TEACHER ANSWER KEY

Studying CO_2 from Pole to Pole

Student Sheet #1: Carbon Dioxide Concentrations in the Atmosphere

Task: To complete the chart below, use the Internet to research how each variable affects CO_2 concentrations in the atmosphere.

Variable	Description of the effect	*Does this increase or decrease CO_2?*
Ocean waters	Water both releases and absorbs CO_2 in response to warming (source) and cooling (sink), biological production (sink) and respiration (source), and increases in atmospheric CO_2 (sink). On balance, the ocean absorbs about a quarter of human produced CO_2 each year.	Decrease (This is true for some locations and times around the globe.)
Land plants	Plants use carbon dioxide in photosynthesis (sink) and produce it in respiration (source). Also, when plants die, they are decomposed by microbes that respire (source) the carbon back to the atmosphere as CO_2. On balance, land ecosystems take up CO_2 during the summer and release it during the winter. Over a year, plants take up and store about a quarter of human produced CO_2.	Decrease (This is true for some locations and times around the globe.)
Fossil fuel combustion (industrial use)	Burning of fossil fuel (source) releases carbon which was stored in the fuel product into the atmosphere.	Increase
Seasons	Outside of the tropics, oceans and land plants store carbon at different rates in summer and winter. During the spring and summer, plants cause decline in CO_2 due to more photosynthesis than respiration; the ocean can either release CO_2 or take up CO_2 because of algae photosynthesis. On balance, high latitude oceans take up slightly more than they release during summer. *Day vs. night has a big effect on photosynthesis rates, too.	Summer: decrease in CO_2 Winter: increase in CO_2
Latitude	CO_2 concentrations are greatest at high northern latitudes during northern hemisphere winter and lowest at high northern latitudes during summer. Averaged over a year, CO_2 concentrations are highest at mid to high northern latitudes. This results from different amounts of land and ocean at each latitude (varying amounts of sources and sinks), and much more fossil fuel burning in the Northern Hemisphere. Global wind patterns can also influence the concentrations. The reason why there is more CO_2 on average in the Northern Hemisphere is because the winds are not fast enough to mix all the industrial CO_2 emissions from the north to the south.	Varies
Altitude	In winter in the Northern Hemisphere there is more CO_2 closer to the surface because of net respiration and fossil fuel burning and slow vertical mixing. In the summer in the Northern Hemisphere there is less CO_2 closer to the surface because of net photosynthesis.	Varies

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