without soil, we would starve. However, soil is not only important for food production. Soils play a very important role in supporting life on Earth. They are the link between the air, water, rocks and organisms. For example, the illustration shows that soils help anchor trees and give them nutrients and water needed for **photosynthesis**.



This is why soil is called the 'foundation' of life.

In fact, soils provide support and essential nutrients, as well as heat, water and oxygen to all natural **ecosystems** like forests, grasslands and deserts. These areas, in turn, are responsible for supporting life in all its forms.

Resource Three Activities



Activities

1. Name 3 major natural resources that we cannot live without?
2. List 3 **ecosystem services** that soil provides.
3. Soil is our ally for in the fight against **climate change**. Fill in the gaps for this text.

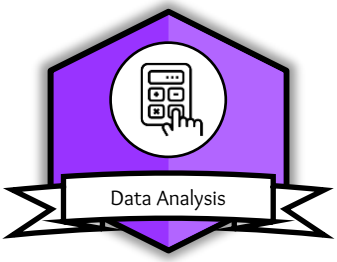
A. Globally, soils _____ more carbon than the world's atmosphere and all its _____ combined.

B. When plants _____, they take carbon out of the _____.

C. If managed properly, soils can play an important role in **climate change** by storing more _____ in the soil.

Resource Three
Further Reading

Explore



Read more about the **soil food web** and why its important:

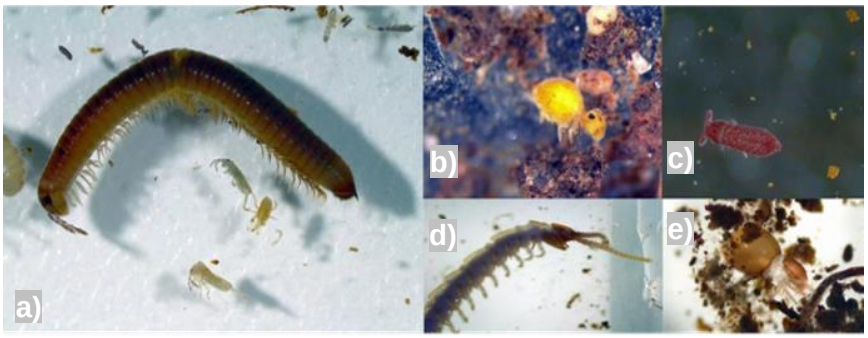
Watch this video to learn more about earthworms and why they are so important. Discuss.

Practical activity to discover **what's in your soil!**

This observation activity involves looking at soil in detail, with discussion points about soil contents and soil quality for plants and earthworms.

There is an online version where you can look at images and discuss.

Identify the soil organisms below and briefly explain their primary role in their soil. I found these in my soil samples!



References

- Ecosystem services (FAO, 2015) https://www.fao.org/3/ax374e/ax374e.pdf

Image Sources

- Food web: https://projectblue.blob.core.windows.net/media/Default/Imported%20Publication%20Docs/SoilFoodWeb_WEB1420_280219.pdf

Resource Four Overview

Topic	What threats do soils face?
Key Stage 3 Subject Area	KS3 Science Unit 9G: Environmental chemistry Unit 9L: Pressure and moments Unit 9M: Investigating scientific questions
Objectives	By the end of this resource, you will be able to: ✔ Understand soil is a fragile and limited resource ✔ Describe some of the threats soil are facing ✔ Learn that soils need legal protection
Instructions	1. Read the data source 2. Complete the activities 3. Explore the further reading 4. Move on to the Final Reflection Activity

Resource Four
Data Source

Section A

Soil is a fragile, limited resource

Active Reading

Although soil is one of the most important resources, there is not very much available.

So, just how much soil is there?

In short – not very much! Most of the Earth is covered in water, mostly in the form of vast oceans. Only about 29% of the Earth is covered by land.

