Climate change

GCSE geography

AQA

Name: ....

Contents

RAG RATING

CLIMATE CHANGE	AT THE START OF THE TOPIC			AFTER THE TOPIC			AFTER REVISION		
	☹️	😐	😃	☹️	😐	😃	☹️	😐	😃
KEY IDEA: climate change is the result of natural and human factors, and has a range of effects									
Describe how the climate has changed from the beginning of the Quaternary period to the present day									
Identify the evidence we have of climate change									
Explain the possible natural causes of climate change									
Explain the possible human causes of climate change									
Suggest some of the effects of climate change on both people and the environment									
KEY IDEA: managing climate change involves both mitigation (reducing causes) and adaptation (responding to change									
Define the terms mitigation and adaptation									
Explain a number of mitigation strategies which can be used to manage climate change									
Explain a number of adaptation strategies which can be used to manage climate change									

L1: Evidence of climate change

TASK: Define the term 'climate change'

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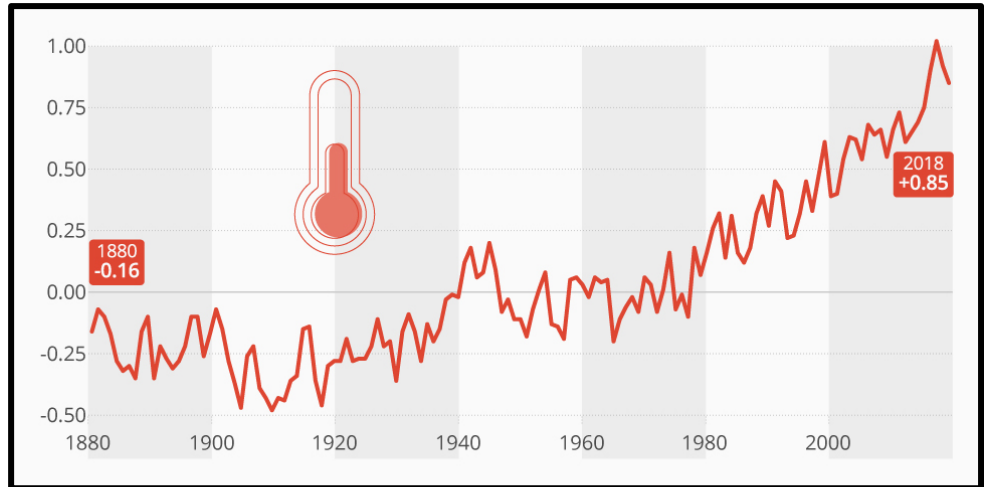**The Earth will undergo cold periods and warm periods every few thousands of years.**

- We have cold periods which are known as……………………………………periods. This where we encounter ice ages.
- We also have warm periods. These are known as ……………………………………periods.
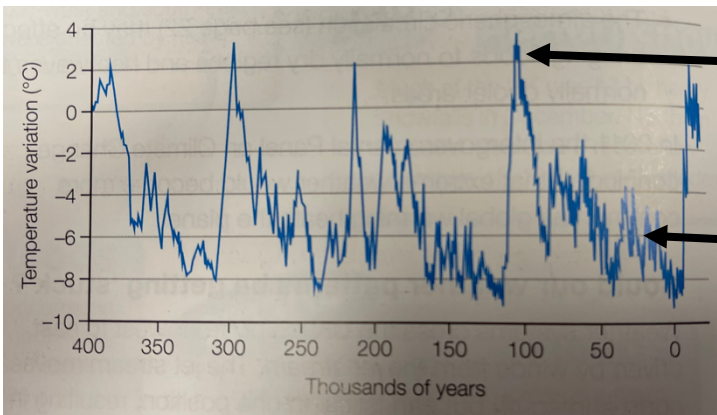
Global changes in temperature from 1880 - 2015

TASK: Describe the changes in Global temperatures from 1880-2015 *(3marks)*

G C S E
GENERAL COMMENT, SPECIFIC EXAMPLE

What can you see?
Does it increase or decrease?

Support your answer with data
E.g., Increased from -0.16 to -0.85

But what is the evidence for climate change over the years?

When looking at evidence for climate change, we look at two things:

Part 1: Past Evidence

TASK: Complete the table below with the appropriate information

EVIDENCE	IMAGE	DESCRIPTION
Tree rings		
Fossils		
Ice cores		
Landforms		
Diary entries & Old paintings		

Part 2: recent evidence

Direct measurements of temperature using thermometers are constantly being taken, and have indicated a clear warming trend, however there is other recent evidence to suggest climate change is also taking place.

What is this image showing?
How can this be used as evidence for changing climate?

1921

2009

David Breashears/Royal Geographic Society

Name: ....

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2

Name: Sea level rise

According to the IPCC the average global sea level has .... between 10 and .... Cm in the past 100 years.

There are two reasons as to why sea levels have risen:

1) When temperatures rise the .... stored in the ice sheets melt. This water is stored in the form of .... And ice caps. This water will then flow into the ....

2) When the ocean water warms it .... in volume. This is called thermal expansion.

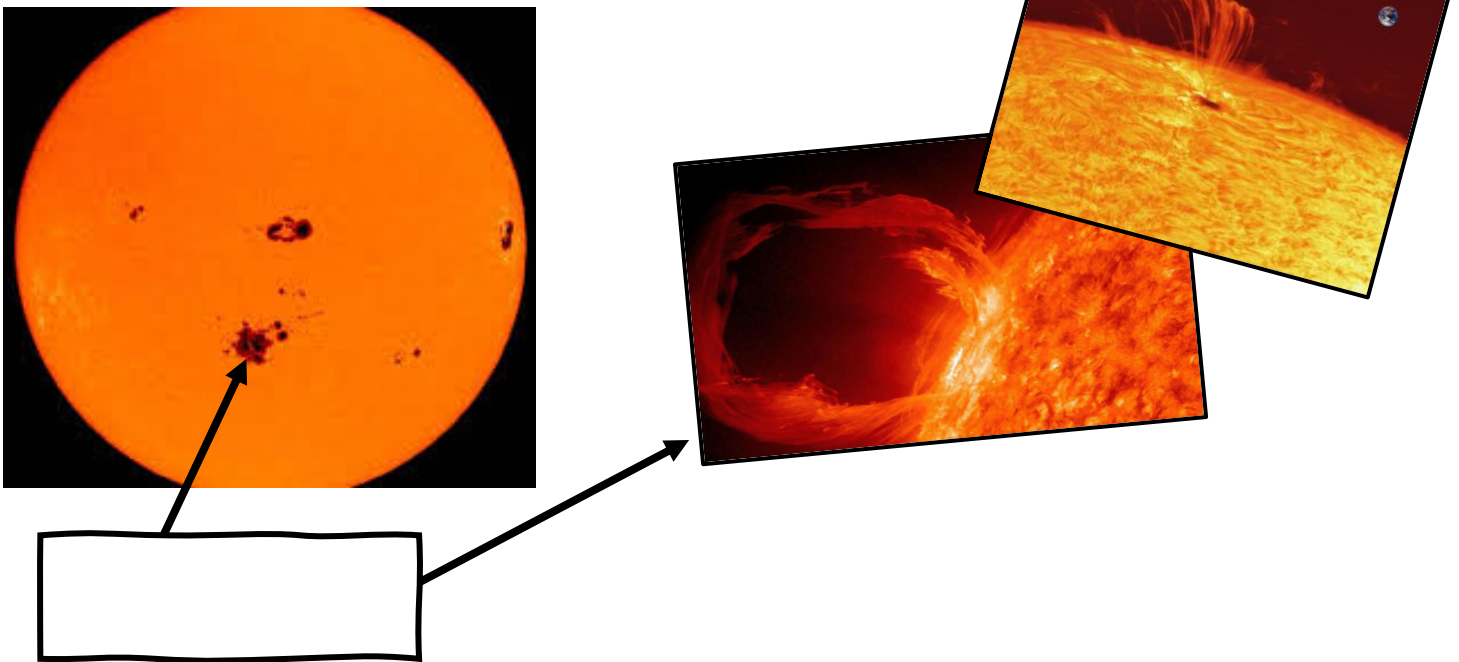| EXPANDS	20	GLACIERS	RISEN	FRESHWATER	SEA

EXTENSION: What are some likely impacts as a result of climate change?

