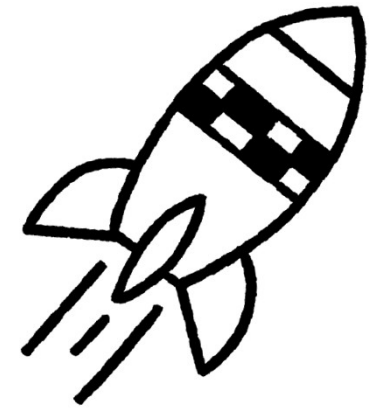


The carbon cycle



Science

Unit: Carbon cycle and climate change

Teacher Guidance

Oak’s lesson structure

Oak’s lessons are structured around **learning cycles**. These are indicated through colour in the slide deck:

Lesson outline

Transverse waves

Labelling a transverse wave

Describing a transverse wave

Displacement and amplitude

Displacement-distance graphs

Learning & Assessment cycle

Transverse waves

Diagram of a transverse wave

Learning & Assessment cycle

Transverse waves

Diagram of a transverse wave

Learning & Assessment cycle

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Learning & Assessment cycle

Transverse waves

Diagram of a transverse wave

Each **learning cycle** covers several phases:



Explanation



Check



Practice



Feedback



Outcome

I can describe the carbon cycle and explain the effect of changes to parts of the cycle.



Keywords

carbon cycle

the process by which carbon is transferred between the atmosphere, organisms, and Earth

photosynthesis

the process in which energy from sunlight converts carbon dioxide and water into glucose and oxygen

respiration

a chemical process in cells that breaks down glucose from food to release energy for life processes

combustion

an exothermic chemical reaction in which a substance reacts with oxygen, releasing heat to the surroundings

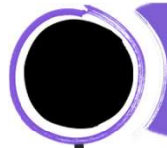
decomposition

the breakdown of dead organic matter by microorganisms



Lesson outline

The carbon cycle



Transferring carbon dioxide out of the atmosphere



Transferring carbon without a gas



Transferring carbon dioxide into the atmosphere



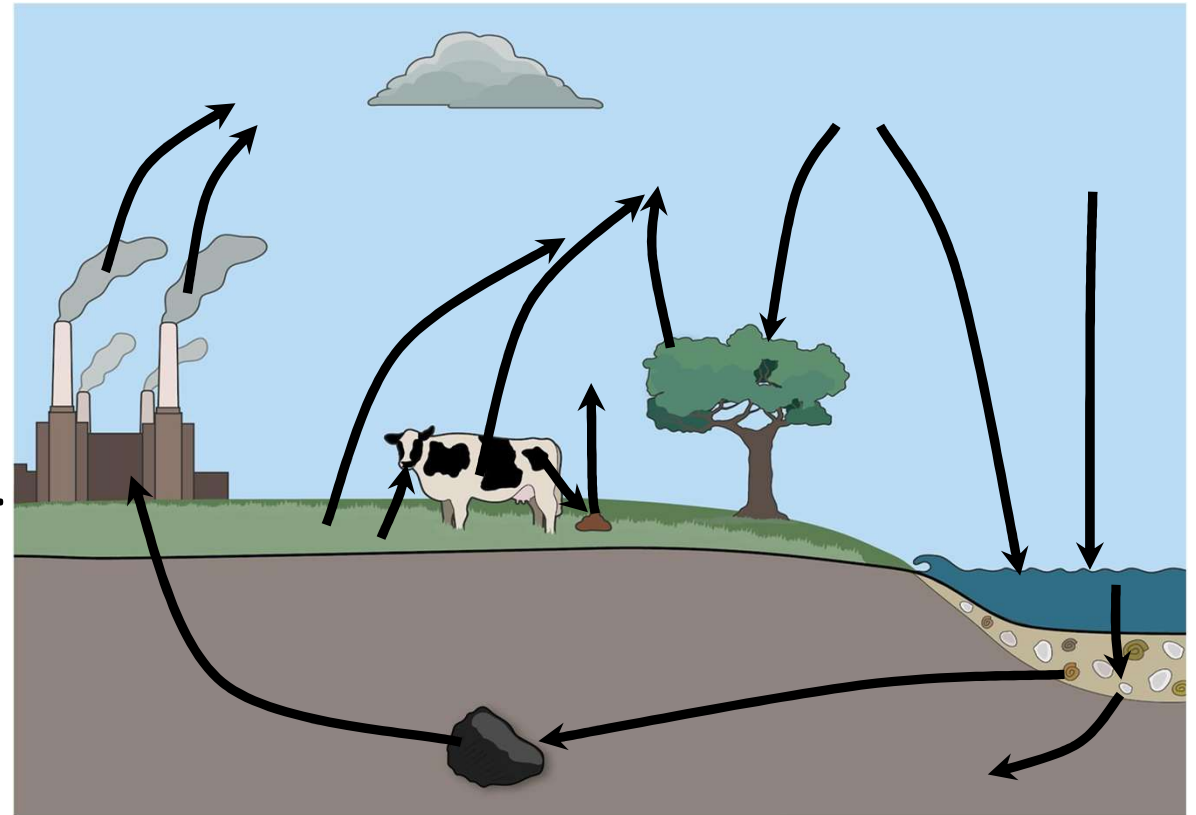
Transferring carbon dioxide out of the atmosphere