Even though soil covers most of this land surface, like the skin of an apple, it consists a very thin layer of the Earth, ranging in thickness from a few centimetres to metres.

Figure

How long it take for healthy soil to form

Modified from FAO, 2019.

https://www.youtube.com/watch?v=wGDVwYvjGss

Soil is often called the Earth's 'fragile skin'.

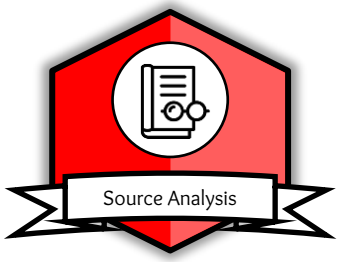
All life is contained inside this very thin layer, and it takes a very long time to build up – yet thousands of years of soil formation can be wiped out in a matter of moments from poor farming practices, forest destruction, or pollution.

Can you think of other non-renewable resources?

This is why despite soils constantly forming, for human purposes, they are considered a limited, non-renewable resource. In other words, the loss of soil is not recoverable during a human lifespan.

Resource Four
Data Source

Section B



Every minute mankind destroys the equivalent of 30 football fields of healthy soil.

The status of soil degradation

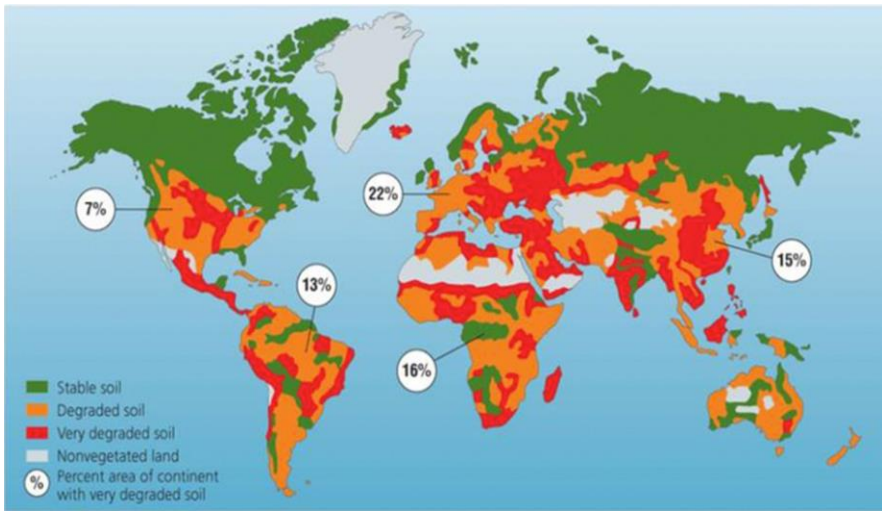
The pressure on soil resources has become more intense over the last years to be able to maintain a growing population. This has resulted in serious **soil degradation**. In other words, we are damaging the soil's health and reducing its ability to deliver its many beneficial **services** that support life as we know it.

Some of the major drivers of **soil degradation**:

- Poor farming practices
- Industrial pollution
- Loss of fertile land for buildings and roads

Avoiding this deterioration is crucial. Unfortunately, the world status of soils is quite scary! Right now, a third of the Earth's soils are highly **degraded** by human activities.

The **degradation** of soils has a dramatic impact on our food security, our climate, and our health.



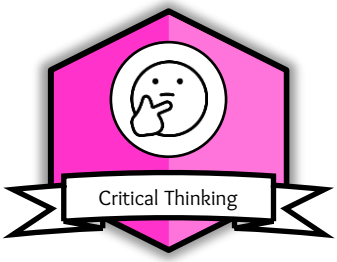
Figure

World map showing where soil degradation is at it's worst

Soil degradation map (UNEP, 2002, p. 157).