L2: Natural causes of climate change

Scientists believe that there are several natural causes for climate change. These include:

1. ………………………………………………………………………………….

2. ………………………………………………………………………………….

3. ………………………………………………………………………………….

1. Solar activity (Sun spot theory)

A sunspot is a dark patch that appears from time to time on the surface of the Sun. Sunspots are areas of more intense energy (solar flare).

TASK: What do you think this will mean in terms of climate change?

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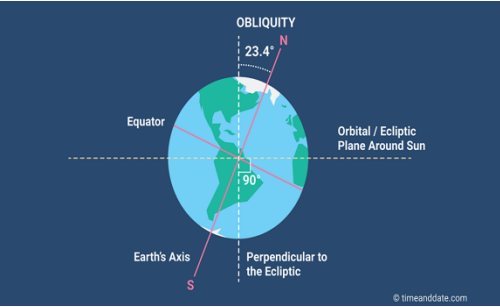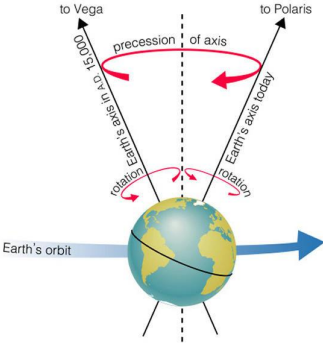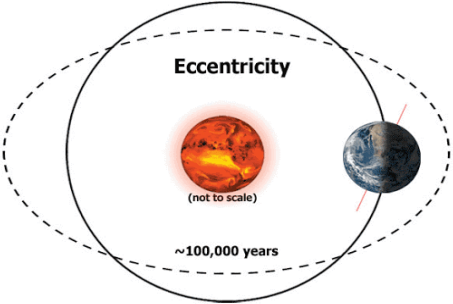……

This cycle occurs over an ………………. year period.

2. Orbital changes (Milankovitch cycles)

TASK:

a) Match up the term with the correct description

AXIAL TILT			This describes the 'wobble' of the earth. A complete wobble cycle takes about 26,000 years. The earths 'wobble' can give areas (such as Norway) Long days and long nights at certain times of the year
PRECESSION			This describes the path of the Earth as it orbits the sun. The Earth's orbit is not fixed as it can change from circular to elliptical (Rugby ball shaped). A complete cycle occurs every 100,000 years
ECCENTRICITY			The Earth spins on its axis, causing night and day. The Earth's axis is currently tilted at an angle of 23.5 degrees. Over a period of 41,000 years the tilt of the Earth moves back and forth between 21.5 degrees and 24.5 degrees.

b) Let's get a better understanding on each of the orbital changes. Answer the following questions:

1) How does the Earth's orbit change every 100,000 years? What is this known as?

....

....

2) If the Earth's orbit is closer to the sun what will this mean for the climate?

....

3) What is an effect of the Earths wobble? Give a named example

....

....

4) The Earth spins on its axis. Over a period of …………………………………… years the tilt moves back and forth

between ………………….. and 24.5 degrees. The current tilt of the earth is ………………….. degrees.

3. VOLCANIC ACTIVITY

TASK:

1 Volcanic ash can ………………….. out the sun, this will …………………………. temperature on earth. This **short-term** impact.

2 Fine droplets form as a result of the conversion of sulphur …………… to sulphuric acid. This acid acts like tiny mirrors …………………. radiation from the sun. This process is a long-term impact and can affect the Earth's climate for many years

REFLECTING	BLOCK	DIOXIDE	REDUCE

** *Knowledge recap*** Define the following terms:
Short term impact:

………

………

1) Long term impact:

………

………

TASK:

a) Out of the three 'natural' causes of climate change, rank them in order of which you believe to contribute most to climate change

1. ....
2. ....
3. ....

b) Justify your choices:
(Use data on cycle frequency, direct impact of the cause etc)

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EXAM QUESTION PRACTICE: Explain how volcanic activity and orbital changes may cause long-term climate change *(4marks)*

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| Level	Marks	Description
2 (Clear)	3-4	AO1 Demonstrates accurate knowledge about long- term climate change. AO2 Shows a clear understanding of the natural factors that help to account for long-term changes in climate. Explanations are developed.
1 (Basic)	1-2	AO1 Demonstrates limited knowledge about long- term climate change. AO2 Demonstrates some understanding of the natural factors that help to account for long-term changes in climate. Explanations are partial and limited in scope.
	0	No relevant content

L3: Human causes of climate change

Many scientists believe that human activities are at least partly to blame for the rapid rise in temperatures. This is known as **global warming.**

The **greenhouse effect** has been given the name as the atmosphere acts similarly to a greenhouse. A greenhouse is made from pure glass. When heat passes through the glass, it cannot escape therefore the greenhouse becomes warmer than the air outside. The Earth's atmosphere undergoes the same processes. When solar radiation passes through the Earth's surface is warmed. However, the Earth gives off heat in the form of long-wave radiation. Some of our greenhouse cases e.g., CO_2 and methane absorb it. This then warms global temperatures

