



# Humans and the Carbon Cycle

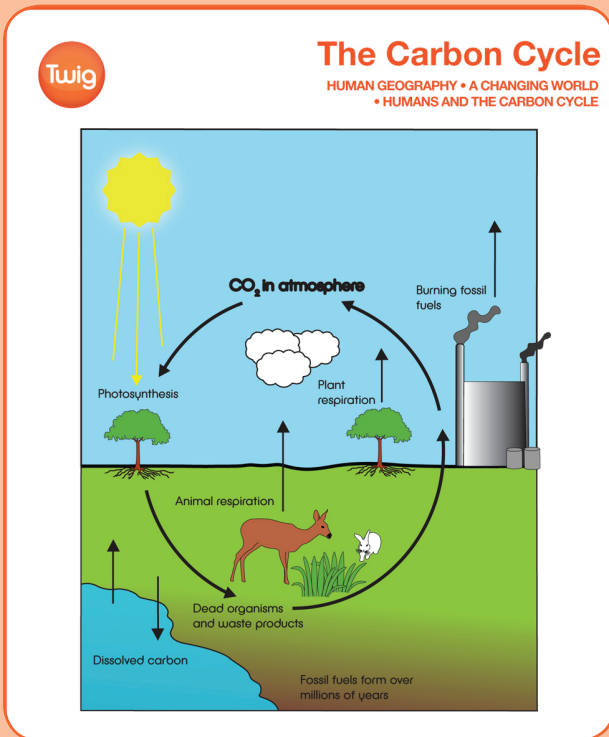
HUMAN GEOGRAPHY • A CHANGING WORLD • HUMANS AND THE CARBON CYCLE

## Section 1: The Carbon Cycle

### • What is the carbon cycle?

Carbon atoms move through all living organisms, the atmosphere, the oceans, and the Earth's crust in a movement known as the carbon cycle. A carbon atom may spend millions of years in one of these stores before being transferred to another. Carbon exists in the atmosphere as carbon dioxide, in the Earth's crust as sedimentary rock, and dissolved in oceans. Carbon atoms do not necessarily move through the cycle in any particular order, but the movement of carbon is known as the carbon cycle.

### DIAGRAM 01:



### • Suggested Film - The Carbon Cycle

### Extension Questions

#### Q1. Do all forms of life contain carbon?

Yes, so far all forms of life on Earth contain carbon. Carbon forms the basic building blocks that are essential for animal and plant life.

#### Q2. What are stores and transfers?

The idea of a 'store' or 'transfer' can be useful when describing the movement of a substance around a cycle, such as water, nitrogen or carbon. A store is a place that the substance can be held for some time without moving, for example, the oceans and plants. A transfer is a process whereby something that happens results in change. A transfer in the carbon cycle includes decomposition, which moves carbon from dead organic matter to the atmosphere.

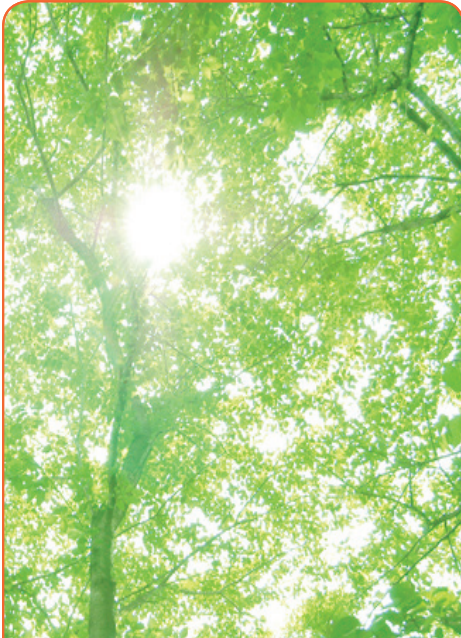
#### Q3. What is carbon sink?

A carbon sink is anything that absorbs more carbon than it releases. Carbon sinks include rainforests and oceans.

#### Q4. What is a carbon source?

A carbon source is anything that releases more carbon than it absorbs. Carbon sources include the burning of fossil fuels and the respiration of living organisms.

