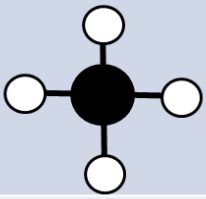
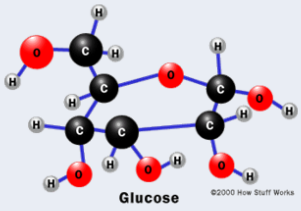
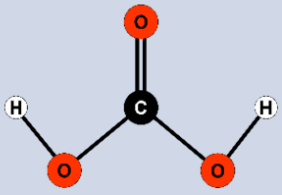
Where do we find the carbon?

There is a fixed amount of carbon on Earth, much of it combined with other elements forming compounds, that moves through a carbon cycle, from one reservoir (store) to another, with varying processes and timescales.

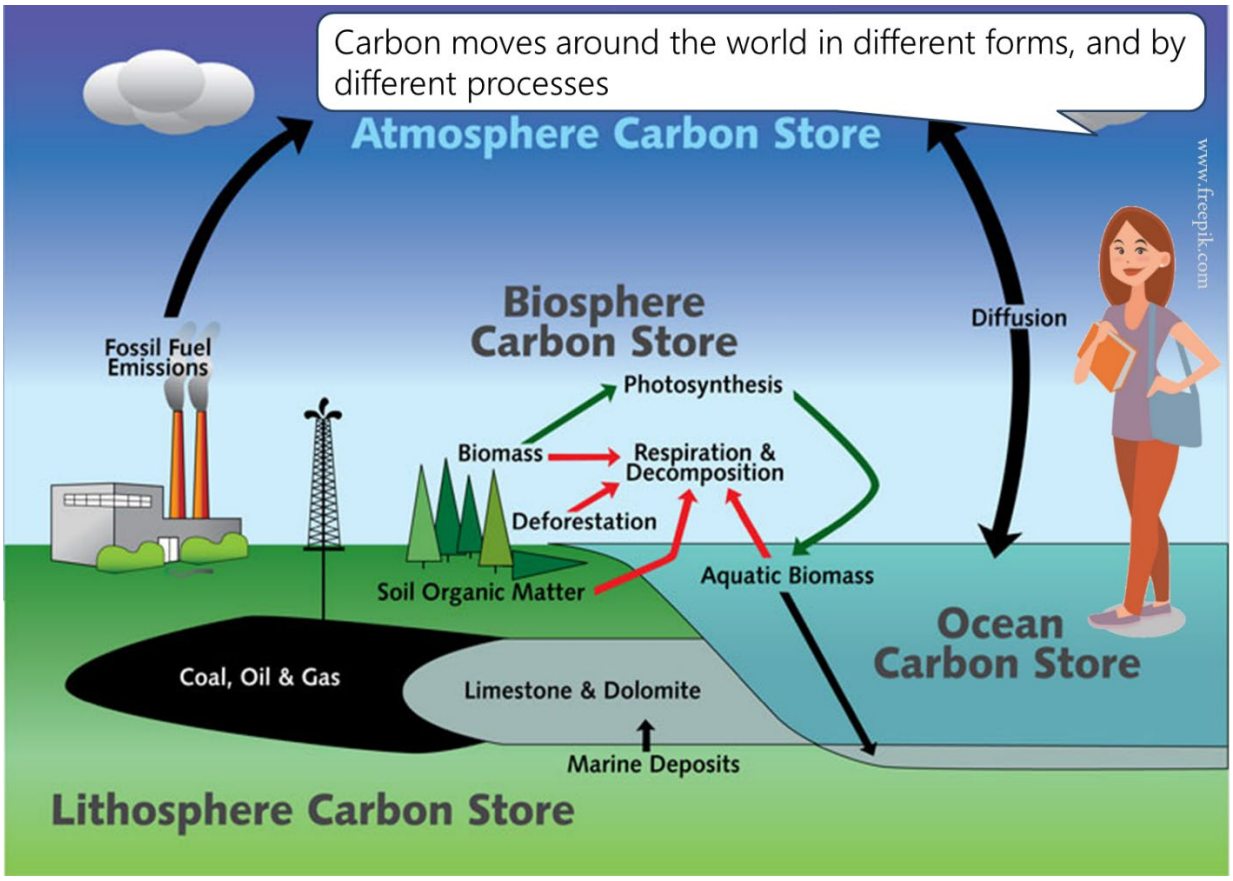
Name	Formula	Model	Where is this found on Earth?	What process creates this?
Carbon (graphite/ diamond)	C		underground	Heat and pressure from underground, originally from coal
carbon dioxide	CO_2		In the atmosphere	Combustion respiration
Calcium carbonate	$CaCO_3$		In marine/snail shells In rocks like limestone and marble	Biological shell building Pressure and heat on shells underground