Resource Four
Data Source

Section C



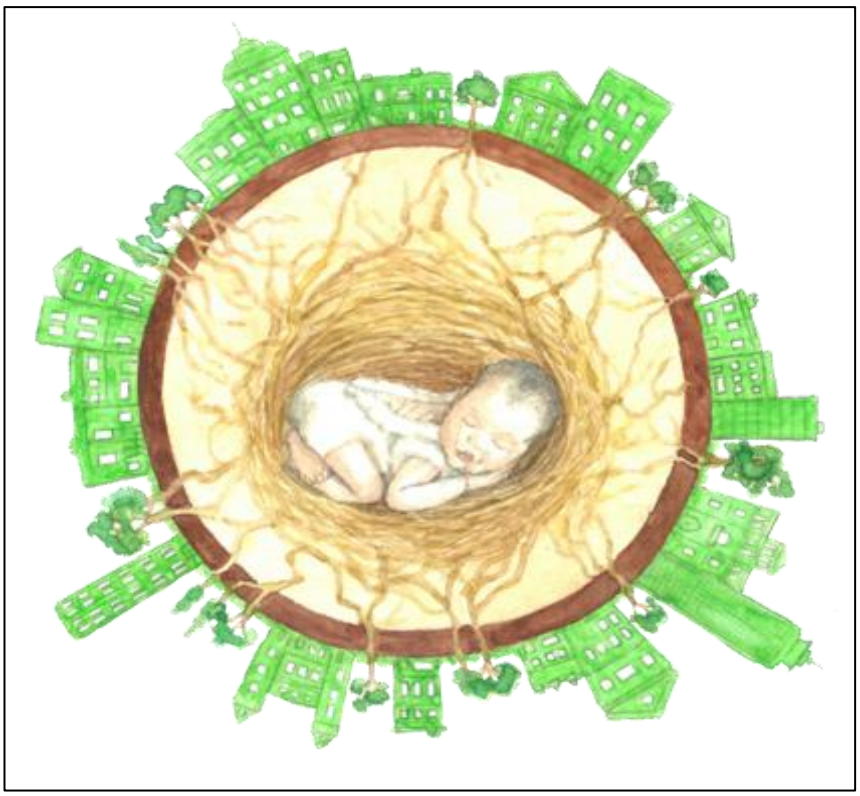
Soil, the forgotten resource

Soil is a key and very complex natural resource, yet we are more and more ignoring its value.

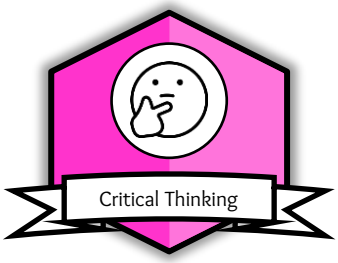
How can we restore, manage, and conserve something that we cannot see directly? And of which we do not have full knowledge?

EU law does not address all the threats in a complete way and some countries lack specific legislation on soil protection. As a result, soil is not protected in the same way as other important natural resources such as water and air.

Scientists are now warning that continuing to ignore it could have terrible consequences.



Resource Four Activities



Activities

1. On average, how long does it take for two centimetres of soil to form?

- Hundreds to thousands of years
- Fifty to one hundred years
- A few months

2. What percentage of the world's soils are estimated to be currently degraded? Select one.

- 25%
- 33%
- 50%
- 12%

3. What percentage area of Africa has very degraded soil (Hint - use the map!)
4. Define what is **soil degradation** and name 3 major causes.
5. Explain why for human purposes, soil is considered a non-renewable resource.

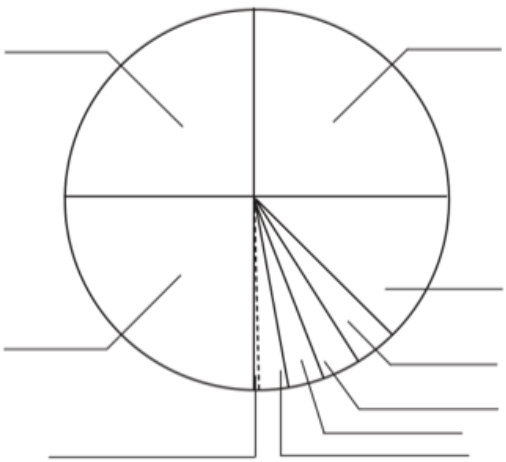
Resource Four
Further Reading

Explore

Only a tiny portion of our lands is capable of producing food. Try this practical exercise to visualize how so much depends on so little!