The **carbon cycle** outlines how carbon moves between the atmosphere, living organisms, Earth's surface layer and oceans.

The carbon cycle is a closed system.

No carbon is added or removed, it is just transferred from place to place.



the carbon cycle

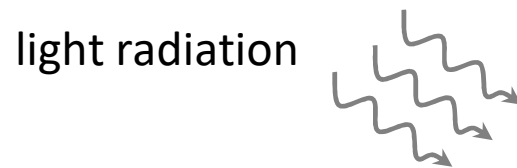


Transferring carbon dioxide out of the atmosphere



Most carbon in the atmosphere is in the form of carbon dioxide (CO₂).

Sunlight provides energy to plants, which is needed for **photosynthesis**.



Photosynthesis transfers some carbon from the atmosphere into plants.



Transferring carbon dioxide out of the atmosphere



Only about half of all **photosynthesis** is carried out by plants on land.



pine forest

The other half is carried out by phytoplankton and certain types of bacteria in oceans.



ocean wave

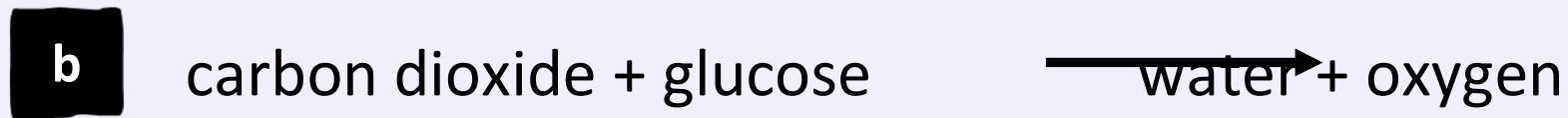
These living organisms are too small to be seen with the naked eye.



Transferring carbon dioxide out of the atmosphere



Which is the correct equation for photosynthesis?



Transferring carbon dioxide out of the atmosphere



Some gases from the atmosphere dissolve in the oceans.

Fish need oxygen dissolved in ocean water.

Carbon dioxide also dissolves in ocean water.