Name	Formula	Model	Where is this found on Earth?	What process creates this?
methane	CH_4		In the atmosphere In permafrost (frozen ground) Underground	Decomposition dead plants and animals)
Glucose	$C_6H_{12}O_6$		In plants In animals	Photosynthesis Transfer from plants to animals by eating
carbonic acid	H_2CO_3		In oceans In the air/atmosphere	CO_2 reacting with water in the oceans CO_2 Reacting with water in the atmosphere

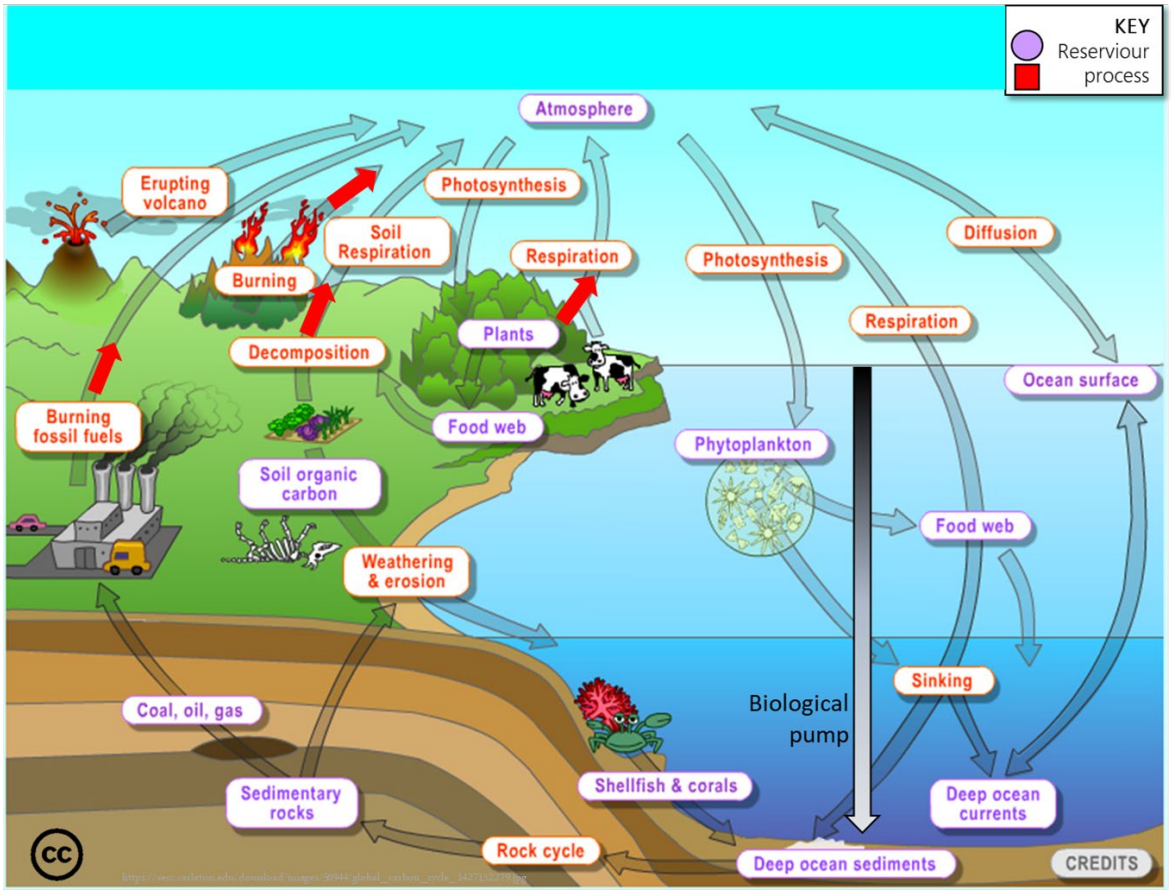
Name	Formula	Model	Where is this found on Earth?	What process creates this?
oil	Carbon and hydrogen molecules		underground	Fossilised sediment remains of marine animals, heat and pressure underground
coal	Mostly carbon		Underground, open cast mines	Fossilised remains of plants, heat and pressure underground