TASK: Match the statements with the correct number on the diagram
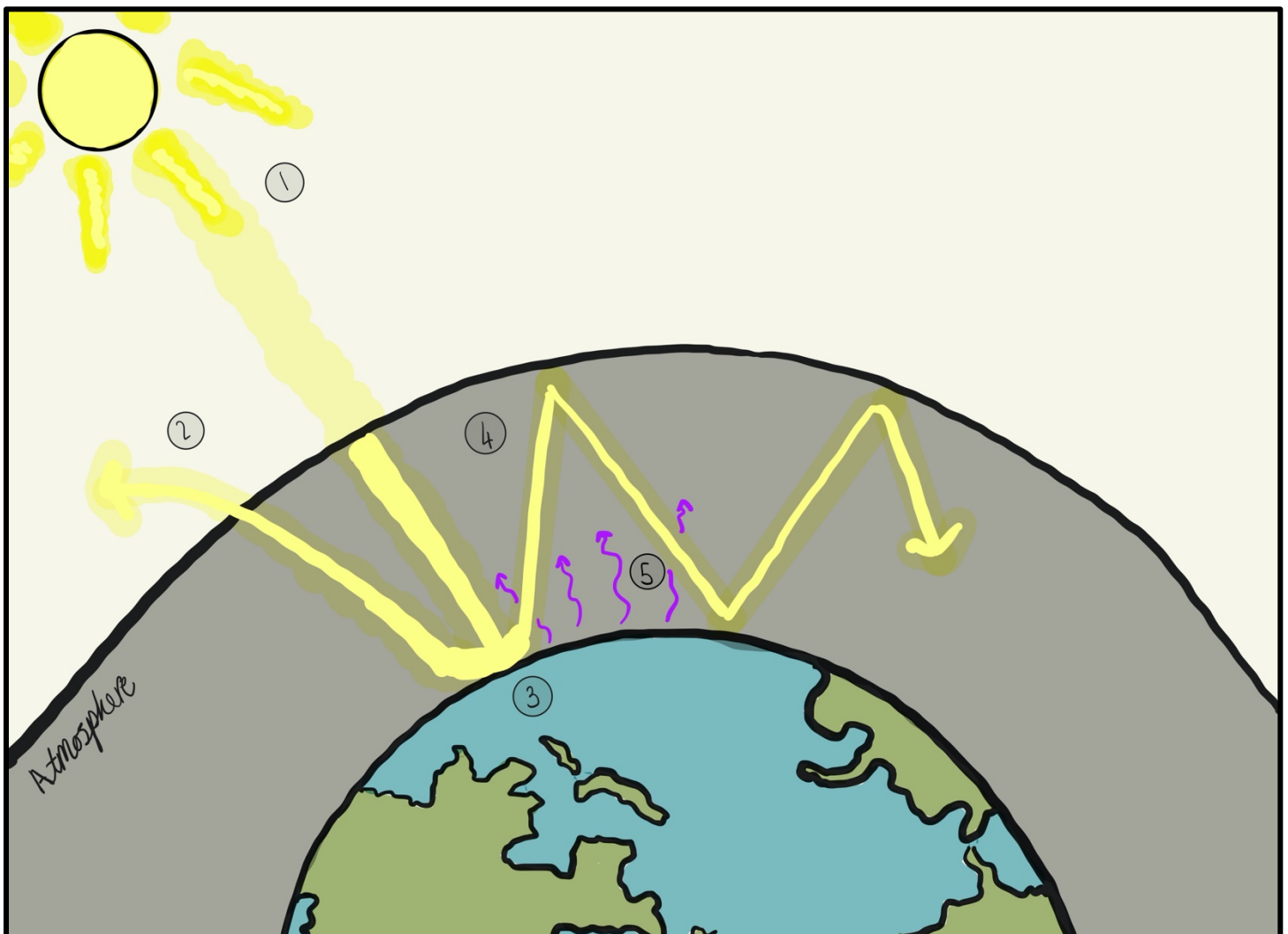
Number	Statement
	Heat is released from the earth, in the form of Long-wave radiation,
	The sun lets out solar radiation which passes through the atmosphere
	Earth warms up
	Some long wave radiation passes through the atmosphere
	Long wave radiation moves in all directions and is absorbed by greenhouse gases such as CO_2, Methane and nitrous oxides

TASK: Look at the images below. Each represents a human cause of deforestation. Can you guess what they are?

1 **2** **3**
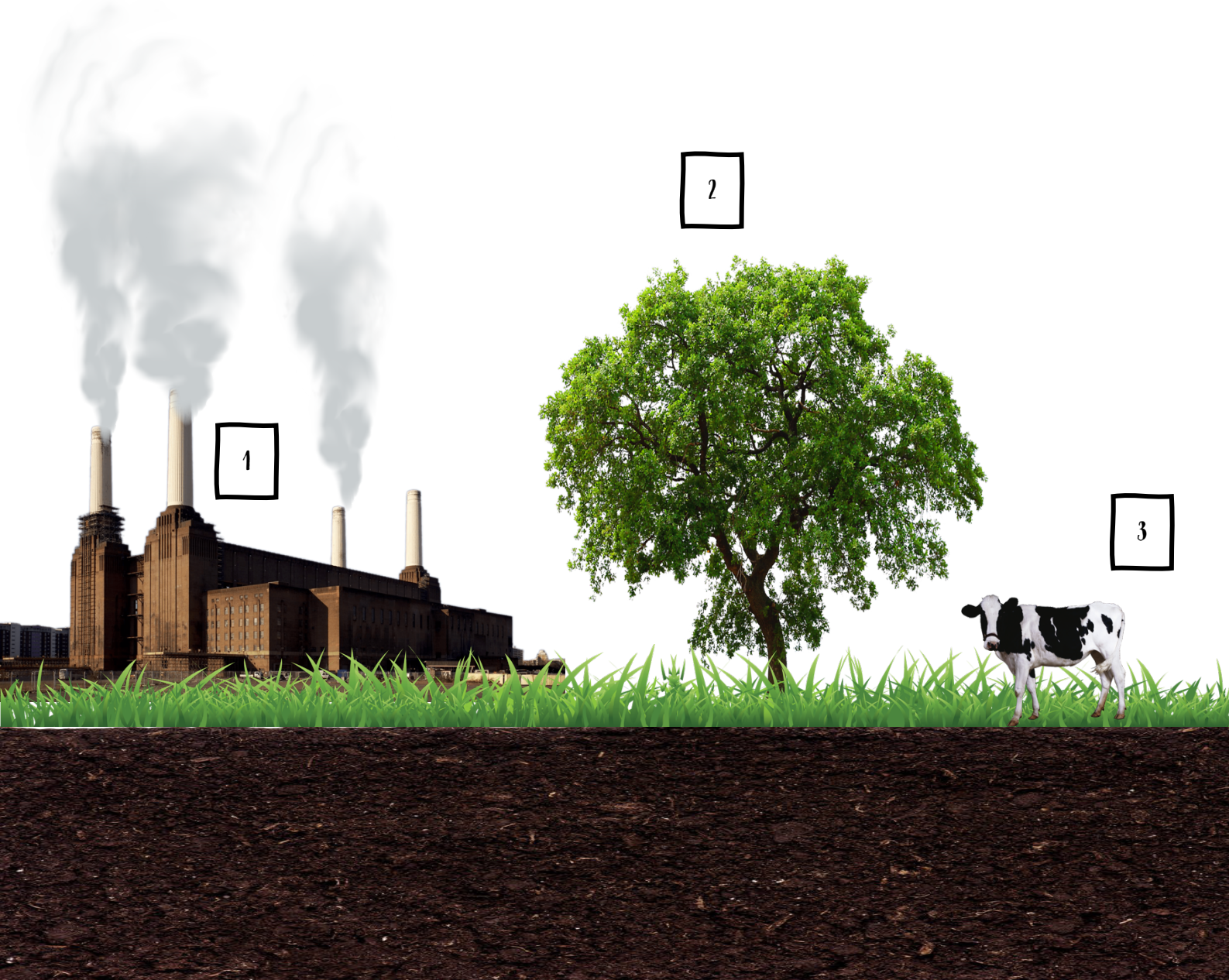
1.

2.

3.

TASK: Out of the list below, highlight the key greenhouse gases

WATER VAPOUR	RADON	NEON	CFC'S	CARBON DIOXIDE
KRYPTON	METHANE	NITROUS OXIDE	HELIUM	OXYGEN

1. BURNING FOSSIL FUELS

TASK: Answer the following questions
   a) Burning fossil fuels releases greenhouse gases such as:
   1. ……………………………………………….. 2. ……………………………………………………

   b) This is through using fuels such as oil, gas and ……………………………………………………… in industry and power stations.

   c) Another cause of CO2 and Nitrous oxide is through the use of …………………………. As there is an increase in population more people are driving resulting in higher emissions.