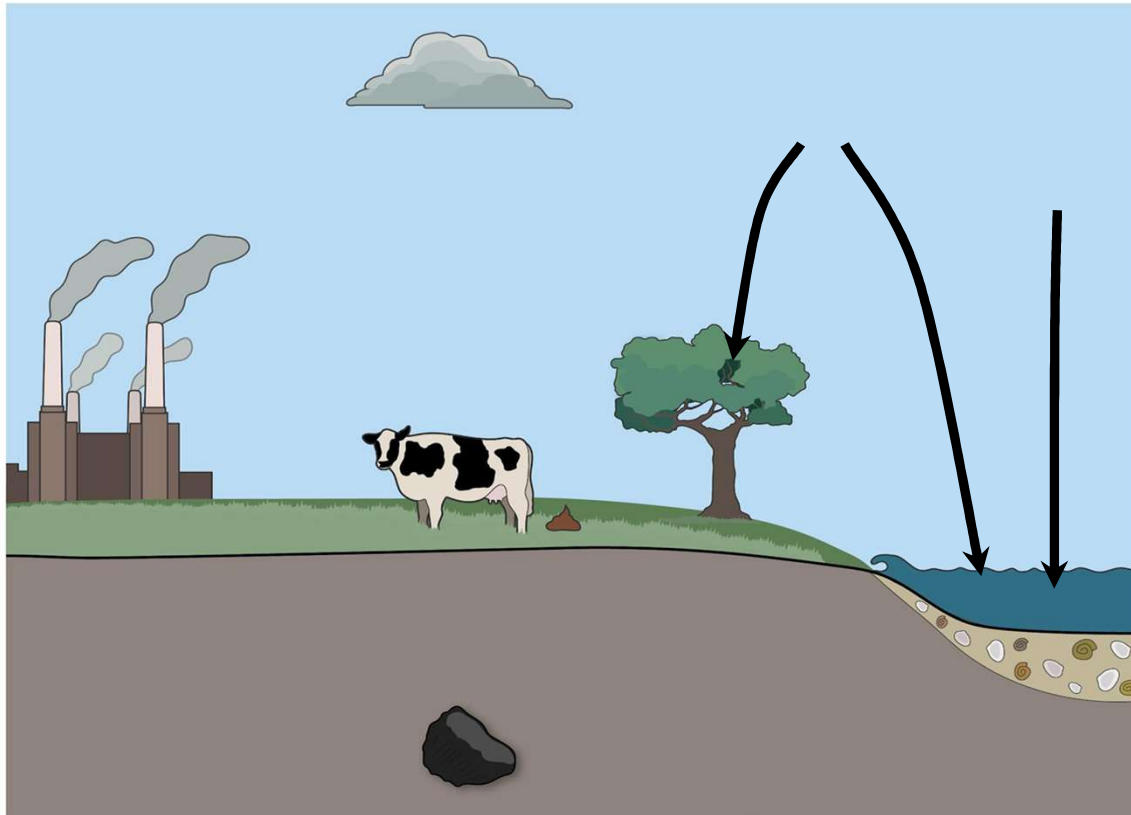


ocean containing dissolved gases



Transferring carbon dioxide out of the atmosphere

Some carbon dioxide transfers out of the atmosphere into:



- living things by **photosynthesis**
- the oceans by dissolving



Transferring carbon dioxide out of the atmosphere



If more carbon dioxide is added to the atmosphere by human activity...

...more carbon dioxide will dissolve in the oceans.



ocean containing dissolved gases

About 30% of the extra carbon dioxide will dissolve in the oceans.



Transferring carbon dioxide out of the atmosphere



How is carbon dioxide transferred out of the atmosphere?

a by combustion

b by dissolving



c by photosynthesis



d by respiration



Task A Transferring carbon dioxide out of the atmosphere



1) Complete the equation for photosynthesis:

_____ + water $\longrightarrow$ glucose + _____

2) State two examples of organisms that photosynthesise.

3) State two ways carbon dioxide is transferred out of the atmosphere.



Task A Transferring carbon dioxide out of the atmosphere



Feedback

1) Complete the equation for photosynthesis:

carbon dioxide + water $\longrightarrow$ glucose + oxygen

2) State two examples of organisms that photosynthesise.

Any two of: plants, phytoplankton, some types of bacteria in oceans.

3) State two ways carbon dioxide is transferred out of the atmosphere.

By photosynthesis and by dissolving in oceans.



Lesson outline

The carbon cycle



Transferring carbon dioxide out of the atmosphere



Transferring carbon without a gas



Transferring carbon dioxide into the atmosphere



Transferring carbon without a gas

Carbon is transferred from one living organism to another by eating.



grass



rabbit



fox

In this food chain, carbon is transferred from the grass to the rabbit, and then from the rabbit to the fox.



Transferring carbon without a gas



Carbon is transferred from living organisms into the soil through animal waste.



waste from cattle

It is also transferred into the soil when organisms die.



Transferring carbon without a gas



How is carbon transferred from the atmosphere into an animal?

- a** by photosynthesis and eating ✓
- b** by photosynthesis, respiration and eating
- c** by photosynthesis and respiration



Transferring carbon without a gas



Carbon dioxide dissolved in the oceans can form carbonate ions.