The Carbon Cycle

Carbon stores (***reserviours)*** are 'areas' where carbon, often contained within compounds, are naturally stored on Earth. The atmosphere is a reserviour where carbon is stored in the form of carbon dioxide gas (CO_2). However, this is one the smallest carbon reservoirs, where CO_2 makes up only 0.03% of the atmospheric gases. Another reserviour is held within biological sources, such as trees and fossil fuels. The largest reservoir of carbon is in ocean water, which also acting as a ***carbon sink***, with a net movement (more in one direction than the other) of carbon into the ocean from the atmosphere. The atmosphere acts as a ***source***, where the carbon originates from.

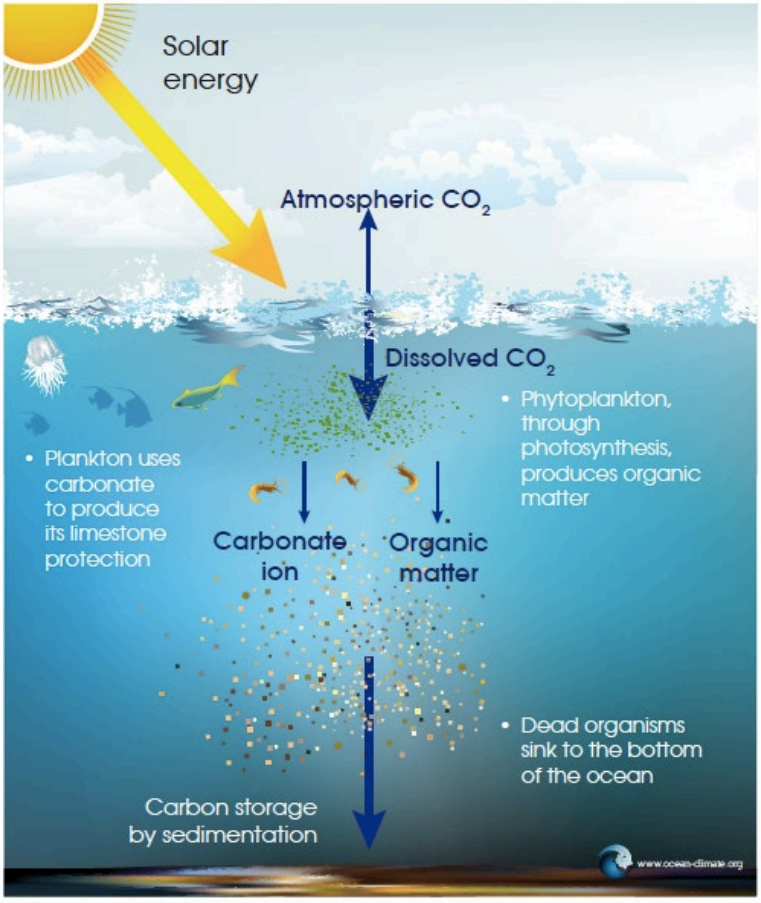


The Detailed Carbon Cycle

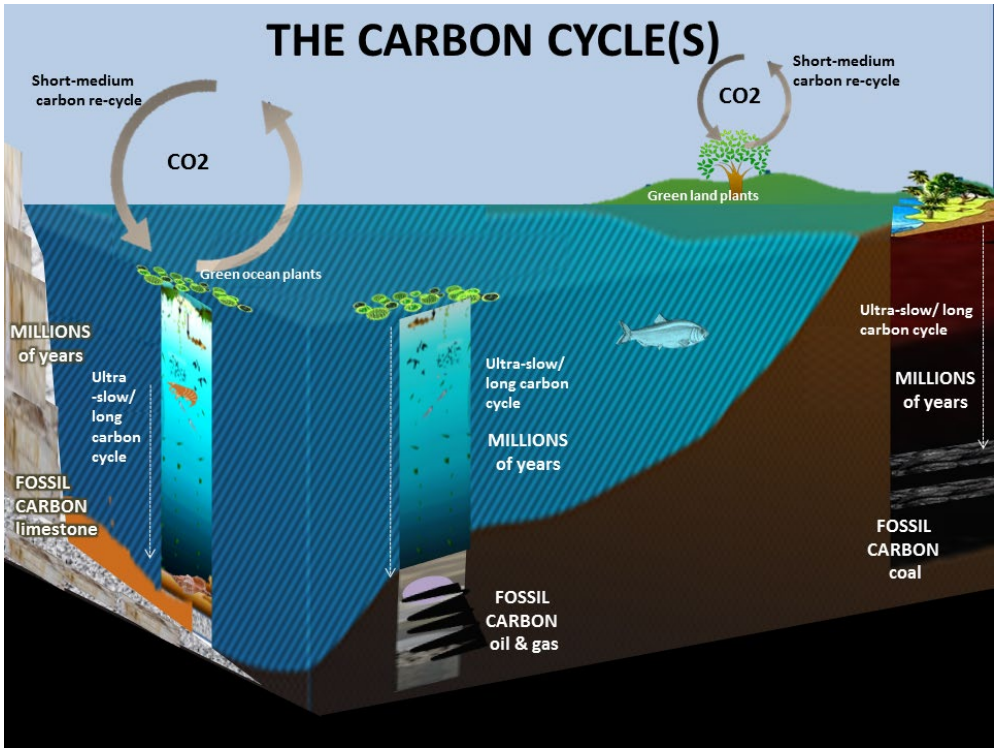


The ocean, as a biological pump

Once in the ocean, carbon enters the marine food chain via photosynthesis, as well as being utilised for invertebrate (without internal skeleton) shells and outer skeletons made by calcifiers, such as marine molluscs and microorganisms. This *sequestration* (storing away) mechanism acts as a *biological pump*, with carbon moving in one direction through the ocean's organisms.



https://oceans.taraexpeditions.org/en/m/science/news/plankton-network-linked-to-oceans-biological-carbon-pump-revealed/