2. DEFORESTATION

TREES RELEASE MOISTURE (H_2O) AS A RESULT OF TRANSPIRATION. THIS MOISTURE ACTS A COOLING EFFECT FOR THE ATMOSPHERE

TREES ABSORB …………………………………

THE GAS THAT IS ABSORBED BY THE TREE IS STORED IN THE TRUNK
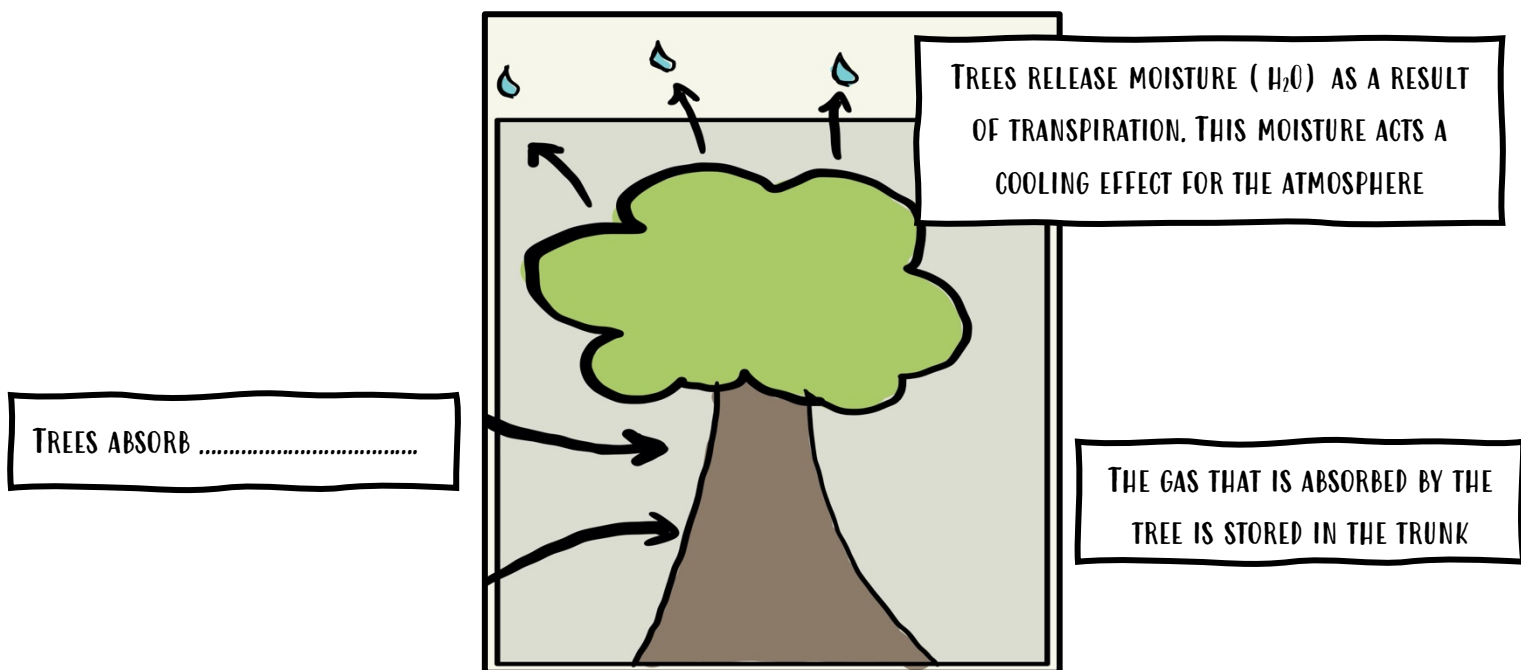
TASK: Answer the following questions, using the diagram above for help
   1. If we were to cut down trees, what would happen to all the stored CO_2?

……

……

   2. The tree will no longer be releasing H_2O into the atmosphere. What will this mean for global temperatures?

……

……

   3. By deforesting large areas of trees, less …………………… is going to be absorbed, increasing the levels of ……………………………. gases in the atmosphere. These gases will ………………………………. heat from the sun increasing global temperatures

3. AGRICULTURE

TASK: What do we know about the worlds population? *(Use the graph as reference – Inc data)*
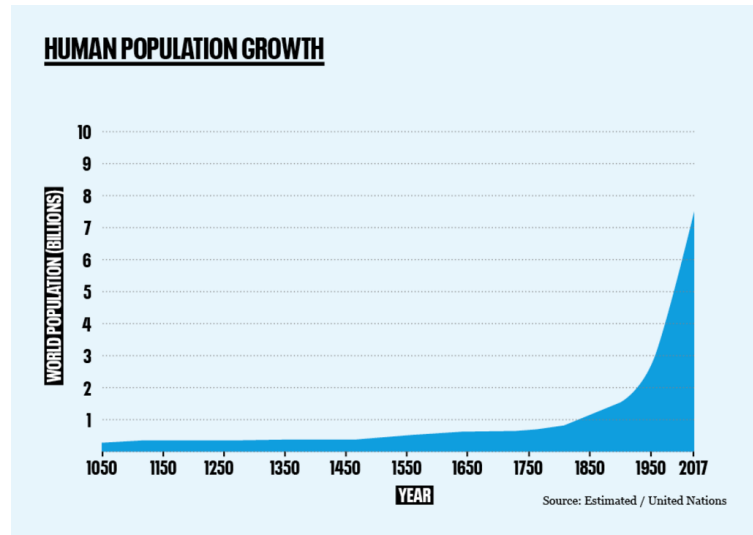
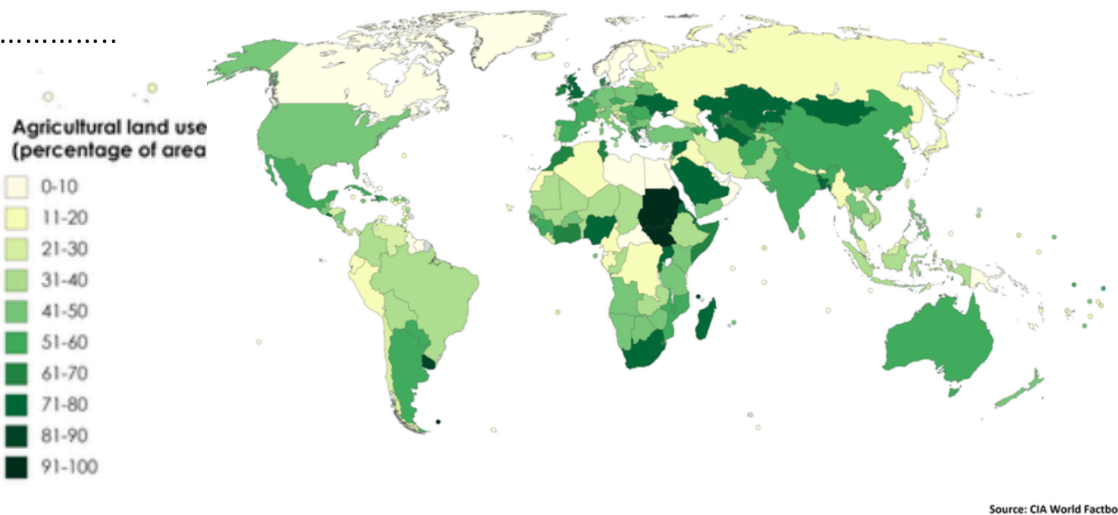...