Some animals use these ions to build their shells or bones.

When these animals die, their shells and bones may settle at the bottom of the ocean and become cemented together, forming sedimentary rock



mussel shells



sedimentary rock



Transferring carbon without a gas



Almost all the carbon on Earth is stored in rock.

Rocks can hold carbon for millions or even billions of years.



Most rock is found deep beneath Earth's surface.



Transferring carbon without a gas



Dead plants and the soft tissues of dead sea creatures may become trapped in sediment at the bottom of the ocean.

Over millions of years, those that do not decay quickly can turn into fossil fuels.

Fossil fuels include coal, oil, and natural gas.



coal



Transferring carbon without a gas



How is carbon transferred from the atmosphere into rocks?

- a** by dissolving, shell formation and cementing of sediment ✓
- b** by dissolving, bone formation and cementing of sediment ✓
- c** by photosynthesis, shell formation and cementing of sediment
- d** by photosynthesis, bone formation and cementing of sediment



Transferring carbon without a gas

Some carbon can be transferred into:



- animals when they eat
- soil from animal waste and dead plants and animals
- the shells and bones of animals in oceans
- sedimentary rocks formed from shells and bones
- fossil fuels formed from dead plants and animals in oceans



Transferring carbon without a gas



How can carbon be transferred in the carbon cycle?

a

from dead animals into rocks



b

from living animals into soil



c

from fossil fuels into dead plants or animals



Task B Transferring carbon without a gas



- 1) Who is correct about how carbon is transferred in the carbon cycle?
- 2) Make changes to improve any incorrect comments.

Carbon dioxide in the oceans can end up in shells and bones.



Sofia

When animals eat plants, carbon gets broken down.



Laura

When organisms die, carbon inside them is destroyed.



Andeep

Carbon from dead sea creatures can end up in fossil fuels.



Lucas



Task B Transferring carbon without a gas



Feedback

- 1) Who is correct about how carbon is transferred in the carbon cycle?
- 2) Make changes to improve any incorrect comments.

Carbon dioxide in the oceans can end up in shells and bones.



Sofia



Laura

When animals eat plants, carbon is transferred to the animal.

When organisms die, carbon is transferred into the soil.



Andeep



Lucas

Carbon from dead sea creatures can end up in fossil fuels.



Lesson outline

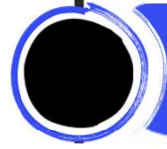
The carbon cycle



Transferring carbon dioxide out of the atmosphere



Transferring carbon without a gas



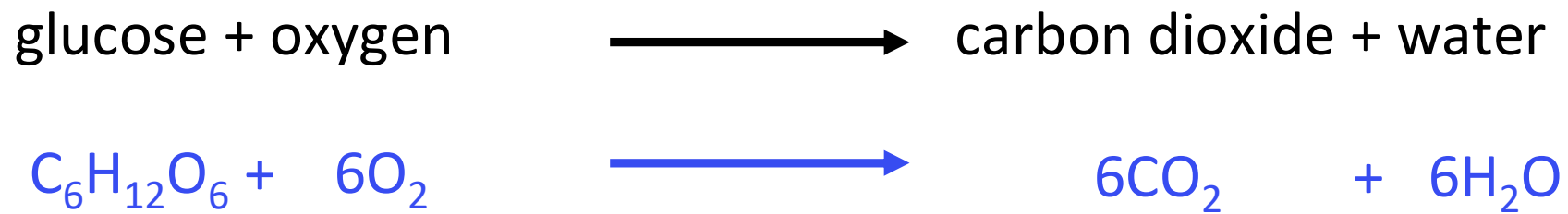
Transferring carbon dioxide into the atmosphere



Transferring carbon dioxide into the atmosphere



Cellular **respiration** is a chemical process that happens inside plant and animal cells to provide energy for life processes.



Cellular respiration transfers some carbon from plants and animals into the atmosphere.



Transferring carbon dioxide into the atmosphere



Decomposers break down dead plants, dead animals and organic waste into smaller pieces.