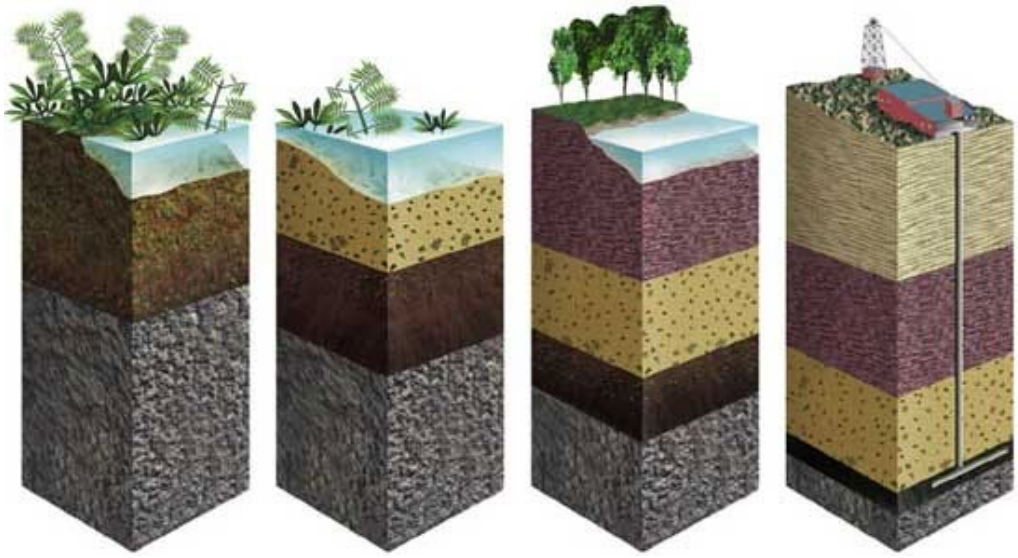
https://www.climateemergencyinstitute.com/committed_climate_change.html

Fossil fuels as a (store) reservoir

Carbon from the sedimentary remains of marine organisms becomes locked up, often for millions of years, once it is processed into rocks, such as limestone, and fossil fuel carbon reservoirs, with coal forming from ancient plant remains, and natural gas and oil from marine organisms.

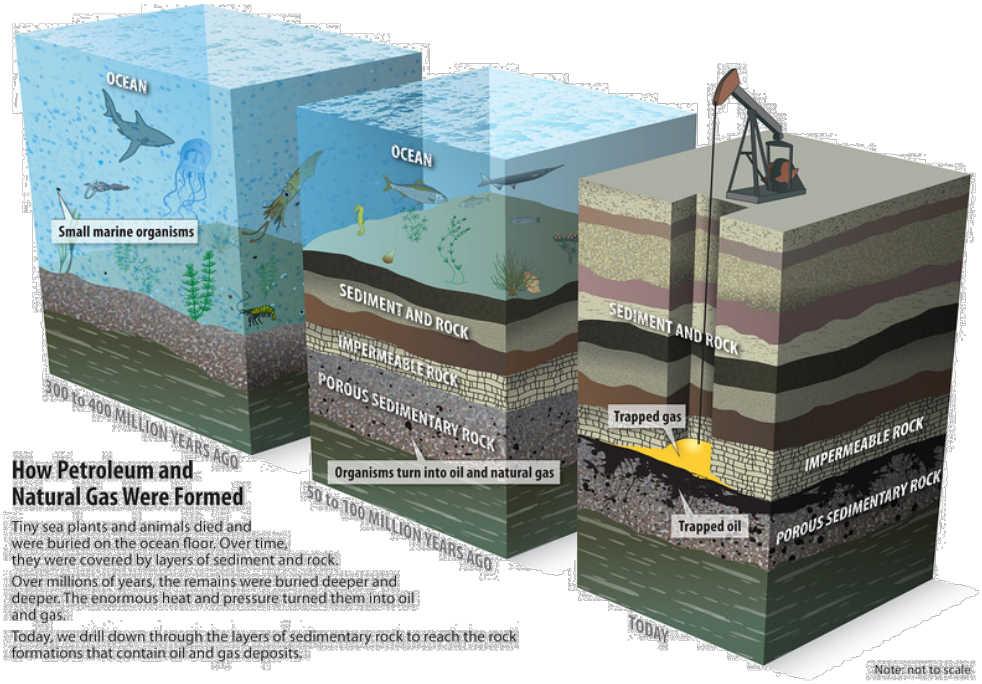
Coal was formed millions of years ago when plants fell into peat swamps and were buried by heavy earth and rocks. Over millions of years, the weight of the rocks and heat in the ground turned the plants into coal.

Most of the world's coal was formed 300–350 million years ago during the **Carboniferous** period that was warm and damp, ideal for plant growth. New Zealand coals are much younger – they were made 30–70 million years ago and they are a less energy rich fuel. Coal is mined either underground or in large open cast mines.