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HUMAN POPULATION GROWTH

Source: Estimated / United Nations

As a result of the growing population there is a higher demand for:
- ....
- ....

Agricultural land use (percentage of area

- 0-10
- 11-20
- 21-30
- 31-40
- 41-50
- 51-60
- 61-70
- 71-80
- 81-90
- 91-100

Source: CIA World Factbook

TASK: Answer the following questions

1) Agriculture accounts for over 31% or above in land use across ¾ of the world. (True / False)
2) Areas such as Russia and Greenland have the lowest agricultural land use (True / False) at <20%
3) UK has the highest Agricultural use in the world at 90-100% (True / False)
4) Areas where agriculture is lower tend to have more extreme conditions. E.g. Extreme cold or extreme heat (True / False)
5) The agricultural land use percentage for the following countries are:
a) Australia: ....
b) Sudan: ....
c) Argentina: ....
d) Algeria: ....

   o Farming releases significant amounts of what gases into the atmosphere? ....
   &..........................
   o Methane is produced by livestock (**excretion**) and accounts for 20% of the greenhouse gas effect.
      o Nitrous oxide is released as in indirect product of organic and mineral **fertilizers**.

4: Impacts of climate change

TASK:

a) On the diagram below, write down the impacts of climate change associated with each arrow

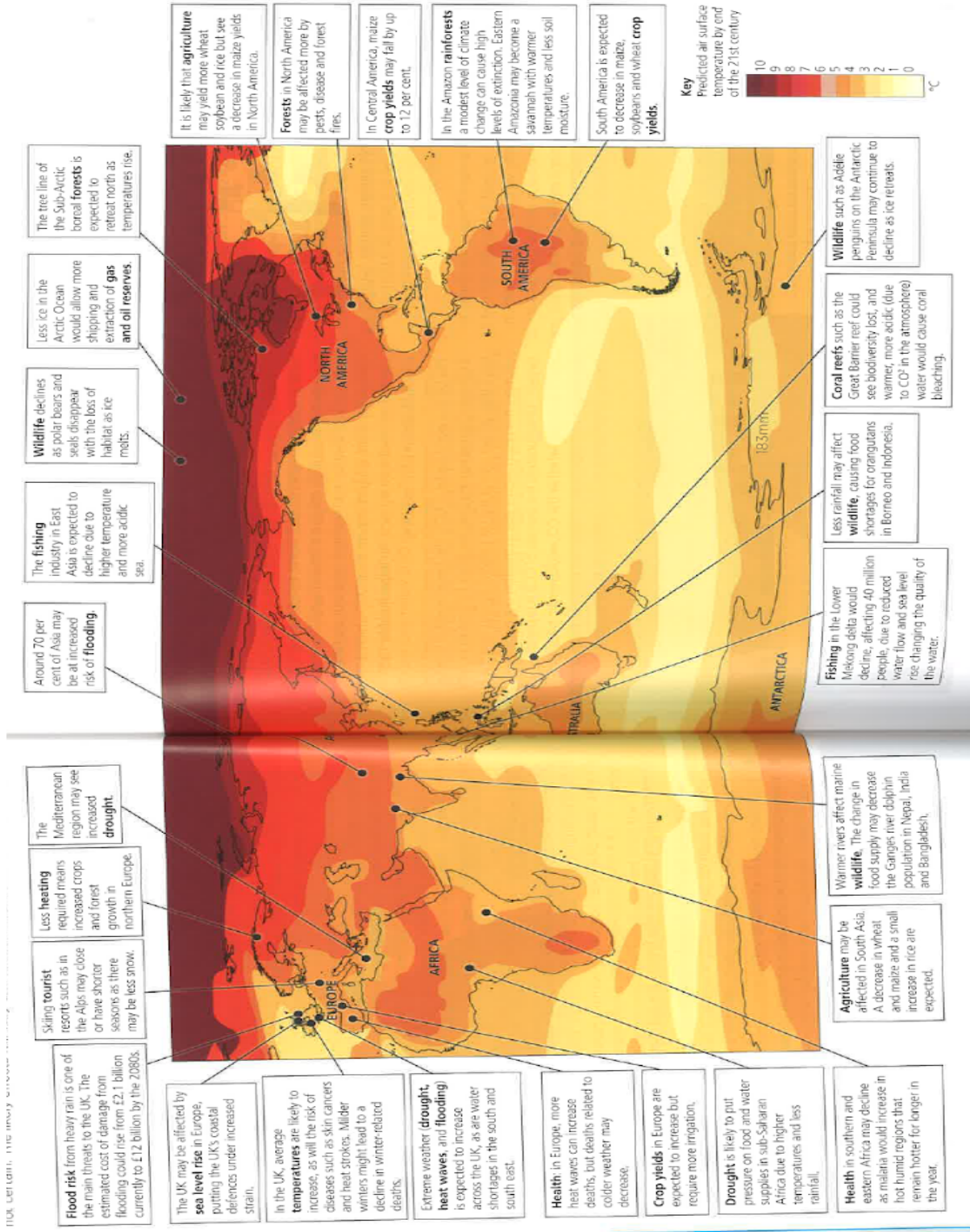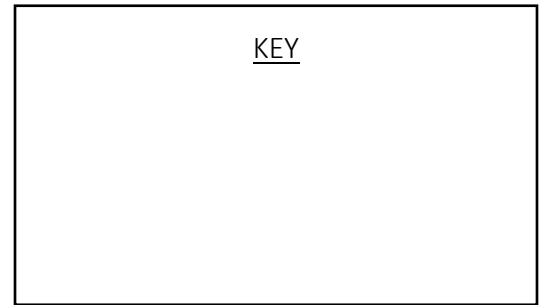b) Highlight if the impact is social, economic or environmental

| Sea level rise: Islands disappearing | Drought: Food & Water insecurity | Ice caps melting, habitat loss | Increase frequency of tropical storms & Extreme weather as a result of rising sea temps | Ice Sheets melting, stored gases being released | Increased crop yields as there are better growing conditions |

Impacts of climate change across the globe

TASK:

a) Highlight whether the impact is social, economic or environmental

It is likely that **agriculture** may yield more wheat soybean and rice but see a decrease in maize yields in North America.

Forests in North America may be affected more by pests, disease and forest fires.

In Central America, maize **crop yields** may fall by up to 12 per cent.

In the Amazon **rainforests** a modest level of climate change can cause high levels of extinction. Eastern Amazonia may become a savannah with warmer temperatures and less soil moisture.

South America is expected to decrease in maize, soybeans and wheat **crop yields.**

Key
Predicted air surface temperature by end of the 21st century

10
9
8
7
6
5
4
3
2
1
0

°C

The tree line of the Sub-Arctic boreal **forests** is expected to retreat north as temperatures rise.

Less ice in the Arctic Ocean would allow more shipping and extraction of **gas and oil reserves.**

Wildlife declines as polar bears and seals disappear with the loss of habitat as ice melts.

Wildlife such as Adélie penguins on the Antarctic Peninsula may continue to decline as ice retreats.

The **fishing** industry in East Asia is expected to decline due to higher temperature and more acidic sea.

Coral reefs such as the Great Barrier reef could see biodiversity lost, and warmer, more acidic (due to CO² in the atmosphere) water would cause coral bleaching.