Decomposition by fungi and some bacteria breaks down organic matter enough to release carbon dioxide.



fungi



bacteria

Decomposers also release carbon dioxide through cellular **respiration**.

Decomposition transfers carbon from dead plants, dead animals and organic waste into the atmosphere.



Transferring carbon dioxide into the atmosphere



Which is the correct equation for respiration?

a carbon dioxide + glucose $\xrightarrow{\text{oxygen}}$ + water

b carbon dioxide + water $\xrightarrow{\text{glucose}}$ + oxygen

c oxygen + glucose $\xrightarrow{\text{water}}$ + carbon dioxide



Transferring carbon dioxide into the atmosphere



Combustion is a chemical reaction that occurs when a fuel burns in oxygen.

Natural gas is a fuel used in many homes for heating and cooking.

natural gas + oxygen $\longrightarrow$ carbon dioxide + water



Combustion transfers carbon from fuels into the atmosphere, usually as carbon dioxide.



Transferring carbon dioxide into the atmosphere



The **combustion** of fossil fuels is still used to generate much of the electricity we use.



power station

The combustion of fossil fuels is still used to power many cars, lorries, boats and planes.

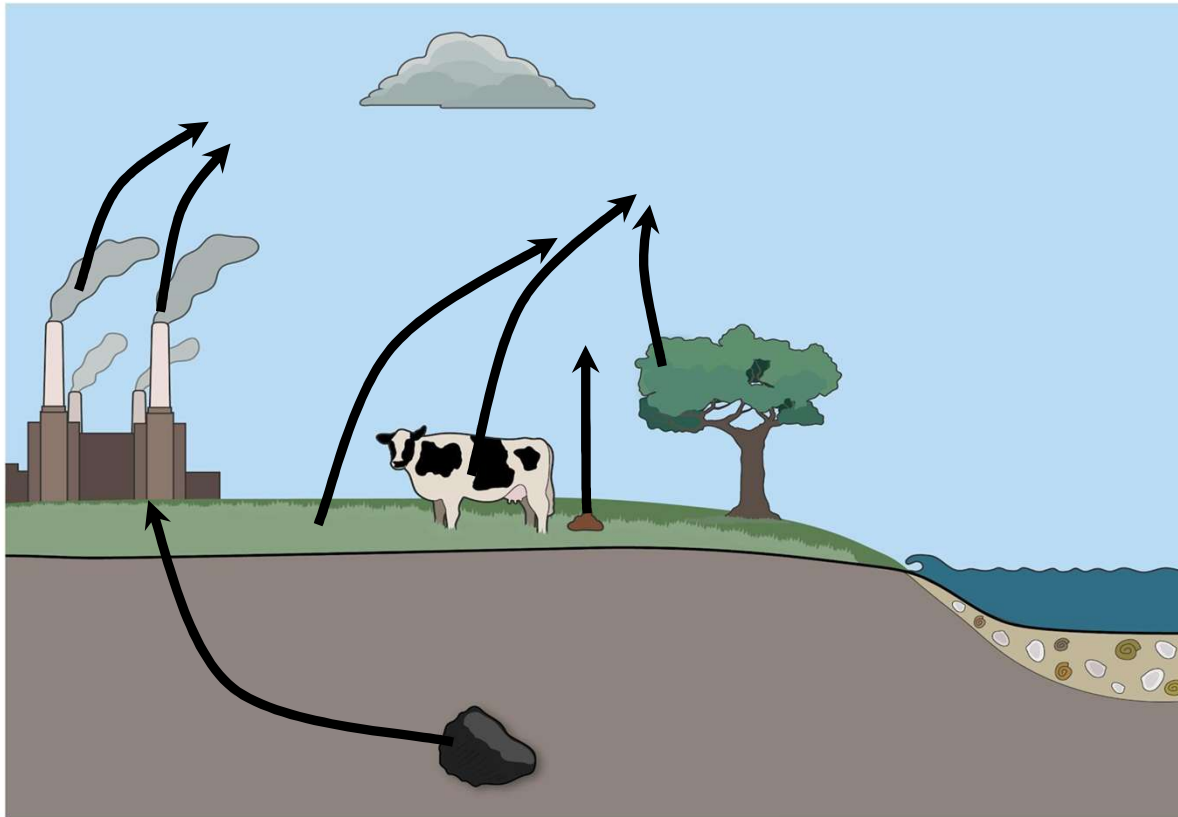


plane



Transferring carbon dioxide into the atmosphere

Carbon dioxide transfers into the atmosphere through:



- cellular **respiration** in plants and animals
- **decomposition** of dead organic matter
- **combustion** of fossil fuels and plants



Transferring carbon dioxide into the atmosphere



How can carbon be transferred into the atmosphere?