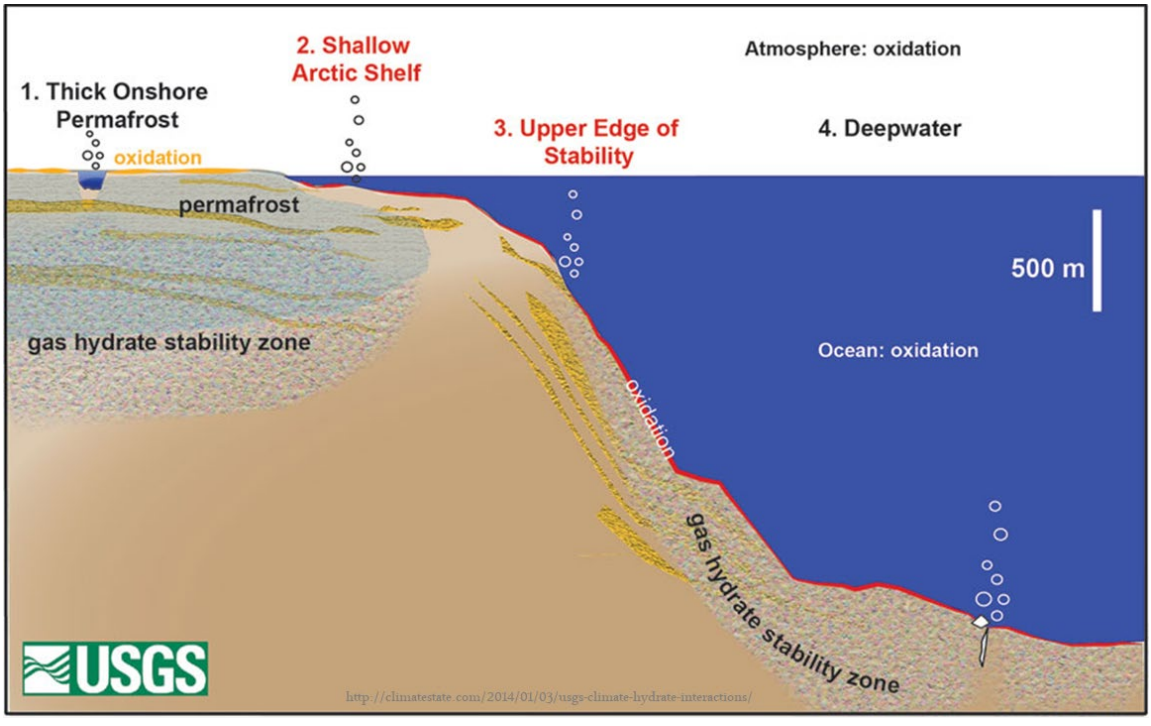
Fossil fuels – Forming oil

Oil and gas were formed many millions of years ago from dead sea organisms falling to the sea floor and being covered by sediment. Over time the sediment that covered these dead creatures was compressed and formed rock. The carbon and hydrogen atoms that used to be part of the dead organisms' bodies reformed into fuel – the liquid form called oil and the gas form. Oil and gas are mined by drilling deep into the ground from oil rigs.