Around 70 per cent of Asia may be at increased risk of **flooding.**

Less rainfall may affect **wildlife,** causing food shortages for orangutans in Borneo and Indonesia.

183mm

Fishing in the Lower Mekong delta would decline, affecting 40 million people, due to reduced water flow and sea level rise changing the quality of the water.

The Mediterranean region may see increased **drought.**

Less **heating** required means increased crops and forest growth in northern Europe.

Skiing tourist resorts such as in the Alps may close or have shorter seasons as there may be less snow.

Flood risk from heavy rain is one of the main threats to the UK. The estimated cost of damage from flooding could rise from £2.1 billion currently to £12 billion by the 2080s.

The UK may be affected by **sea level rise** in Europe, putting the UK's coastal defences under increased strain.

In the UK, average **temperatures** are likely to increase, as will the risk of diseases such as skin cancers and heat strokes. Milder winters might lead to a decline in winter-related deaths.

Extreme weather (**drought, heat waves, and flooding**) is expected to increase across the UK, as are water shortages in the south and south east.

Health in Europe, more heat waves can increase deaths, but deaths related to colder weather may decrease.

Crop yields in Europe are expected to increase but require more irrigation.

Drought is likely to put pressure on food and water supplies in sub-Saharan Africa due to higher temperatures and less rainfall.

Health in southern and eastern Africa may decline as malaria would increase in hot humid regions that remain hotter for longer in the year.

Agriculture may be affected in South Asia. A decrease in wheat and maize and a small increase in rice are expected.

Warmer rivers affect marine **wildlife.** The change in food supply may decrease the Ganges river dolphin population in Nepal, India and Bangladesh.

NORTH AMERICA

SOUTH AMERICA

EUROPE

AFRICA

AUSTRALIA

ANTARCTICA

B) Are all impacts of climate change negative? Give an example

....

....

TASK: Using the information provided, write down key info for each impact below.

Sea Level Rise: Maldives

Shrinking ice caps: Habitat loss

Drought: food & water shortages

Sea Level Rise: Maldives

L5: Managing the impacts (1)

TASK: Define the term Mitigation

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There are several ways that we have mitigated against climate change. This includes:

1. ………………………………………………………………………………

2. ………………………………………………………………………………

3. ………………………………………………………………………………

4. ………………………………………………………………………………

Planting trees

TASK: Fill in the gaps using your knowledge from previous lessons

Deforestation is a major cause of ………………………………………………………

This is because trees act as a 'carbon sink' Trees take …………………..

out of the atmosphere and store it within their trunk. When we

plant more trees there is more CO_2 being absorbed.

Not only this the more trees we have the more ……………………

Being released into the atmosphere from transpiration. This will

help …………………… global temperatures.
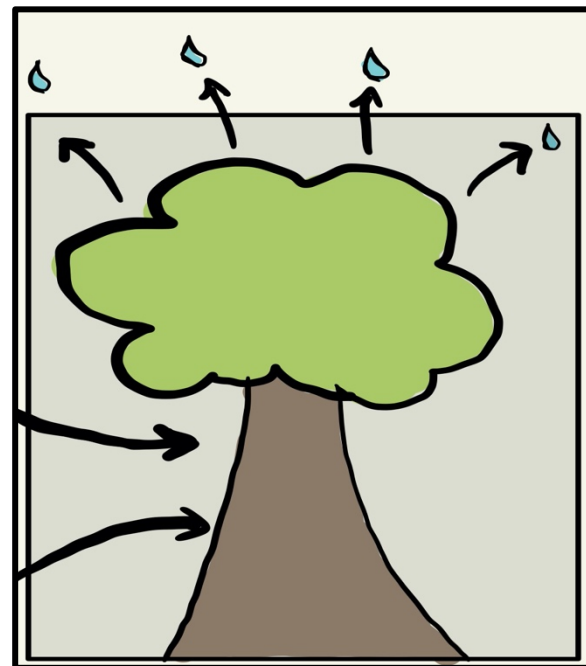
Renewable energy

The world is heavily reliant on burning fossil fuels. For example:
- A) ………………………………….
- B) ………………………………….
- C) ………………………………….

This is through the use of vehicles and power industries (factories).

Overall, it contributes to …………………. Of all CO_2 produced.

Therefore, to help reduce carbon emissions many countries are turning to alternative energy production.

TASK: Match the renewable energy with its correct description

TERM		DEFINITION
BIOMASS		Energy from the sun is used to heat water or generate electricity using solar panels
WIND		Water is pumped into the ground, where heat deep in the Earth's crust turns it into steam. This drives a turbine to generate electricity
TIDAL		Uses the energy of falling water. Water is trapped by a dam and allowed to fall through tunnels, where the pressure of the falling water turns turbines to generate electricity. E.g., A dam
SOLAR		Wind blowing across water makes waves, which drives turbines to generate electricity.
GEOTHERMAL		Currents or changes in water level caused by tides are used to turn turbines and generate electricity
WAVE		Turbines use the energy of the wind to generate electricity, either on land or in the sea. E.g., Wind turbines
HYDRO		Wood, plants or animal waste burnt for power or used to produce biofuels

You will have heard of some of these before. Within the UK it is very common to find **wind turbines** and **solar panels.**

TASK: What are the benefits of Renewable energy sources in reducing climate change? Use examples *(6marks)*

………………………………………………………………………………………………………

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INTERNATIONAL AGREEMENTS

Climate change is a global issue and requires global solutions. Carbon emissions spread across the world and affect everyone

2005

The Kyoto Protocol – the first international treaty – became law. Over 170 countries agreed to reduce carbon emissions by an average of 5.2 per cent below their 1990 levels by 2012. Of the major greenhouse gas emitters, only the USA and Australia refused to sign the treaty.

2009

World leaders met in Copenhagen to consider international agreements on tackling climate change beyond 2012. The outcome was the Copenhagen Accord. It pledged to reduce emissions with financial support for developing nations to help them cope with the impacts of climate change. But there was no legally binding agreement.

2015

Paris Agreement 2015 – 195 countries adopted the first ever universal and legally binding global climate deal.
- To peak greenhouse gas emissions as soon as possible and achieve a balance between sources and sinks of greenhouse gases in the second half of this century.
- To keep global temperature increase below 2°C and limited to 1.5°C above pre-industrial levels.
- To review progress every five years.
- US$100 billion a year to support climate change initiatives in developing countries by 2020, with further finance in the future.

There have been criticisms that many of these agreements are 'promises' or aims and not firm commitments.

TASK: Read the information above and answer the following questions:

1) **2005**
   A. What international agreement occurred in 2005? ………………………………………………………………
   B. How many countries signed? ……………………………….
   C. What was the aim of this agreement?
   ………
   ………

2) **Copenhagen Accord**
   A. The Copenhagen Accord was set out to tackle climate change beyond ……………………….
   B. It was set up in the year …………………………….
   C. The purpose of this agreement was to…
   ………
   ………
   ………

3) **Paris Agreement, 2015**
   A. This was the first ever …………………………………………………………………………………………………
   ………
   B. The 4 main aims of this deal are (Summarised):
   - ………
   ………
   - ………
   - ………
   - ………

However there have been criticisms to this agreement. **Why is this?**
………
………
………
………

Carbon capture

Carbon capture and storage uses technology to capture CO_2 produced from the use of fossil fuels in electricity generation and industrial processes.

