

1 Key Stage 3&4 Climate Science Mapping

2 Readme

This document is a mapping of Climate Science issues against mainly the Key Stage 3* curriculum for Biology, Chemistry, Geography and Physics.

It is arranged in four high level subjects (Header 1) which are then broken down into two further sublevels (Header 2 and 3). A good hierarchical view can be seen using the Navigation Pane or the Outline view.

The subjects represent a compilation of what we have seen broadly presented on the issue of Global Warming and Climate change. The list is comprehensive.

Under each heading there are extracts from the curricula of KS3 Biology, Chemistry, Geography and Physics. You can trace their origin by the square bracket suffix relating to the relevant subject [B, C, G, P]. Maths is seen as a facilitating subject relevant to all subjects and so is not explicitly listed in this document.

We obviously do not expect Key Stage Three students be taught all these subjects. The document is simply a tool for teachers to understand the bigger picture and to use the curricula extracts to justify/segue teaching a particular subject they feel comfortable to do within the context of Climate Science.

The detail makes the document applicable at all educational levels where younger students might only be taught some of the Header 1 subjects at a high level and A Level and University students can study in detail at the Header 3 level.

There is a companion document to Climate Science mapping called [KS3_Tacking_Climate_Change_Mapping](#) which provides the same detail but relating to what we observe being broadly taught relating to Tackling Climate Change.

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* There may be some content from KS4

3 Mechanism for Global Warming

Production of CO₂ by human activity & impact on climate [C]

understand how human and physical processes interact to influence, and change landscapes, environments [G]

3.1 Keeling Curve

understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information [G]

3.2 Global Temperature Curves

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

3.3 Energy Transfer Sun to Earth

light waves travelling through a vacuum; speed of light [P]

our sun as a star, other stars in our galaxy, other galaxies [P]

3.4 Energy Budget

Note - Earth's Energy Budget... measurements show Earth receives peak energy from Sun as visible radiation (absorption) but emits peak in infra-red (emission)

3.4.1 First Law of Thermodynamics

energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change [P]

3.5 UV – Visible – Infra Red

Note: Absorption Spectra absorption, diffuse scattering and specular reflection at a surface · light transferring energy from source to absorber, also basics of reflection)

Light waves: the similarities and differences between light waves and waves in matter [P]

frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound [P]

colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection [P]

the composition of the atmosphere [C]

3.6 Temperature and EM Frequency

Note: The higher the temperature the higher the emissions the shorter the wavelength of (peak) emission – Black body radiation.

colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection [P]

3.7 Feedback mechanisms

Note: Oxygen, photosynthesis and carbon dioxide, Cellular respiration (aerobic & anaerobic in outline) incl. methane? [B Materials Cycles & Energy] - Carbon dioxide (+methane?) in the atmosphere; the Carbon Cycle [C Earth & Atmosphere]

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

the composition of the atmosphere [C]

understand how human and physical processes interact to influence, and change landscapes, environments [G]

3.8 Causes of Global Temperature Change

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

3.8.1 Planet precession

the seasons and the Earth's tilt, day length at different times of year, in different hemispheres [P]

physical geography relating to: geological timescales and plate tectonics; rocks, weathering and soils; [G]

3.8.2 Volcanoes

rocks [G]

physical geography relating to: geological timescales and plate tectonics; rocks, weathering and soils; [G]

3.8.3 Flora and Fauna Changes e.g. Carboniferous, Cretaceous

Physical geography relating to: geological timescales [G]

the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere [B]

3.8.4 Albedo changes e.g. Ice cover

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

physical geography relating to weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

3.8.5 Land Emissions from Permafrost

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

physical geography relating to weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

3.8.6 Sea current changes

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

3.8.7 Air current changes

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

3.8.8 Anthropogenic Changes

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

4 GHG Gases

the production of carbon dioxide by human activity and the impact on climate [C]

4.1 CO₂

Note: The Carbon Cycle [C - earth and the Atmosphere] [C Earth & Atmosphere (Production of CO₂ (+) by human activity & impact on climate)]

combustion, thermal decomposition, oxidation and displacement reactions [C]

the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere [B]

aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life [B]

a word summary for aerobic respiration [B]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

understand how human and physical processes interact to influence, and change landscapes, environments[G]

4.2 Methane

combustion, thermal decomposition, oxidation and displacement reactions [C]

aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life [B]

the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration [B]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

understand how human and physical processes interact to influence, and change landscapes, environments[G]

4.3 Ozone

4.4 Water

4.5 Sources

4.5.1 Scales – How big is Giga, how small is Nano?

Note: This is a crucial concept to understand the relative importance of various contributions to global warming both in terms of emissions and mitigation.