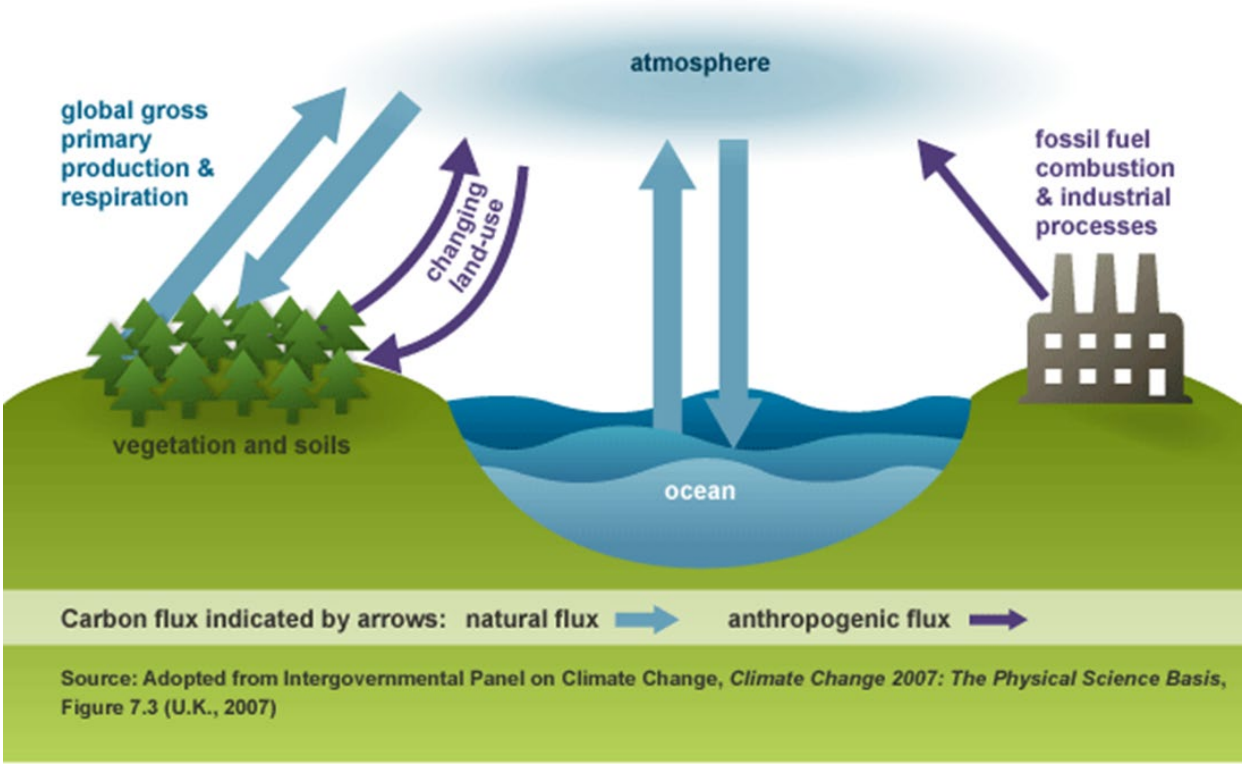
Stored Methane, as a carbon reservoir

Methane (CH_4), mostly formed through biological processes, is a potent greenhouse gas found in the atmosphere, in permafrost *(frozen ground)* near the poles, and stored under the sea floor in the form of hydrates, *stabilised* by pressure and stable cool temperatures



Human influence on the carbon cycle

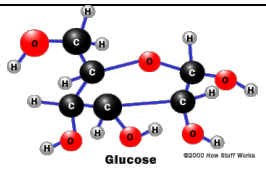
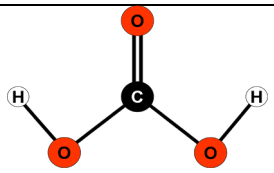
Human activity is increasing the net flow of carbon from other reservoirs into atmospheric CO_2. Human (anthropogenic) caused combustion (burning) of fossil fuels accounts for the greatest change to the carbon cycle in the post-industrial age (the time after 1780's when humans started using engines to power industry), which converts (changes) most of the carbon locked up in oil, gas, or coal, into CO_2 released into the atmosphere. Changing land-use can influence the total CO_2 emissions as well.