• How does carbon move between the land, oceans and the atmosphere?



The process of photosynthesis is involved in the carbon cycle

Carbon moves around the Earth in vast quantities, through processes including photosynthesis, decomposition and rock formation. The world's oceans play an important role in the carbon cycle, as carbon dioxide from the atmosphere dissolves in seawater. Plants absorb carbon dioxide held in the atmosphere or oceans, and through photosynthesis they transform carbon into a usable energy for growth. The carbon will then be 'locked up' or 'stored' in plants, before being released back into the atmosphere through respiration or decomposition after they die. If the plant dies in the ocean, such as phytoplankton, it can sink to the bottom and be buried in sediment, where it may eventually be transformed into sedimentary rock.

**Extension Questions**

**Q5. What is phytoplankton?**

Phytoplankton are tiny plants that live in the oceans. They 'bloom' when conditions are right and float in vast numbers, forming the basis of marine food chains. They need sunlight and nutrients to grow, and carbon dioxide to photosynthesise.

**Q6. Which rocks contain carbon?**

Many sedimentary rocks contain carbon, as they are made up of sediments rich in the skeletal remains of coral or marine life that accumulated on seabeds. Since metamorphic rocks might have once been sedimentary rocks, they can contain carbon. Limestone contains a lot of carbon in the form of calcium carbonate ( $\text{CaCO}_3$ ); chalk is a very pure form of limestone. Coal contains a large amount of carbon, but diamonds are pure carbon!

• **Suggested Films**

- The Carbon Cycle
- Carbon Capture: Phytoplankton

• How is man affecting the carbon cycle?

Man is affecting the carbon cycle in many ways, both directly and indirectly. Many human activities, such as electric power plants, transportation and deforestation, involve the burning of fossil fuels and releasing carbon dioxide into the atmosphere. An increase in greenhouse gas emissions has been linked with global warming, which could cause permafrost to melt and ocean temperatures to rise. As permafrost melts, carbon that has been 'locked up' for thousands of years is released into the atmosphere. As oceans warm, they can hold less dissolved carbon dioxide, which also means there will be more in the atmosphere.

• **Suggested Films**

- The Carbon Cycle
- Carbon Capture: Artificial Trees
- The Carbon Family
- The Future Carbon Family
- Deforestation



Transportation emits greenhouse gases into the air

### Extension Questions

#### Q7. What is permafrost?

Permafrost is soil that is always below 0°C. It is found mainly in northern latitudes, including Alaska, Canada and Russia. Permafrost may have a layer in which the water melts in summer and refreezes in winter. Carbon dioxide (and methane) is trapped in permafrost in dead organic matter, and once it melts these gases can be released.

#### Q8. Where do greenhouse gases come from?

Greenhouse gases can be emitted through transport, land use and clearance, food production, power stations, industry and manufacturing, and agriculture.

## Section 2: Carbon Footprint

### • What is a carbon footprint?

A carbon footprint is a measure of the greenhouse gas emissions (including carbon dioxide) produced to support human activity, and the impact they have on the environment. It can be measured for an individual, an organisation, an event, or a product. Both direct impacts, such as driving a car that burns petrol, and secondary impacts, such as the consumption of products that have used fossil fuels in their production, affect a carbon footprint.



Flying contributes to a large carbon footprint

### • Suggested Films

- The Carbon Family
- The Future Carbon Family

### • How do carbon footprints vary?

There is a strong correlation between the carbon footprint and wealth. Generally, the citizens of the world's more economically developed countries have much larger carbon footprints than those in less economically developed countries.

We measure carbon footprints, typically, in metric tons of carbon dioxide (or equivalent) released per capita per year. Large carbon footprints might be as high as over 30 tonnes/year/capita, and low figures might be less than 0.1 tonnes/year/capita. Oil rich countries in the Middle East often have large carbon footprints of around 30 tonnes/year/capita. Many European countries have carbon footprints of between 5 and 10 tonnes/year/capita.

