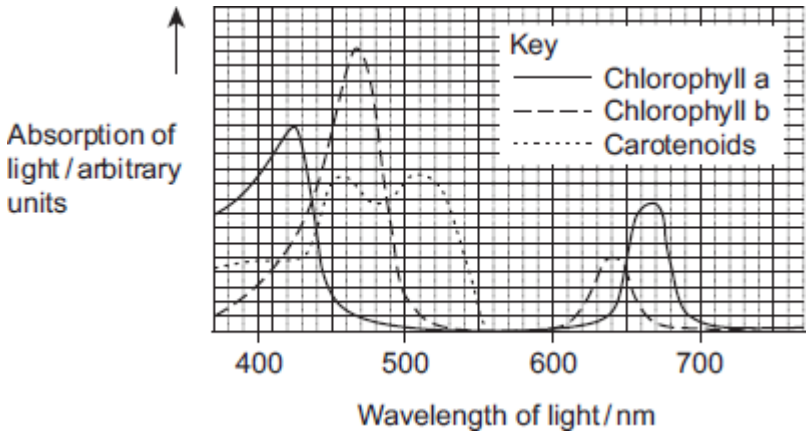
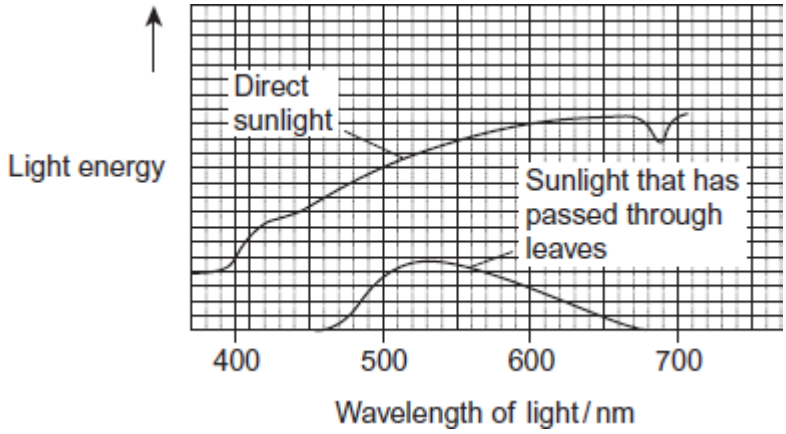
Photosynthesis homework 1: Light dependent stage

Q1. Plants have pigments that absorb light energy for photosynthesis. These pigments include two types of chlorophyll and a group of pigments known as carotenoids. Different species of plant contain different amounts of these pigments. The pigments that each plant species has are adaptations to where and how they live; their ecological niche. **Figure 1** shows the absorption of light of different wavelengths by chlorophyll a, chlorophyll b and carotenoids.



A scientist investigated the energy in light of different wavelengths reaching the ground in a forest. She measured the energy in

- direct sunlight
- sunlight that had passed through the leaves of trees.



Beech trees have two types of leaves called sun leaves and shade leaves. Sun leaves grow on branches exposed to direct sunlight, shade leaves grow on branches exposed to light that has passed through leaves. An ecologist collected sun leaves and shade leaves from beech trees and determined the mean mass of each photosynthetic pigment in both types of leaf. His results are shown in **Figure 3**.

Photosynthetic pigment	Mean mass of each pigment per m^2 of leaf area / µg (± standard deviation)	
	Sun leaves	**Shade leaves**
Chlorophyll a	299.3 (± 2.1)	288.9 (± 0.1)
Chlorophyll b	90.7 (± 2.1)	111.1 (± 0.1)
Carotenoids	0.10 (± 0.01)	0.07 (± 0.01)

(a) It is an advantage to beech trees to produce more chlorophyll b in the shade leaves. Suggest and explain why.

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_____ **(2)**

(b) There are two hypotheses about the advantage to plants of producing carotenoids.

Hypothesis 1: Carotenoids help shade leaves to absorb more light of wavelengths 480 nm to 520nm for photosynthesis.

Hypothesis 2: Carotenoids prevent damage to chlorophyll from very bright light.

(i) Which hypothesis do the data provided on the resource sheet support? Explain your answer.

Hypothesis _____

Explanation _____

_____

_____

_____**(2)**

(ii) Suggest **one** other piece of experimental evidence you would need in order to be more confident about drawing your conclusion in (b)(i).