4.5.2 Dairy

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

the content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed [B]

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops [B]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors[G]

human geography relating to the use of natural resources [G]

4.5.3 NO_xs

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

human geography relating to the use of natural resources [G]

4.5.4 Aviation

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

4.5.5 Buildings

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

human geography relating to the use of natural resources [G]

4.5.6 Electricity Generation

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

human geography relating to the use of natural resources [G]

4.5.7 Fuel production including flaring

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

human geography relating to the use of natural resources [G]

4.5.8 Manufacture and Construction

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

4.5.9 Permafrost

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life [B]

the process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

physical geography relating to weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts [G]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

4.5.10 Transport

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

combustion, thermal decomposition, oxidation and displacement reactions [C]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

4.5.11 Trees

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

the dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere [B]

the reactants in, and products of, photosynthesis, and a word summary for photosynthesis [B]

aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life [B]

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

human geography relating to the use of natural resources [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

4.5.12 Waste

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

human geography relating to the use of natural resources [G]

4.5.13 UK List of biggest emitters

Understand how human and physical processes interact to influence, and change landscapes, environments and the climate [G]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

5 Climate and Weather

Weather & climate, including the change in climate from the Ice Age to the present; and glaciation [G]

the seasons and the Earth's tilt, day length at different times of year, in different hemispheres [P]

6 Climate Change Impacts

Note: Global Warming and Climate change: Increased energy transfer -> More evaporation, stronger circulation of oceans & atmosphere -> increasing storms & temperatures (esp. high latitude). [P
Energy (transfer of energy between thermal stores & thermal equilibrium)

the production of carbon dioxide by human activity and the impact on climate [C]

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction [B]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.1 Extreme Heat

How human activity relies on effective functioning of natural systems [G]

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops [B]

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.2 Droughts

How human activity relies on effective functioning of natural systems [G]

the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases [B]

the adaptations of leaves for photosynthesis [B]

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops [B]

how organisms affect, and are affected by, their environment, including the accumulation of toxic materials [B]

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.3 Flood

Hydrology and coasts [G]

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

physical geography relating to weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.4 Storms

How human activity relies on effective functioning of natural systems [G]

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.5 People Migration

How human activity relies on effective functioning of natural systems [G]

melting sea ice also leading to habitat destruction [B Interactions & Interdependencies (Relationships in Ecosystems)]

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops [B]

changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction [B]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

human geography relating to: population and urbanisation; international development; economic activity in the primary, secondary, tertiary and quaternary sectors;[G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.6 New Crops

How human activity relies on effective functioning of natural systems [G]

the content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed [B]

the adaptations of leaves for photosynthesis [B]

the interdependence of organisms in an ecosystem, including food webs and insect pollinated crops [B]

how organisms affect, and are affected by, their environment, including the accumulation of toxic materials [B]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]

6.7 Ice Melt & Sea Level Rise

Note: Ocean warming (expansion) + melting of glaciers & ice sheets on land leads to rising sea levels [P & C Particle nature of Matter; Energy (including changes of state - qualitative only)];

Hydrology and coasts [G]

extend their locational knowledge and deepen their spatial awareness of the world's countries [G]

physical geography relating to weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts [G]

build on their knowledge of globes, maps and atlases and apply and develop this knowledge routinely in the classroom and in the field [G]

interpret Ordnance Survey maps in the classroom and the field, including using grid references and scale, topographical and other thematic mapping, and aerial and satellite photographs [G]

use Geographical Information Systems (GIS) to view, analyse and interpret places and data [G]

use fieldwork in contrasting locations to collect, analyse and draw conclusions from geographical data, using multiple sources of increasingly complex information. [G]