### • Suggested Films

- The Carbon Family
- The Future Carbon Family

**Extension Question**

**Q9. What is a correlation?**

Correlation is a statistical technique that can show whether, and how strongly, pairs of variables are related. Correlation can be shown on a scatter graph. You can have a positive correlation (for example, two variables increase together), a negative correlation (for example, two variables decrease together), and no correlation. Note, a relationship means a correlation, but a correlation does not mean there is a relationship!

**• Suggested Activity**

**Discuss: Which countries do you think are most likely to have a high/low carbon footprint and why?**

**• Why do carbon footprints vary?**

There are many factors affecting a carbon footprint including culture, industry, consumerism and transportation but, generally, countries with a high per capita income have a larger carbon footprint. Many people in wealthy countries, such as the USA, consume more (from petrol in their cars to taking frequent flights) and their lifestyles are energy intensive. Oil and gas producing countries, like Qatar and the United Arab Emirates, also have large carbon footprints. This is due to heavy energy consumption because fuel supplies are very cheap. Small, isolated countries, such as islands in the Atlantic or Indian oceans, often have to import many goods and their people may travel a lot, meaning their carbon footprint will be very high.

**• Suggested Films**

- The Carbon Family
- The Future Carbon Family



**Reducing consumption and recycling can lower a carbon footprint**

**Section 3: Offsetting Carbon**

**• What is carbon offsetting?**

Carbon offsetting is a financial tool that enables individuals and businesses to invest in environmentally friendly projects in order to balance out their carbon footprint. For example, it is possible to calculate both the carbon dioxide emissions of a return flight to New York, and the environmental benefit of planting a tree. Carbon offsetting may provide a cheaper and more convenient alternative to reducing fossil fuel consumption, effectively making an activity 'carbon neutral'.



**Wind farms create renewable energy**

**• Suggested Film**

- Carbon Trading

**Extension Question**

Carbon offsetting is only compulsory for a few industries, such as the private jet industry. However, it is likely that it will become compulsory for a number of other industries.

**Extension Question**

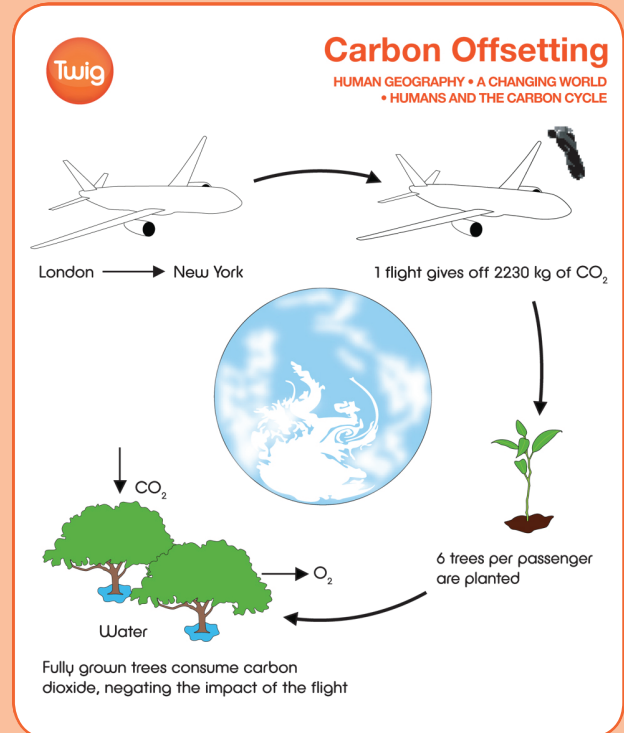
Q11. What does carbon neutral mean?

Carbon neutral is when an individual or business has a net zero carbon footprint, for example, their carbon emissions are entirely balanced, or negated, by their positive environmental activities.



Positive environmental practices can allow individuals or companies to balance their carbon emissions

**DIAGRAM 02:**



• What are the criteria for carbon offsetting projects?

Carbon offsetting projects have to benefit both the physical and human environment in a sustainable way. Usually, a third party company will deal with the accumulated 'offset fund' to deliver a sustainable, environmentally advantageous project. Existing examples of carbon offsetting projects include:

- Providing people in Indonesia with solar cookers
- Introducing energy efficiency measures at a hotel resort hotel in India
- Harnessing river hydroelectric power in Fiji
- Establishing the first wind energy plant in Cyprus

The Quality Assurance Scheme (QAS) for Carbon Offsetting is an organisational body that has been created to ensure the quality and integrity of these schemes.



