A-Level Geography Resource Package

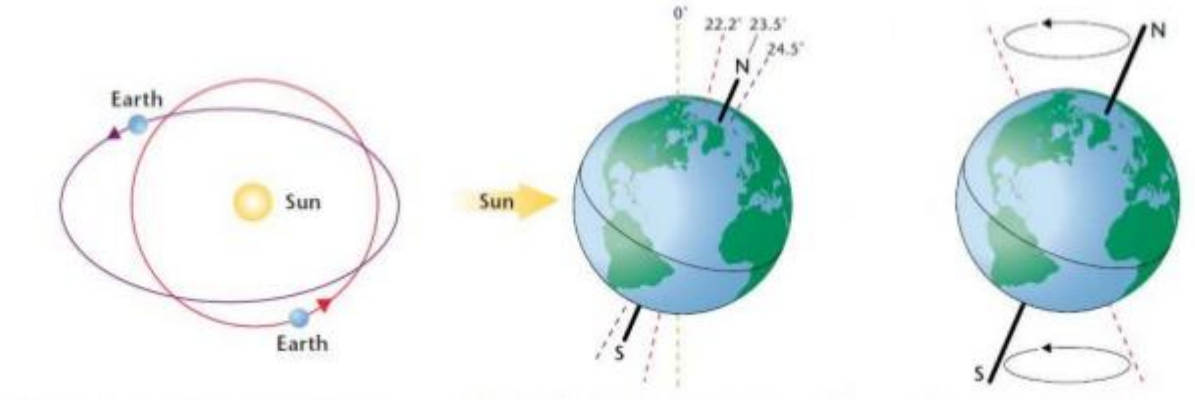
[Physical >> Water & Carbon Cycles >> Carbon Cycle Changes]

What are "Milankovitch Cycles?"

The Milankovitch cycles describe how relatively slight changes in Earth's movement affect the planet's climate over differing periods of time.

The cycles are named for Milutin Milankovitch, a Serbian astrophysicist who began investigating the cause of Earth's ancient ice ages in the early 1900s.

There are three cycles which are collectively measured, all acting independently of one another but working together to alter Earth's climate.



	ECCENTRICITY	**OBLIQUITY *(AXIAL TILT)***	**PRECESSION**
What?	The Earth orbits the sun not in a perfect circle – instead elliptically. Over time, the 'shape' of Earth's orbit around the sun changes.	Obliquity describes the 'tilt' of Earth. On average at around 23.5°, but this varies by around 1-1.5° plus and minus.	Earth wobbles slightly as it rotates on its axis. This is known as precession and it doesn't change the Earth's tilt, rather the orientation of this.
How often?	Every 100 000 years	41 000 years from lowest to highest and vice versa.	26 000 years in a complete circle.
What does this mean? [A* extra]	When the Earth's orbit has a higher eccentricity, the planet's surface receives 20-30% more solar radiation when it's at perihelion *(the shortest distance between the Earth and Sun)* than when it is at aphelion *(greatest distance between Earth and Sun)*. When it has little eccentricity, the total solar radiation doesn't particularly vary.	When the axis is at its minimal tilt, the amount of solar radiation doesn't change much between summer and winter for much of Earth's surface and therefore, seasons are less noticeable. Hence summer at the poles is cooler, which allows snow and ice to persist through summer and into winter, eventually building up into enormous ice sheets – helping form a glacial period.	As Earth completes a precession cycle, the orientation of the planet is altered. If a hemisphere is pointed toward the sun during perihelion, it will be pointed away during aphelion and the opposite is true for the other hemisphere. The hemisphere that's pointed toward the sun during perihelion and away during aphelion experiences more extreme seasonal contrasts than the other hemisphere.

How do they relate to **Changes in the Carbon Cycle?**

Recap:

- The **fast carbon cycle** is largely the movement of **carbon** through life forms on Earth
- The **slow carbon cycle** involves five key stages in the movement of carbon around the cycle that takes place over many tens and hundreds of millions of years and between different stores.

*"Left untouched, the **fast and slow carbon cycles** maintain a relatively steady concentration of carbon in the atmosphere, land, plants, and ocean. But when anything changes the amount of carbon in one reservoir, the effect ripples through the others."*

In Earth's past, the carbon cycle has changed in response to climate change. Variations in Earth's orbit alter the amount of energy Earth receives from the Sun and leads to a cycle of glacial and interglacial periods, like Earth's current climate, as per the Milankovitch cycles. Our human interventions are only furthering the disparities between these periods.

Ice ages developed when Northern Hemisphere summers cooled and ice built up on land, which in turn slowed the carbon cycle. Meanwhile, a number of factors including cooler temperatures and increased phytoplankton growth may have increased the amount of carbon the ocean took out of the atmosphere.

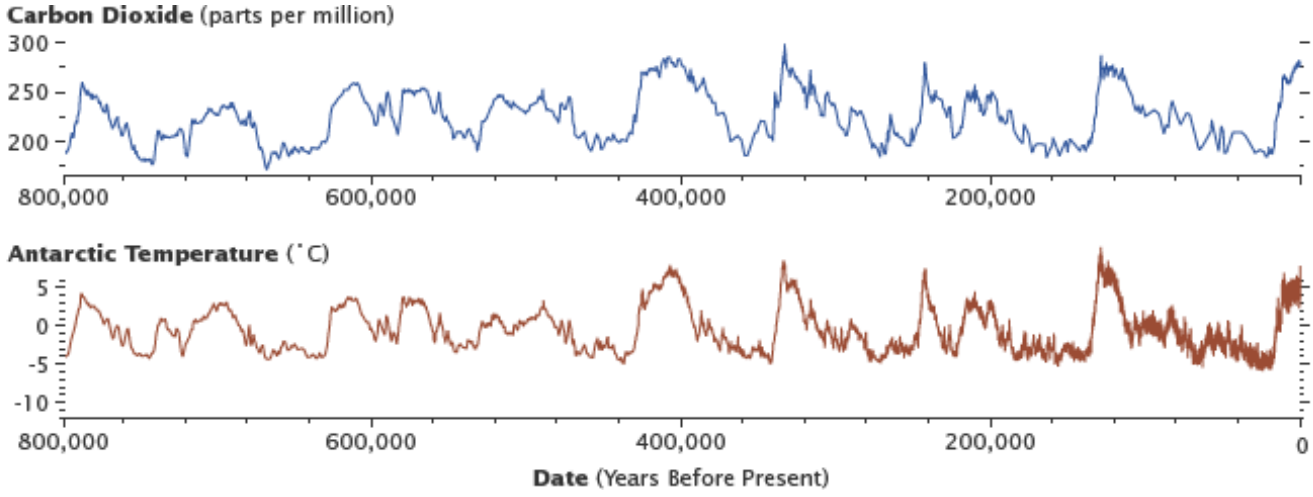


Figure 2: Carbon Dioxide levels are inextricable linked to temperature changes over time, through processes in the Milankovitch cycles.

Useful Link to a great explanatory video: https://www.youtube.com/watch?v=iA788usYNWA

Suggestions? File Errors? Please Contact:

21pearle@reeds.surrey.sch.uk | L. Pearson

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