It is possible to capture up to ....% of the CO_2 that would otherwise enter the atmosphere

Large fossil fuel electricity power station ➡ Fossil fuel is burnt ➡ CO_2 is captured from the exhaust gases ➡ CO_2 is pumped through pipelines to old oil fields ➡ CO_2 is converted into a liquid and injected into sedimentary rocks in old oil fields

Land

Sea

Permeable 'cap rock' stops CO_2 escaping ➡

Old oil field
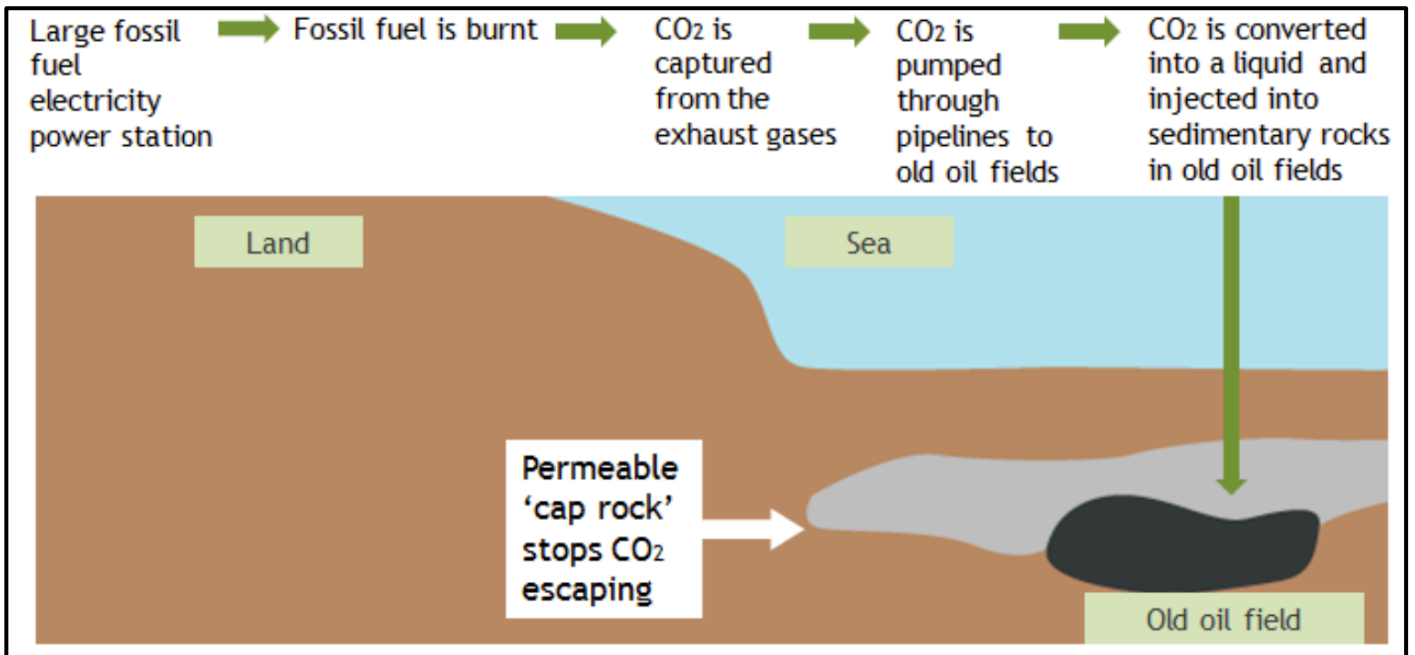
TASK: Explain how the process of carbon capture can help to mitigate the causes of climate change

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TASK: Rank the mitigation methods from most effective to least effective. *Justify your choices.*

Most effective

Least effective

1. ....

2. ....

3. ....
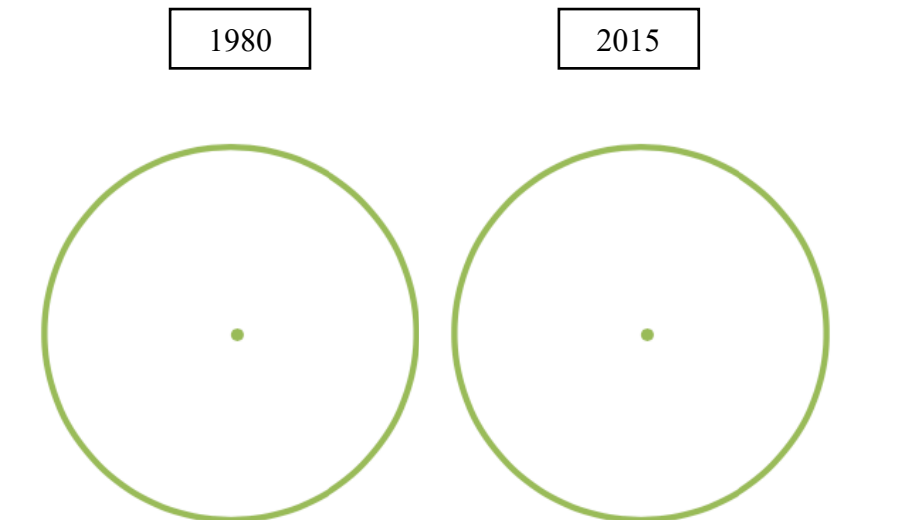
4. ....

I think this because…

Homework: mitigating against climate change

TASK: Complete the following questions
- a) Draw two labelled pie charts to illustrate the data in figure 2

Figure 2: UK energy mix		
Source of energy	1980 %	2015 %
Fossil fuels: gas, coal and oil	91	50
Nuclear power	6	19
Renewable energy: wind, solar, HEP	3	23
Imports	0	8

1980

2015

- b) Which sources of energy have decreased since 1980? ....
- c) Which sources of energy have increased since 1980? ....
- d) Which energy source has increased the most? ....
- e) To what extent is the UK reducing its use of fossil fuels? ....
....
....
....
- f) Draw a line graph to show the information in figure 3.

	Forest area as % of land area
1920	5
1940	6
1960	8
1980	9
2000	11
2020	13
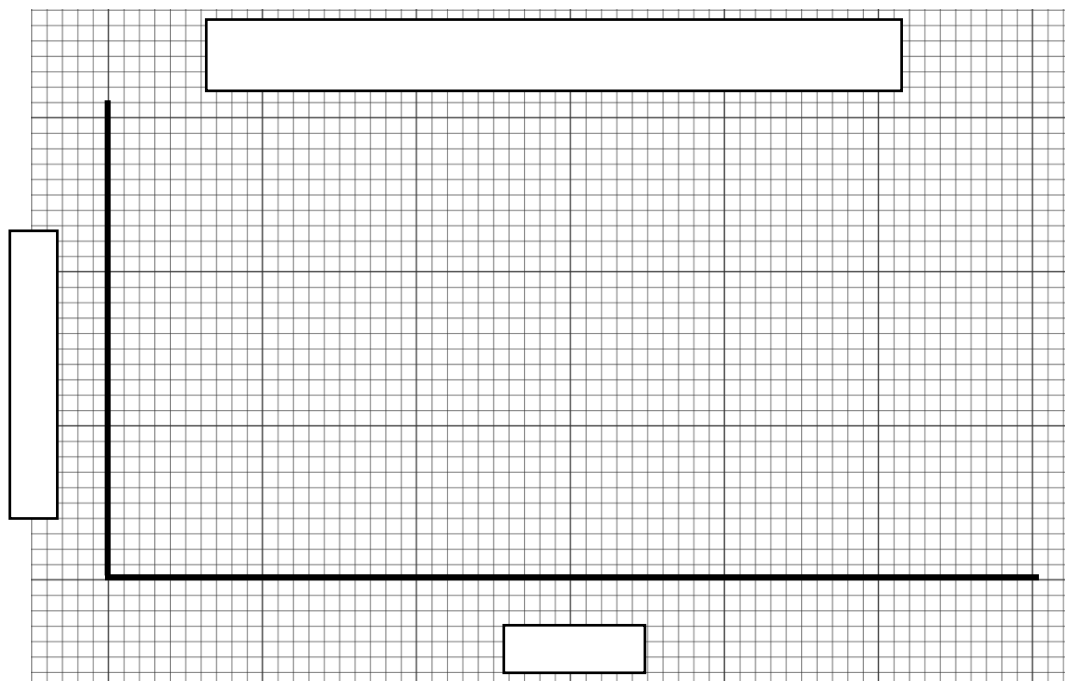
Don't forget to give your graph a title and axis titles