Planting trees can offset the carbon used in various human activities

• Suggested Activity

Discuss: Do you think it is ethical to offset carbon, or is it better to reduce our emissions?

• Suggested Film

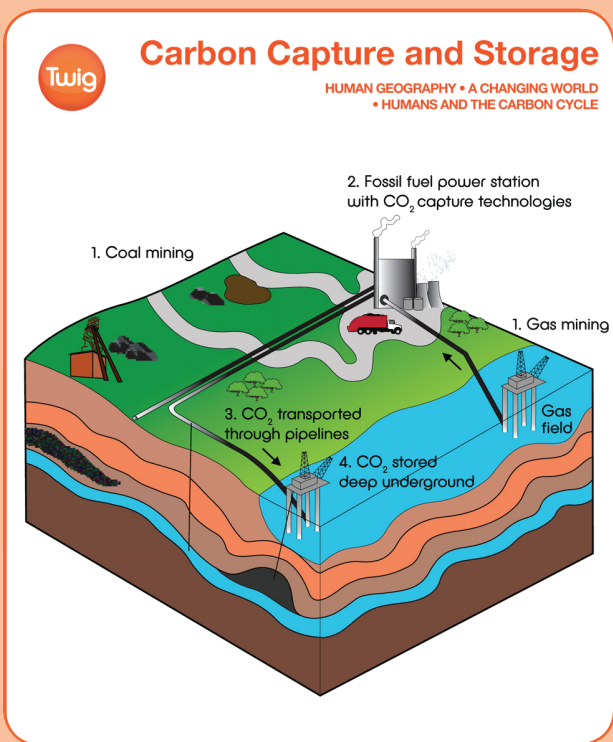
- Carbon Trading

• What is carbon capture?

Carbon capture is an industrial technique that captures, processes and stores carbon dioxide emissions, preventing it from entering the atmosphere and thereby combating climate change. Once captured, the carbon dioxide is then transported via pipelines to a storage location deep underground, such as deep caverns or the space left after oil or gas has been extracted.

It is estimated that our planet has the ability to store up to 10 trillion tonnes of carbon dioxide, allowing 100 years of storage for all human created emissions. Underground storage works well because the increased pressure causes carbon dioxide to behave more like a liquid than a gas. The gas is able to seep into the spaces in porous rocks, meaning a great amount can be stored in a relatively small area. Equally, the carbon dioxide can be injected into underground rock formations that act as a natural reservoir below the Earth's surface. These natural reservoirs have overlying rocks that form a seal, keeping the gas contained and safe from humans and the atmosphere.

DIAGRAM 03:



Extension Questions

Q12. Is there a difference between carbon capture and carbon storage?

No. Any carbon that has been captured will be stored and prevented from re-entering the atmosphere. Carbon Capture and Storage is often referred to as CCS.

Q13. How is carbon actually captured?

Carbon can be captured in three ways: post-combustion, pre-combustion and oxy-fuel combustion. Combustion refers to the burning of fossil fuels, which produces by-products called flue gases, including carbon dioxide, water vapour, sulphur dioxides and nitrogen oxides. The most common method of capturing carbon dioxide is post-combustion, whereby the carbon dioxide is captured after the fossil fuel is burned. In a post-combustion process, carbon dioxide is removed and captured from the flue gases. A problem with this method is that the process requires a lot of energy to compress the gas sufficiently for transport.

• Suggested Film

- Carbon Trading

• Suggested Activity

Discuss: What are your opinions on carbon capture and storage?



Carbon can be captured in three ways: pre-combustion, post-combustion and oxy-fuel combustion

### Extension Questions

**Q14. When the carbon is captured and piped from source to destination, does it use normal pipes?**

Not really, because the carbon dioxide gas needs a compressor to keep it moving and this needs to be made of a material that is resistant to the corrosive effects of the gas. A carbon dioxide pipeline usually begins at the source of capture and travels directly to the storage site. Pipelines can transport carbon dioxide in three states: gaseous, liquid and solid. Pipelines commonly transport carbon dioxide in its gaseous state, and a compressor 'pushes' the gas through the pipeline. The carbon dioxide must be clean and dry, otherwise it can corrode a typical (carbon manganese steel) pipeline. There are currently no standards in place for 'pipeline quality' carbon dioxide, but experts say that pipelines built from stainless steel would have a lowered risk of corrosion. This, however, may not be economical, since we would have to build brand new pipelines just for carbon dioxide.