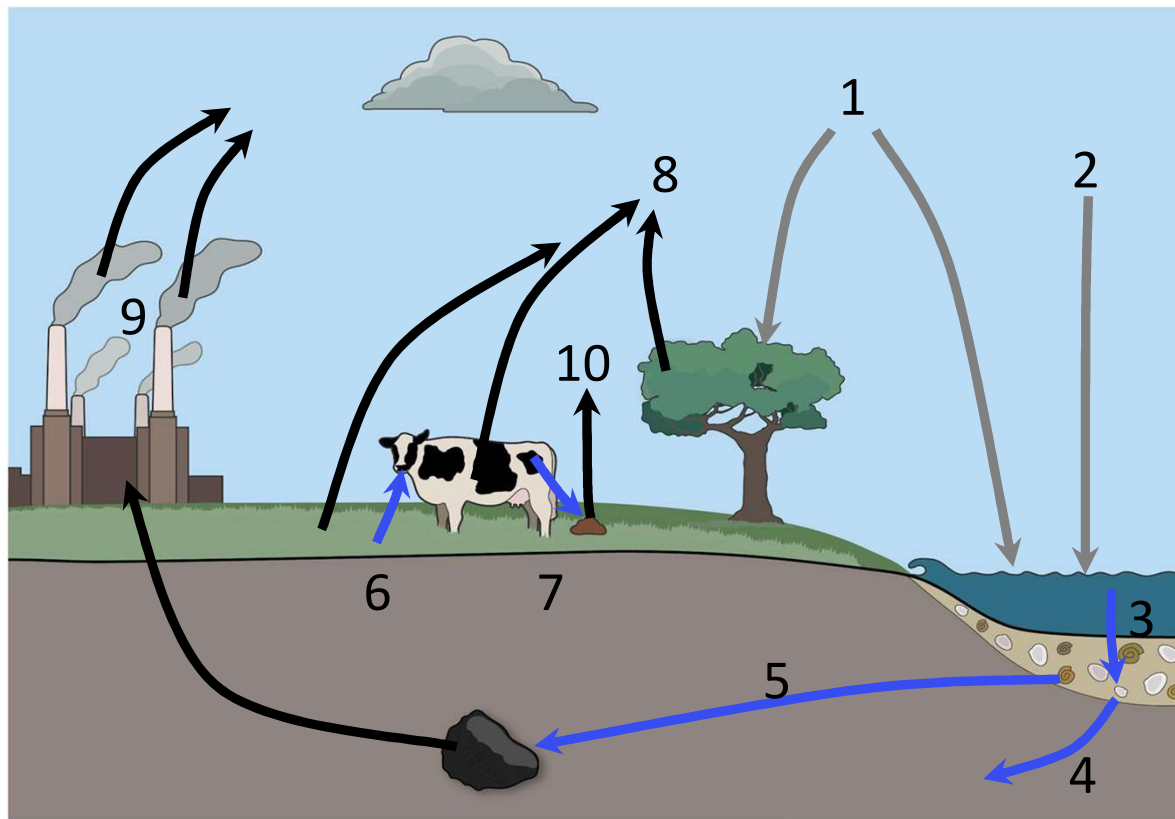
- a** by photosynthesis in plants
- b** by respiration in plants ✓
- c** by decomposition of organic matter ✓
- d** by the production of organic waste in animals



Task C Transferring carbon dioxide into the atmosphere



Match each process to the correct stage of the carbon cycle.