The evidence for Human influence on the carbon cycle

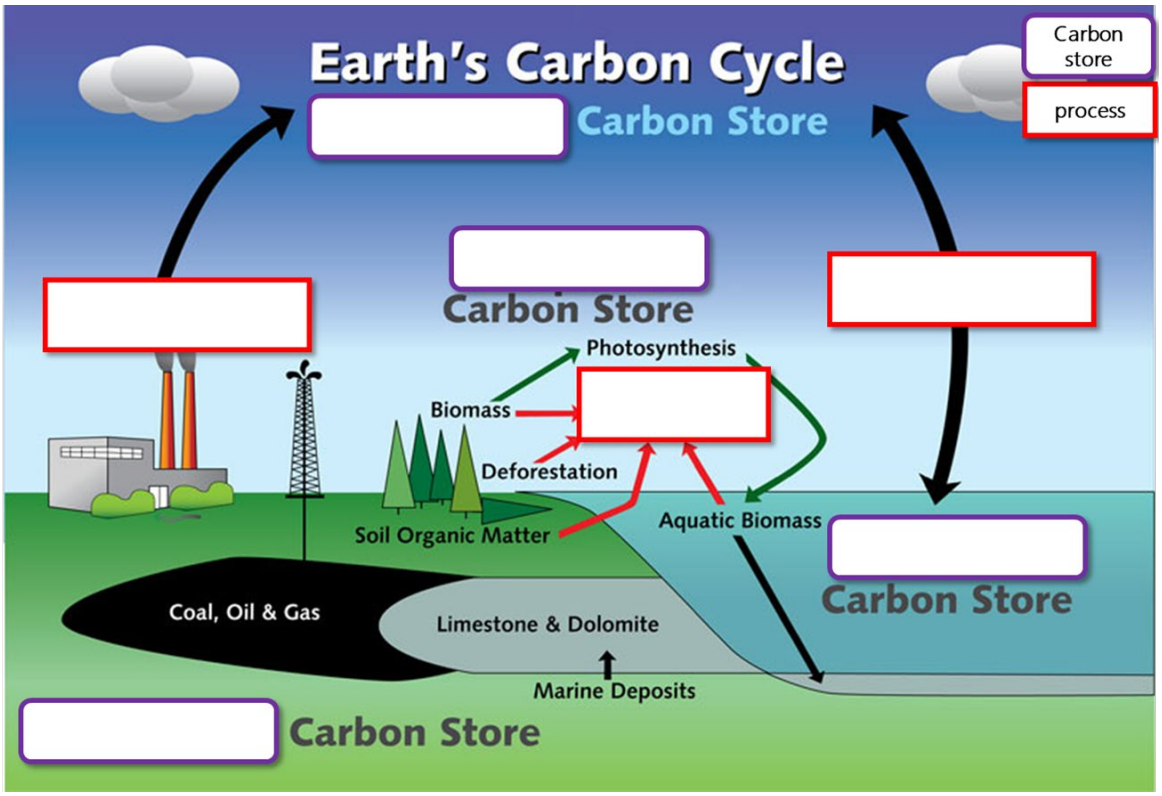
Past records from ice cores (see below) show that the level of CO_2 in the atmosphere is higher than at any time since humans have been on Earth. "Carbon dioxide concentrations [in the atmosphere] have increased by 40 per cent since pre-industrial times" and currently sits at around 406ppm (parts per million).

1. Research to complete information sheet on Carbon on Earth

Name	Formula	Model	Where is this found on Earth?	What process creates this?
carbon (graphite / diamond)				
carbon dioxide				
methane				
Calcium carbonate	$CaCO_3$			
glucose	$C_6H_{12}O_6$			
carbonic acid	H_2CO_3			
oil	Carbon and hydrogen molecules			
coal	Mostly carbon			

2. Write in correct processes and carbon store (reservoir) terms from word bank.
Shade in the processes that you think **human activity** could influence

Possible stores (reservoirs): atmosphere ocean lithosphere biosphere
Possible processes: fossil fuel emissions respiration & decompositions diffusion



3. Summarize your further research on one of the processes involved with the carbon cycle

photosynthesis, respiration, soil respiration, erupting volcano, burning, decomposition, burning fossil fuels, weathering and erosion, diffusion, dissolving, sinking, rock cycle