**Q15. What are some real life examples of carbon storage centres?**

The Sleipner gas field located in the North Sea, west of Norway, has been injecting carbon dioxide into the sea floor since 1996.

**Q16. Are there alternatives to underground carbon storage?**

Yes. In addition to underground storage, scientists are also looking at the ocean for permanent carbon dioxide storage. Some experts claim that we can safely dump carbon dioxide directly into the ocean, provided we release it at depths greater than 3500m. At these depths, they think the carbon dioxide will compress to a slushy material that will fall to the ocean's floor. Ocean carbon storage is largely untested, and there are many concerns about the safety of marine life and the possibility that the carbon dioxide will eventually make its way back into the environment.



Pipelines can transport carbon dioxide in three states: gaseous, liquid and solid



Scientists are looking at the ocean for permanent carbon dioxide storage

## • Quizzes

## Carbon Capture: Phytoplankton

## Basic

• What name is given to the glowing marine organisms that can be seen from space?

- A – urea
- B – Aurora Borealis
- C – phytoplankton

• How are phytoplankton similar to trees?

- A – they both give off a green light
- B – they both absorb carbon dioxide from the atmosphere and release oxygen in a processes called photosynthesis
- C – they absorb oxygen from the atmosphere and release carbon dioxide in a process called photosynthesis

• Phytoplankton is vital in supporting life on Earth. Which of the following reasons is NOT true?

- A – phytoplankton forms a basis for marine food chains
- B – phytoplankton reduces carbon dioxide in the atmosphere
- C – phytoplankton reduces oxygen in the atmosphere

• Where can phytoplankton be found?

- A – near the surface of the water
- B – in deeper, cooler waters
- C – in the bodies of marine life

## Advanced

• What are phytoplankton?

- A – minute marine organisms that photosynthesise within the oceans
- B – bacteria organisms that give off a green light in the oceans
- C – minute marine organisms that absorb oxygen from the oceans around the world

• Phytoplankton carry out marine photosynthesis. What is this?

- A – the process of breathing through fish gills
- B – they absorb carbon dioxide from the atmosphere and release oxygen
- C – they absorb oxygen from the atmosphere and release carbon dioxide

• What happens when phytoplankton die?

- A – they are eaten by large whales and sharks
- B – the carbon in their tissues is deposited on the bottom of the sea floor in a harmless state
- C – they fall to the bottom of the sea floor and accumulate into poisonous deposits



### Carbon Capture: Phytoplankton

#### Basic

- The growth of phytoplankton is not always a good thing. Why?

A – the water becomes polluted with nitrogen, killing all the phytoplankton

B – too many phytoplankton lead to a reduction in the quantity of oxygen dissolved in the water, consequently killing other marine life

C – too many phytoplankton lead to a reduction in the quantity of carbon dioxide dissolved in the water, consequently killing other marine life

#### Advanced

- Why is global warming a threat to phytoplankton?

A – global warming warms the top layers of the oceans, stopping the natural mixing of the sea and cutting off the supply of nutrients from the cooler waters below

B – global warming warms the top layers of the oceans, which reduces the amount of carbon dioxide and stops their photosynthesis

C – the pollution generated by the burning of fossil fuels disrupts the balance of marine photosynthesis

- What is the benefit of releasing urea into the seas and oceans?

A – it encourages phytoplankton growth, thus enabling more marine photosynthesis to be carried out and in turn giving off more carbon dioxide into the atmosphere

B – it encourages phytoplankton growth, thus enabling more marine photosynthesis to be carried out and in turn giving off more oxygen into the atmosphere

C – It acts as a poison, killing the phytoplankton, so that they fall to the sea floor and speed up the creation of new fossil fuels

## Offsetting Carbon

### Basic

• Between the USA, UK and China, who has the highest total of carbon emissions?