photosynthesis

decomposition

animals eating

formation of fossil fuels

rock formation

combustion

organic waste

respiration

shell and bone formation

dissolving gas

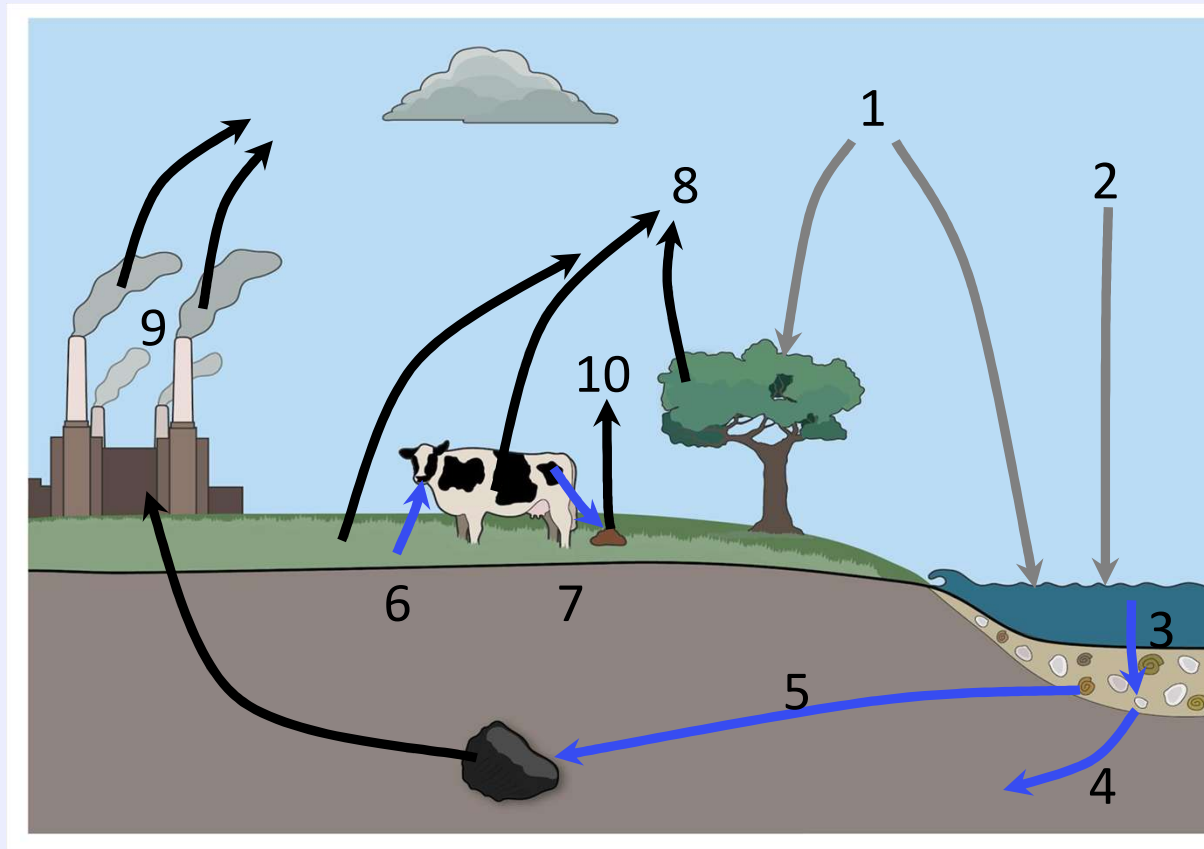


Task C Transferring carbon dioxide into the atmosphere



Feedback

Match each process to the correct stage of the carbon cycle.



1. photosynthesis
2. dissolving gas
3. shell and bone formation
4. rock formation
5. formation of fossil fuels
6. animals eating
7. organic waste
8. respiration
9. combustion
10. decomposition



Summary The carbon cycle

The carbon cycle outlines how carbon transfers between the atmosphere, living organisms, Earth's surface layer and oceans.

Carbon is transferred from carbon dioxide in the atmosphere into plants and oceans by photosynthesis and dissolving.

Carbon is transferred into living things by eating, and into soil from waste.

Carbon is transferred into rock when sediments of shell and bone are cemented together. Organic matter trapped in sedimentary rock can transfer carbon into fossil fuels.

Carbon is transferred into the atmosphere by cellular respiration in plants and animals, decomposition of organic matter, and by combustion of fossil fuels and plants.



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