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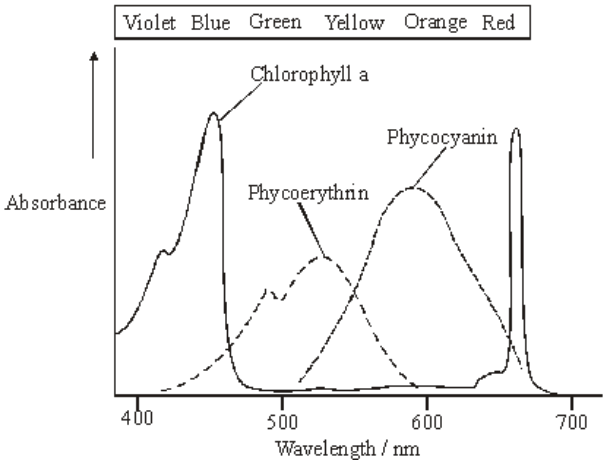
_____**(1)**

Q2. The graph shows the absorption of different wavelengths of light by three photosynthetic pigments in a red seaweed.



(a) (i) Describe what the graph shows about the properties of chlorophyll a.

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_____**(1)**

(ii) Describe the part played by chlorophyll in photosynthesis.

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_____**(3)**

(b) The red seaweed lives under water at a depth of 2 metres. Suggest an advantage to the red seaweed of having other pigments in addition to chlorophyll a.

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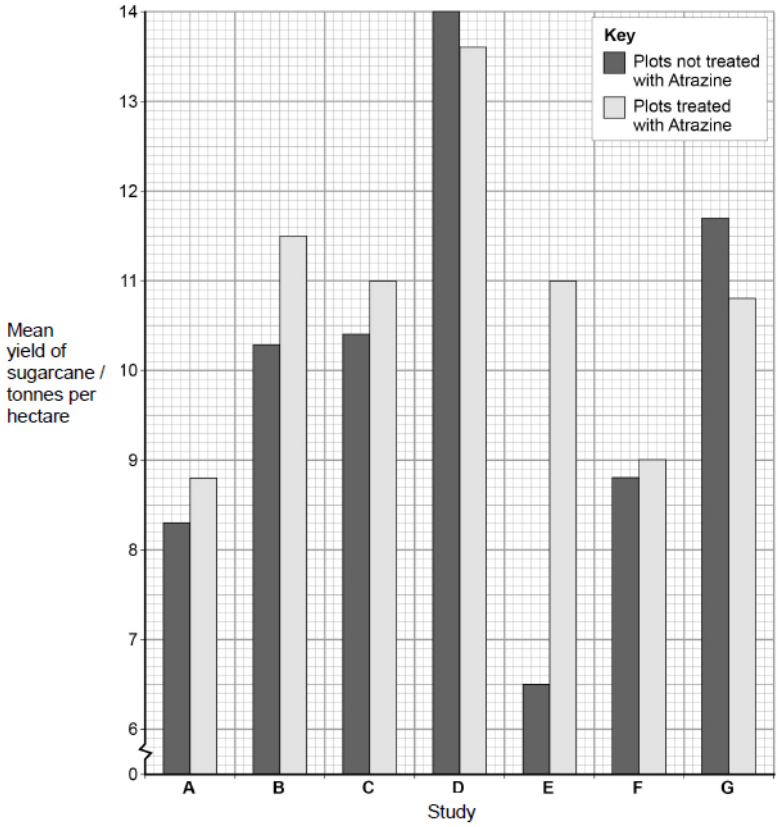
_____**(2)**

Q3. Herbicides can be used to reduce the growth of weeds.

Scientists completed seven studies to determine how the use of the herbicide Atrazine affected the yield of sugarcane. In each study, some plots were treated with Atrazine and some plots were not treated with Atrazine. The graph below shows the scientists' results. (1 hectare = 10 000 m^2)

(a) Calculate the percentage decrease in yield caused by the use of Atrazine in study **G**.

Answer = _____ % **(1)**



(b) A teacher studying these data with her students told her class that no definite conclusions could be drawn when comparing the mean values in the graph. Suggest why the teacher said this.

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_____

_____ **(2)**

(c) Atrazine binds to proteins in the electron transfer chain in chloroplasts of weeds, reducing the transfer of electrons down the chain. Explain how this reduces the rate of photosynthesis in weeds.

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_____ **(4)**

(d) When treated with Atrazine, weeds have been shown to give off small amounts of heat. Suggest an explanation for this observation.

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_____ **(1)**