- A – China
- B – USA
- C – UK

• What is carbon offsetting?

A – when an organisation finances the export of its carbon to another country, so they can recycle it in an environmentally friendly way

B – when an organisation pays an offset fine to the government

C – when an organisation finances the development of renewable energies as a way of balancing its own greenhouse gas emissions

• What is carbon trading?

A – when a country exceeds its carbon emission quota it is fined

B – when an organisation finances the development of renewable energies as a way of balancing its own greenhouse gas emissions

C – the process whereby heavy carbon producers trade with greener countries so that they inherit some of their carbon quotas

### Advanced

• Which country has the largest carbon footprint?

- A – China
- B – USA
- C – India

• Which is the odd one out: carbon quotas, carbon trading, carbon offsetting

A – carbon quotas

B – carbon offsetting

C – carbon trading

• What is carbon offsetting?

A – when an organisation pays an offset fine to the government

B – a fee you can pay when booking a flight that will make the plane travel via a more environmentally friendly route

C – balancing carbon emissions by funding green initiatives

• Why is carbon offsetting and trading criticised by industrialising developing countries?

A – because they want to manufacture more products than their developed neighbours

B – because they must move from an economy based on agriculture to a manufacturing one, so that the increased profits will aid their development and help eradicate poverty

C – because they don't want to pay for the mistakes of developers before them

## Offsetting Carbon

### Basic

• Which of the statements below is NOT a disadvantage of carbon trading and offsetting?

A – heavy polluting countries have no incentives to become green, as they can buy their way out of the problem

B – it has generated much speculation in the media, which is making people more environmentally aware as they involve themselves in the debate

C – poorer countries must rely on polluting industrial activities to be able to develop and catch up with the rest of the world

• Which of the following is NOT a renewable energy source?

A – nuclear

B – wind power

C – solar power

### Advanced

• Is carbon offsetting compulsory?

A – no, it is entirely optional, but this will change

B – yes, it is standard business policy now that everyone is environmentally aware

C – only in some industries, however, it is becoming increasingly common

### Carbon Capture: Artificial Trees

#### Basic

• Which of the following activities does NOT give off carbon to the atmosphere?

- A – photosynthesis
- B – manufacturing
- C – deforestation

• Which of the statements is incorrect?

- A – plants provide the atmosphere with carbon dioxide through the process of photosynthesis
- B – the burning of trees releases carbon into the atmosphere
- C – plants store huge quantities of carbon in their leaves

• Artificial trees collect atmospheric carbon dioxide and pass it through a carbon filter of what chemical?

- A – sodium hydroxide
- B – sodium dioxide
- C – sodium carbonate

• Which statement is incorrect?

- A – artificial trees do not provide a habitat for bird life
- B – artificial trees are more efficient at consuming harmful carbon from the atmosphere than normal trees; therefore, natural trees will be cut down and replaced by artificial ones
- C – artificial trees are one of many new technologies being developed to help combat climate change

#### Advanced

• Why is photosynthesis important in reducing global warming?

- A – it provides us with more oxygen, so that we can breathe cleaner air
- B – it takes carbon dioxide out of the atmosphere and converts it into oxygen, reducing the greenhouse effect
- C – it is essential for the growth of plant life, which gives off carbon dioxide into the atmosphere

• What principle does carbon capture work on?

- A – reducing the amount of carbon dioxide that is put into the atmosphere
- B – reducing the amount of carbon dioxide that is in the atmosphere
- C – increasing the amount of oxygen that is in the atmosphere

• Why is an artificial tree more efficient than a natural tree?

- A – because it takes up less space
- B – because it is cheaper to maintain
- C – because it does not need to be in direct sunlight

## Carbon Capture: Artificial Trees

### Basic

• The carbon that has been caught by artificial trees is then stored out of harm's way...

- A – in porous rocks, deep under the sea
- B – in impermeable rocks, deep under the sea
- C – in pipes under oil rigs, along the sea floor

### Advanced

• Which statement is incorrect?

