C1.3 Photosynthesis: data-based questions

What the Cell · DP Biology · data-based questions

Name _____ **Date** _____ **Total** _____ / 13

Read the data carefully before you answer. The number of marks shows how many separate points to make. Show your working in calculations.

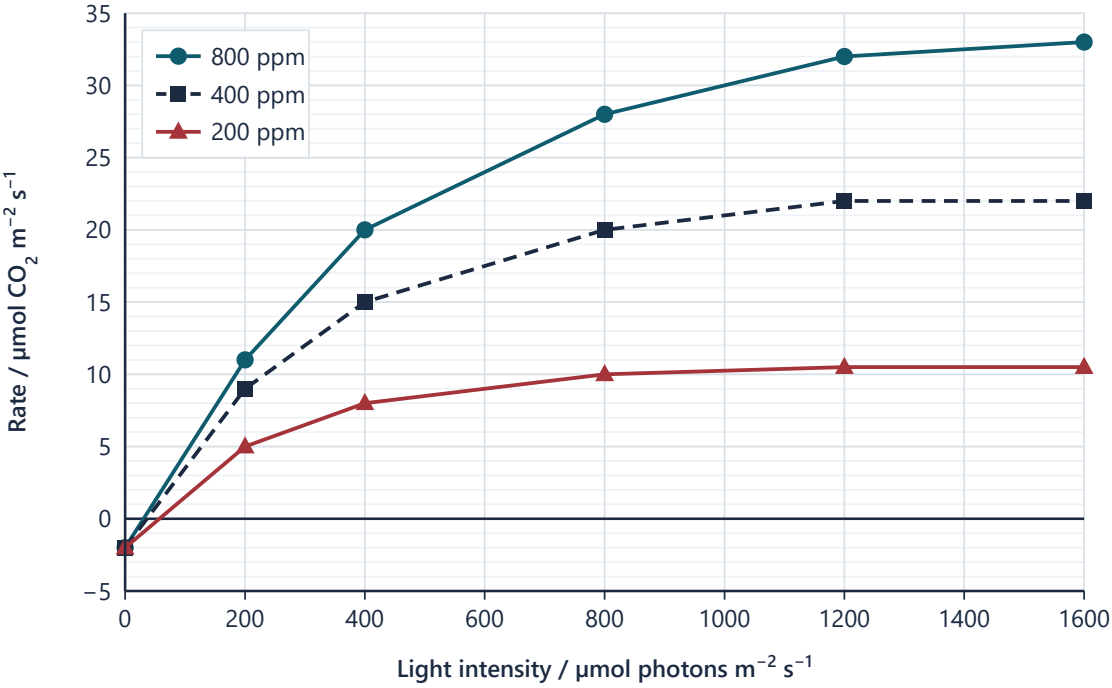
1 Light, carbon dioxide and wheat

8 marks



Photo: Jon Sullivan, Public domain, Wikimedia Commons.

Wheat seedlings were grown at three carbon dioxide concentrations, in parts per million (ppm). The rate of photosynthesis was measured as net carbon dioxide uptake at different light intensities. Temperature was kept at 25 °C.



a **State** the rate of photosynthesis at 800 µmol photons m^{-2} s^{-1} and 400 ppm carbon dioxide. **[1]**

b **Outline** the effect of carbon dioxide concentration on the rate of photosynthesis. **[3]**

c **Identify** the factor limiting the rate at 1600 µmol photons m^{-2} s^{-1} for the 400 ppm plants. Give a reason. **[1]**

d **Explain** why the rate is negative in darkness. **[1]**

e **Calculate** the percentage increase in the highest rate when carbon dioxide is raised from 400 to 800 ppm. **[1]**

f **Suggest** one reason why growers may add carbon dioxide to greenhouses only when light is bright. **[1]**

2 Sun and shade leaves

5 marks

Leaves of English ivy (*Hedera helix*) that grew in full sun were compared with leaves that grew in the shade of other leaves on the same plant. Values are means of 20 leaves, ± 1 SD.

	Sun leaves	Shade leaves
Leaf area / cm^2	18 ± 3	31 ± 5
Total chlorophyll / mg g^{-1}	1.6 ± 0.2	2.4 ± 0.3
Chlorophyll a : chlorophyll b	3.4	2.6

a **Compare** the area of sun and shade leaves. **[1]**

b **Calculate** how much more chlorophyll per gram the shade leaves contain, as a percentage. **[1]**

c **Explain** how a larger area and more chlorophyll help shade leaves. **[2]**

d Chlorophyll b absorbs some wavelengths that chlorophyll a absorbs poorly. **Suggest** why shade leaves have a lower ratio of chlorophyll a to b. **[1]**