Fill in the blanks using these words. Watch out, some can used more than once!

- water
- mountains, deserts or ice
- rocky (poor soil)
- too wet
- too hot



Read more about the causes decreasing soil health in our world.

References

- https://www.eea.europa.eu/signals/signals-2010/soil

Image Sources

- https://www.nhm.ac.uk/discover/soil-degradation.html
- Soil formation. FAO, 2019. https://www.youtube.com/watch?v=wGDVwYvjGss
- Soil degradation map (UNEP, 2002, p. 157).

Final Reflection Activity

What can we do for soil?

Soil is vital to life on the planet! Unfortunately, it is at risk.

So, it is becoming more and more important that we understand the pressures that we are putting on soil and take steps to protect it.

There are many ways we can reduce soil damage. The combination of practices and techniques used to keep soils healthy is called soil conservation.

Scientists are working non-stop on exciting advances to help soils that have been degraded, lost, or polluted.

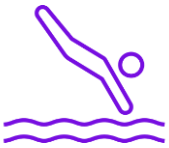
There are also many projects that are focused on raising awareness and improving soil health around the world by tackling **erosion** and adding nutrients back into soils. For example, projects such as 4 Per 1000 initiative, Kiss the Ground, and Save Our Soils.

You can also make a difference!

Learn how you can become a Soildier in action.

Let's work together to help protect this precious resource – which after all, our planet is named after.

More subject resources



A Deeper Look Into Soil

✔Read

- http://www.soil-net.com
- https://soilweb200.landfood.ubc.ca
- https://soil4youth.soilweb.ca
- https://kids.britannica.com/students/article/soil/277127
- https://www.nacdnet.org/general-resources/stewardship-and-education-materials/2014-dig-deeper-mysteries-soil/
- https://www.soils4teachers.org/glossary
- www.fao.org/globalsoilpartnership/iys-2015/en
- https://www.envirothonpa.org/wp-content/uploads/2014/04/7-Soil-Biology-Primer.pdf
- https://kidsgardening.org/wp-content/uploads/2018/09/DiggingIntoSoil_KidsGardening_201809.pdf

✔Watch

- www.iheartsoil.org
- https://kisstheground.com

✔Do

- www.saveoursoils.com

Study Skills, Tips & Guidance

This section includes helpful tips to help you complete this pack, as well as improve your study skills for school.

It also includes a few fantastic easy-to-use resources to know what to do next and where else you can look for more information on the subject.

Helpful information you will find in this section:

1. **Academic terminology (key words)**
2. **Academic Writing Style**
3. **How to evaluate your sources**
4. **University Guidance**

You can use the tips and extra web links in this section throughout your pack!

Psst! Learning these tips to improve your school skills could help you do better in exams and make assignments easier!

Academic Study Skills
Key Words

Below is a series of key terms you will come across from teachers and tutors as you got through school, especially as you enter upper secondary. Knowing these will help you understand what you are being asked to do!

Analyse – When you analyse something you consider it carefully and in detail in order to understand and explain it. To analyse, identify the main parts or ideas of a subject and examine or interpret the connections between them.

Comment on – When you comment on a subject or the ideas in a subject, you say something that gives your opinion about it or an explanation for it.

Compare – To compare things means to point out the differences or similarities between them. A comparison essay would involve examining qualities/characteristics of a subject and emphasising the similarities and differences.

Contrast – When you contrast two subjects you show how they differ when compared with each other. A contrast essay should emphasise striking differences between two elements.