- A – artificial trees do not provide a habitat for bird life
- B – artificial trees are more efficient at consuming harmful carbon from the atmosphere than normal trees; therefore, natural trees will be cut down and replaced with artificial ones
- C – artificial trees are one of many new technologies being developed to help combat climate change

• Artificial trees store carbon out of harm's way. Where and how is it stored?

- A – deep underground the pressure is high. The CO<sub>2</sub> gas then behaves more like a liquid than a gas and is able to seep into porous rocks, deep under the sea
- B – deep underground the pressure is high. The CO<sub>2</sub> gas then behaves more like a liquid than a gas and is able to seep into impermeable rocks, deep under the sea
- C – the gas is stored on the sea floor at depths of 1000m where it becomes a solid sludge and remains on the seabed

## • Answers

**Carbon Capture: Phytoplankton**
**Basic**

• What name is given to the glowing marine organisms that can be seen from space?

A – urea

B – Aurora Borealis

C – phytoplankton

• How are phytoplankton similar to trees?

A – they both give off a green light

B – they both absorb carbon dioxide from the atmosphere and release oxygen in a processes called photosynthesis

C – they absorb oxygen from the atmosphere and release carbon dioxide in a process called photosynthesis

• Phytoplankton is vital in supporting life on Earth. Which of the following reasons is NOT true?

A – phytoplankton forms a basis for marine food chains

B – phytoplankton reduces carbon dioxide in the atmosphere

C – phytoplankton reduces oxygen in the atmosphere

• Where can phytoplankton be found?

A – near the surface of the water

B – in deeper, cooler waters

C – in the bodies of marine life

**Advanced**

• What are phytoplankton?

A – minute marine organisms that photosynthesise within the oceans

B – bacteria organisms that give off a green light in the oceans

C – minute marine organisms that absorb oxygen from the oceans around the world

• Phytoplankton carry out marine photosynthesis. What is this?

A – the process of breathing through fish gills

B – they absorb carbon dioxide from the atmosphere and release oxygen

C – they absorb oxygen from the atmosphere and release carbon dioxide

• What happens when phytoplankton die?

A – they are eaten by large whales and sharks

B – the carbon in their tissues is deposited on the bottom of the sea floor in a harmless state

C – they fall to the bottom of the sea floor and accumulate into poisonous deposits

### Carbon Capture: Phytoplankton

#### Basic

- The growth of phytoplankton is not always a good thing. Why?

A – the water becomes polluted with nitrogen, killing all the phytoplankton

B – too many phytoplankton lead to a reduction in the quantity of oxygen dissolved in the water, consequently killing other marine life

C – too many phytoplankton lead to a reduction in the quantity of carbon dioxide dissolved in the water, consequently killing other marine life

#### Advanced

- Why is global warming a threat to phytoplankton?

A – global warming warms the top layers of the oceans, stopping the natural mixing of the sea and cutting of the supply of nutrients from the cooler waters below

B – global warming warms the top layers of the oceans, which reduces the amount of carbon dioxide and stops their photosynthesis

C – the pollution generated by the burning of fossil fuels disrupts the balance of marine photosynthesis

- What is the benefit of releasing urea into the seas and oceans?

A – it encourages phytoplankton growth, thus enabling more marine photosynthesis to be carried out and in turn giving off more carbon dioxide into the atmosphere

B – it encourages phytoplankton growth, thus enabling more marine photosynthesis to be carried out and in turn giving off more oxygen into the atmosphere

C – It acts as a poison, killing the phytoplankton, so that they fall to the sea floor and speed up the creation of new fossil fuels

## Offsetting Carbon

### Basic

- Between the USA, UK and China, who has the highest total of carbon emissions?

A – China

B – USA

C – UK

- What is carbon offsetting?

A – when an organisation finances the export of its carbon to another country, so they can recycle it in an environmentally friendly way

B – when an organisation pays an offset fine to the government

C – when an organisation finances the development of renewable energies as a way of balancing its own greenhouse gas emissions

- What is carbon trading?

A – when a country exceeds its carbon emission quota it is fined

B – when an organisation finances the development of renewable energies as a way of balancing its own greenhouse gas emissions

C – the process whereby heavy carbon producers trade with greener countries so that they inherit some of their carbon

### Advanced

- Which country has the largest carbon footprint?