QUESTION: The amount of forest area in the UK is increasing.
TRUE / FALSE

L6: Managing the impacts (2)

ADAPTING TO CHANGES

As a result of climate change agricultural systems across the world are under threat.
- Patterns of rainfall and temperature will change
- Extreme weather events such as heatwaves, droughts and floods become more common
- The distribution of pests and diseases will change.

TASK: Using the information above. Explain how agriculture will be impacted as a result of the three factors listed above

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Think back to the previous lesson on impacts of climate change. We know that some areas may thrive as a result of warmer climates.

Examples of this include in Europe, Mediterranean crops such as vines and olives will grow better. In places like North America there is likely to be an increase in production of certain crops like wheat.

However… In lower latitudes that lie near the equator, conditions are already **hot**. Therefore if temperatures become warmer this may lead to more drought.
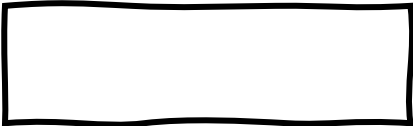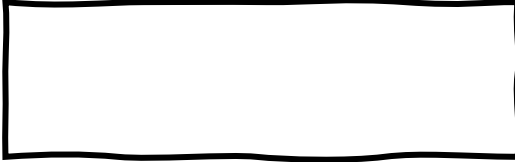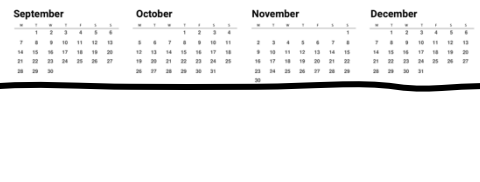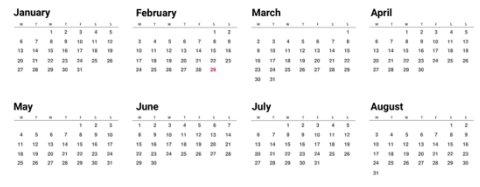
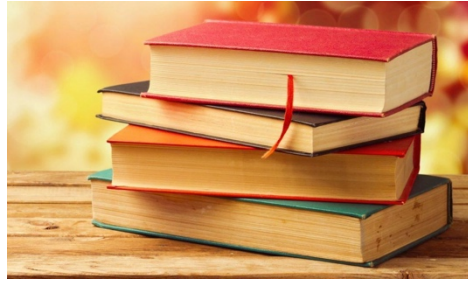**TASK:** Below are some images of how low altitude areas are adapting to climate change. **What are they?**

TASK: Why are these methods beneficial to areas experiencing extreme drought in LIC's?

ANSWER:

....

....

....

....

Methods like the ones mentioned above come under the category: Appropriate technology. This is because they are accessible and cheap for those who are of low income in poorer parts of the world.

How are we protecting against sea level rise?

Sea levels have risen by 20cm since 1900. They are expected to rise by a further 26-82cm by 2100!

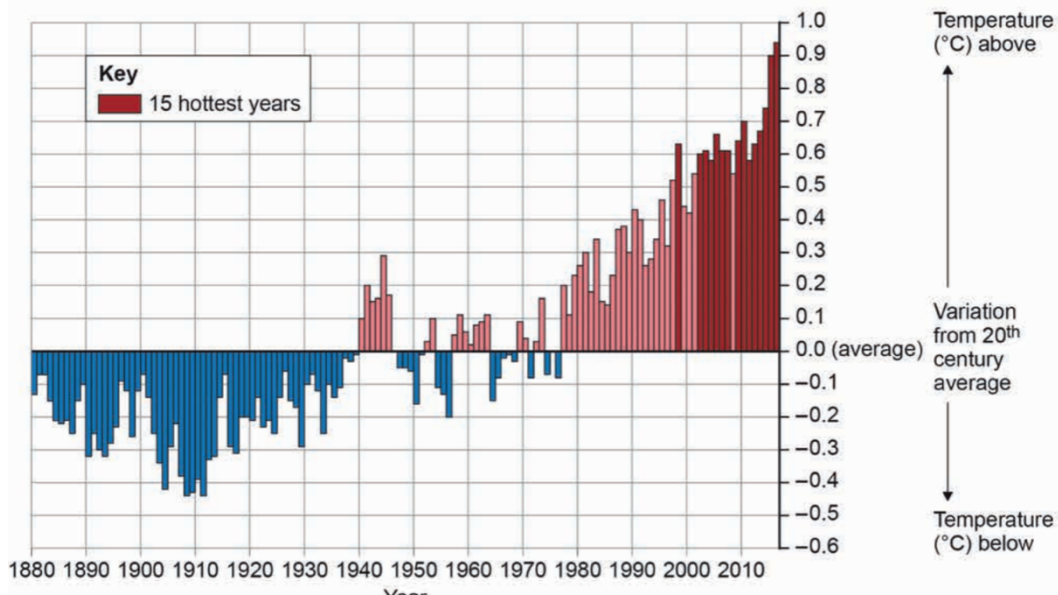| Method	Description
Mangroves	
Sea Walls	
Artificial Islands	
Houses on stilts	
Migration	

EXAM PRACTICE

Study figure 3, a graph showing variation in average global temperature, 1880-2017

Figure 3

a) Using Figure 3, which one of the following statements is true? **Shade only one**. *(1mark)*

   A In the early 1940s global temperatures were below the 20th century average.   ◯

   B Global temperatures showed a steady increase between 1940 and 1980.   ◯

   C The 15 hottest years were all recorded between 1995 and 2017.   ◯

   D Global temperatures have been above the 20th century average every year since 1960.   ◯

b) Give one natural cause of changes in global temperatures *(1mark)*

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c) Give two pieces of evidence, other than the change in global temperature, that how climate change has taken place *(2marks)*

1) ....

2) ....

d) Explain how increasing use of fossil fuels and changes in agriculture may have contributed to global changes in temperature *(4marks)*

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REVISION FACT FILE: CLIMATE CHANGE

What is climate change?

Natural Causes

Evidence of climate change

PAST:

RECENT:

Human Causes

MITIGATION AGAINST CLIMATE CHANGE

GLOBAL ACTIONS

APPROPRIATE TECHNOLOGY