Compare and contrast – To write a compare and contrast essay you would examine the similarities and differences of two subjects.

Criticise – When you criticise you make judgments about a subject after thinking about it carefully and deeply. Express your judgement with respect to the correctness or merit of the factors under consideration. Give the results of your own analysis and discuss the limitations and contributions of the factors in question. Support your judgement with evidence.

Define – When you define something you show, describe, or state clearly what it is and what it is like, you can also say what its limits are. Do not include details but do include what distinguishes it from the other related things, sometimes by giving examples.

Describe – To describe in an essay requires you to give a detailed account of characteristics, properties or qualities of a subject.

Discuss – To discuss in an essay consider your subject from different points of view. Examine, analyse and present considerations for and against the problem or statement.

Evaluate – When you evaluate in an essay, decide on your subject's significance, value, or quality after carefully studying its good and bad features. Use authoritative (e.g. from established authors or theorists in the field) and, to some extent, personal appraisal of both contributions and limitations of the subject. Similar to assess.

Academic Study Skills
Key Words

Continued...

Illustrate – If asked to illustrate in an essay, explain the points that you are making clearly by using examples, diagrams, statistics etc.

Interpret – In an essay that requires you to interpret, you should translate, solve, give examples, or comment upon the subject and evaluate it in terms of your judgement or reaction. Basically, give an explanation of what your subject means. Similar to **explain**.

Justify – When asked to justify a statement in an essay you should provide the reasons and grounds for the conclusions you draw from the statement. Present your evidence in a form that will convince your reader.

Outline – Outlining requires that you explain ideas, plans, or theories in a general way, without giving all the details. Organise and systematically describe the main points or general principles. Use essential supplementary material, but omit minor details.

Prove – When proving a statement, experiment or theory in an essay, you must confirm or verify it. You are expected to evaluate the material and present experimental evidence and/or logical argument.

Relate – To relate two things, you should state or claim the connection or link between them. Show the relationship by emphasising these connections and associations.

Review – When you review, critically examine, analyse and comment on the major points of a subject in an organised manner

Write any other key words you come across below. Ask your teacher to explain their meaning or use a dictionary to find out.

Academic Study Skills
Academic Writing Style

What is academic writing?

'Academic writing' is a specific way of writing when communicating research or discussing a point of view. You will most often do this in essays and reports.

Academic writing has a logical structure and uses formal language. Unlike creative or narrative writing, academic writing uses different sources of information to support what is being said (see next page about different sources

Top Academic Writing Tips

Do's

- Do use words you know the meaning of and are confident using.
- Remember words don't have to be complicated to be clear!
- Do write words out fully e.g., do not, cannot, does not, it would.
- Use the third person point of view
- Minimise use of informal adjectives such as cool, amazing and wonderful.

Don'ts

- Do not use contractions e.g., don't, can't, doesn't, it'd.
- Do not use public speaking phrases like "We can all agree that…" and "As I previously mentioned…".
- Do not use conversational phrases such as 'literally' or 'basically' too often.
- Do not use slang or jargon, for example, 'awks', 'lit', 'woke'.
- Do not use words that express value judgements e.g., crazy, ridiculous, terrible. Suitable synonyms are surprising, unjustified or distressing.

Expressing your opinion in academic writing

In academic writing, it is best practice to express an opinion without writing in the first person.

Rather than saying 'In my opinion, this proves that', you can express your opinion by saying:

- 'Based on (insert fact/theory/finding) it shows that…"
- 'The graph here indicates that…';
- 'The aforementioned problems in Smith's argument reveal that…';
- 'Such weaknesses ultimately mean that…', and so on.

Academic Study Skills
Evaluating your sources

What is a source?

When you learn new things, you might get information from all sorts of different places. These places are called sources. Some sources are more reliable than others. For example, information in a textbook written by an expert is more reliable than information in a non-expert's social media post.