A – China

B – USA

C – India

- Which is the odd one out: carbon quotas, carbon trading, carbon offsetting

A – carbon quotas

B – carbon offsetting

C – carbon trading

- What is carbon offsetting?

A – when an organisation pays an offset fine to the government

B – a fee you can pay when booking a flight that will make the plane travel via a more environmentally friendly route

C – balancing carbon emissions by funding green initiatives

- Why is carbon offsetting and trading criticised by industrialising developing countries?

A – because they want to manufacture more products than their developed neighbours

B – because they must move from an economy based on agriculture to a manufacturing one, so that the increased profits will aid their development and help eradicate poverty

C – because they don't want to pay for the mistakes of developers before them



## Offsetting Carbon

### Basic

- Which of the statements below is NOT a disadvantage of carbon trading and offsetting?

A – heavy polluting countries have no incentives to become green, as they can buy their way out of the problem

B – it has generated much speculation in the media, which is making people more environmentally aware as they involve themselves in the debate

C – poorer countries must rely on polluting industrial activities to be able to develop and catch up with the rest of the world

- Which of the following is NOT a renewable energy source?

A – nuclear

B – wind power

C – solar power

### Advanced

- Is carbon offsetting compulsory?

A – no, it is entirely optional, but this will change

B – yes, it is standard business policy now that everyone is environmentally aware

C – only in some industries, however, it is becoming increasingly common

### Carbon Capture: Artificial Trees

#### Basic

- Which of the following activities does NOT give off carbon to the atmosphere?

A – photosynthesis

B – manufacturing

C – deforestation

A – plants provide the atmosphere with carbon dioxide through the process of photosynthesis

B – the burning of trees releases carbon into the atmosphere

C – plants store huge quantities of carbon in their leaves

- Artificial trees collect atmospheric carbon dioxide and pass it through a carbon filter of what chemical?

A – sodium hydroxide

B – sodium dioxide

C – sodium carbonate

- Which statement is incorrect?

A – artificial trees do not provide a habitat for bird life

B – artificial trees are more efficient at consuming harmful carbon from the atmosphere than normal trees, therefore, natural trees will be cut down and replaced by artificial ones

C – artificial trees are one of many new technologies being developed to help combat climate change

#### Advanced

- Why is photosynthesis important in reducing global warming?

A – it provides us with more oxygen, so that we can breathe cleaner air

B – it takes the greenhouse gas carbon dioxide out of the atmosphere, and converts it into oxygen, reducing the greenhouse warming effect

C – it is essential for the growth of plant life, which gives off carbon dioxide into the atmosphere

- What principle does carbon capture work on?

A – reducing the amount of carbon dioxide that is put into the atmosphere

B – reducing the amount of carbon dioxide that is in the atmosphere

C – increasing the amount of oxygen that is in the atmosphere

- Why is an artificial tree more efficient than a natural tree?

A – because it takes up less space

B – because it is cheaper to maintain

C – because it does not need to be in direct sunlight

## Carbon Capture: Artificial Trees

### Basic

- The carbon that has been caught by artificial trees is then stored out of harms way...

A – in porous rocks, deep under the sea

B – in impermeable rocks, deep under the sea

C – in pipes under oil rigs, along the sea floor

### Advanced

- Which statement is incorrect?

A – artificial trees do not provide a habitat for bird life

B – artificial trees are more efficient at consuming harmful carbon from the atmosphere than normal trees, therefore, natural trees will be cut down and replaced with artificial ones

C – artificial trees are one of many new technologies being developed to help combat climate change

- Artificial trees store carbon out of harm's way. Where and how is it stored?

A – deep underground the pressure is high. The CO<sub>2</sub> gas then behaves more like a liquid than a gas and is able to seep into porous rocks, deep under the sea

B – deep underground the pressure is high. The CO<sub>2</sub> gas then behaves more like a liquid than a gas and is able to seep into impermeable rocks, deep under the sea

C – the gas is stored on the sea floor at depths of 1000m where it becomes a solid sludge and remains on the seabed