How do you decide which source to use? From newspaper articles to books to tweets, this provides a brief description of each type of source and breaks down the factors to consider when selecting a source.

A platform for millions of very short messages on a variety of topics.

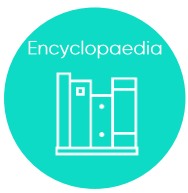
Blogs (e.g. Wordpress) are an avenue for sharing both developed and unpublished ideas and interests with a niche community.

A collection of millions of educational, inspirational, eye-opening and entertaining videos.

A reporting and recording of cultural and political happenings that keeps the general public informed. Opinions and public commentaries can also be included.

A collection of analytics reports that outline the objectives, background, methods, results and limitations of new research written for and by scholars in a niche field.

The information presented is supported by clearly identified sources. Sometimes each chapter has a different author.



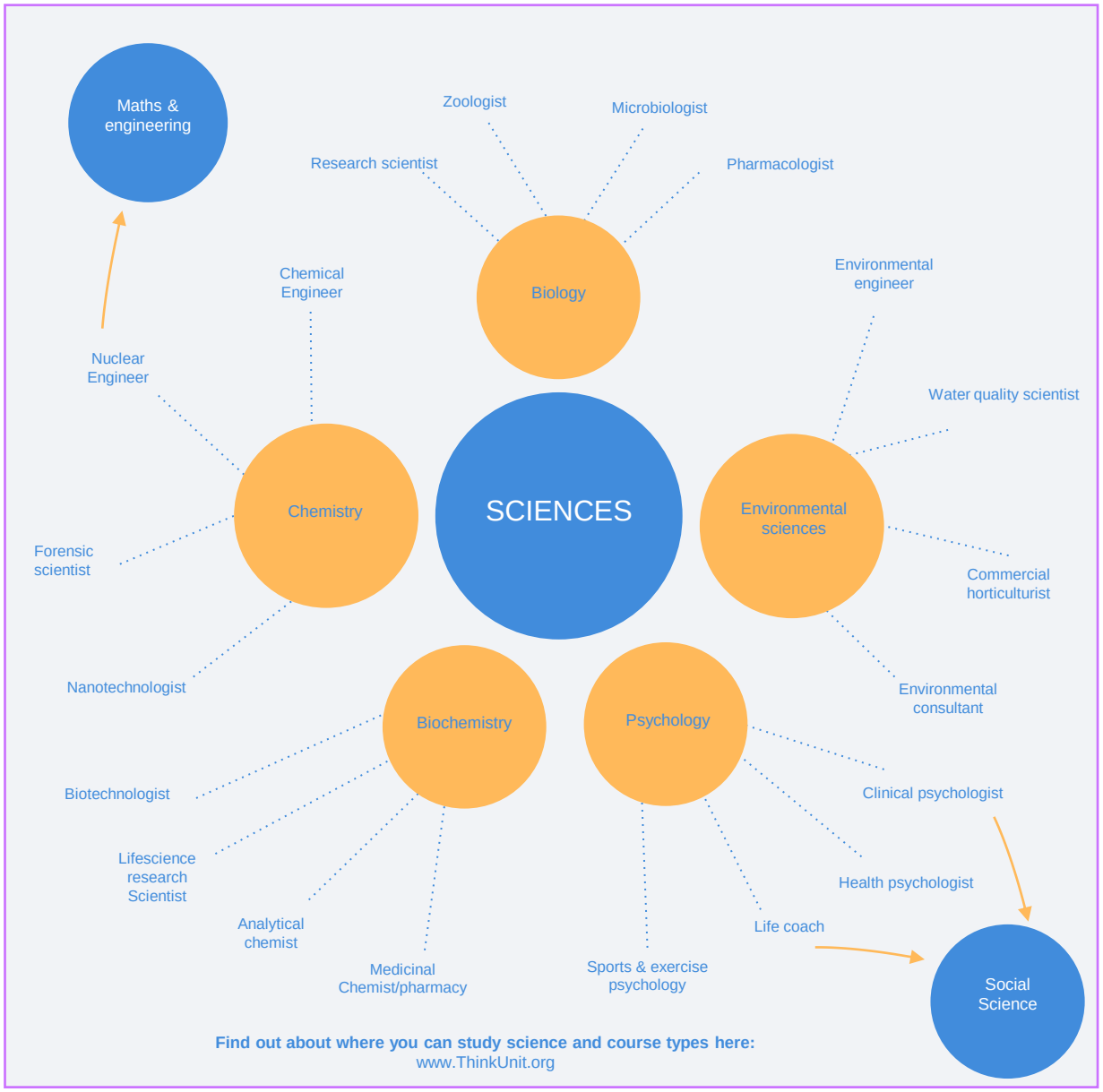
Books or online – giving information on many different subjects. Some are intended as an entry point into research, some provide detailed information and onwards references.

A glossy compilation of stories with unique themes intended for specific interests.

What's next?
Sciences subject maps & jobs

Studying Sciences gives students access to a large number of career choices.

Did you know? Being a scientist of any kind can open up may doors within any industries, from managing projects to labs to health policy teams with governments!

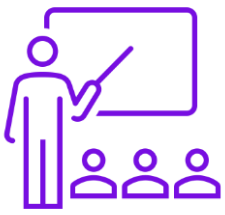


Find our about Science-related careers here:
PROSPECTS: https://www.prospects.ac.uk
TARGET JOBS: https://targetjobs.co.uk

What's next?
Future study options

Exploring Careers and Subject Options

- ✔ Find job descriptions, salaries and hours, routes into different careers, and more at https://www.startprofile.com/
- ✔ Research career and study choices, and see videos of those who have pursued various routes at http://www.careerpilot.org.uk/
- ✔ See videos about what it's like to work in different jobs and for different organisations at https://www.careersbox.co.uk/
- ✔ Find out what different degrees could lead to, how to choose the right course for you, and how to apply for courses and student finance at https://www.prospects.ac.uk/
- ✔ Explore job descriptions and career options, and contact careers advisers at https://nationalcareersservice.direct.gov.uk/
- ✔ Discover which subjects and qualifications (not just A levels) lead to different degrees, and what careers these degrees can lead to, at http://www.russellgroup.ac.uk/media/5457/informed-choices-2016.pdf



University

You may or may not have thought about studying at university in the future. Don't worry – you have plenty of time to think about this and explore your options if you would like to go!

If you'd like to start exploring resources about what university us like, you can see other popular resources here:

- ✔ https://www.ucas.com/
- ✔ https://www.whatuni.com/
- ✔ http://unistats.direct.gov.uk/
- ✔ https://www.thecompleteuniversityguide.co.uk/
- ✔ https://www.opendays.com/

Insight into University of Reading

University of Reading

The author of this coursebook attends the University of Reading.

The University of Reading offers a variety of programmes for key stage 3 pupils. For more information about the below programmes click here.

Widening Participation for Under 16s

Find Your Future: Our Find Your Future days are on campus events that feature a diverse range of university subject activities focused around a particular theme or topic for the day.

Schools Conferences: Support your pupils through significant transitions in their school life and give them the skills to unlock their future with our multi-school conferences for years 8, 9 and 11.

Assemblies: We are available to come into your school and give University information talks to entire year groups or more. Our talks are about 20 minutes long and are perfect for assemblies.

Subject Taster Sessions: We offer various subject tasters focused on engaging and introducing your pupils to university subjects and learning styles.

Ignite: Our Ignite programme provided sustained, focused support for a cohort of students from widening participation backgrounds, from year 7 through their school career.

Activities for Looked After Children: We offer on campus events and bespoke campus visits for Virtual Schools, during half terms and term time.

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