**1.**

 The absorption spectrum of chlorophyll a and chlorophyll b are shown in the graph below.



(b) On the graph above, draw the action spectrum of photosynthesis for a green plant.

(1)

 (Total 1 marks)

**2.** In the graph below which line shows an action spectrum of photosynthesis?



(Total 1 mark)

**3.** Why is the action spectrum for photosynthesis similar to the absorption spectra of photosynthetic pigments?

A. Photosynthetic pigments have the same optimum temperature as the enzymes used in photosynthesis.

B. Plants absorb the same photosynthetic pigments for use in photosynthesis.

C. Only wavelengths of light absorbed by pigments can be used in photosynthesis.

D. The amount of energy absorbed by photosynthetic pigments is equal to the activation energy for photosynthesis.

(Total 1 mark)

**4.** Which diagram represents the action spectrum of photosynthesis?



(Total 1 mark)

**5.** Which two colours of light does chlorophyll absorb most?

A. Red and yellow

B. Green and blue

C. Red and green

D. Red and blue

(Total 1 mark)

**6.**

(b) Explain the relationship between the absorption spectrum and the action spectrum of photosynthetic pigments.

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(3)

(Total 3 marks)

**7.** Pigments are extracted from the leaves of a green plant. White light is then passed through the solution of pigments. What effect do the leaf pigments have on the white light?

A. Green wavelengths are absorbed and red and blue wavelengths are transmitted.

B. Red and blue wavelengths are absorbed and green wavelengths are transmitted.

C Blue wavelengths are absorbed and green and red wavelengths are transmitted.

D. Green and red wavelengths are absorbed and blue wavelengths are transmitted.

(1)

**8.** The cyanobacterium *(Calothrix elenkenii)* is cultivated as a source of photosynthetic pigments for use in research and industry. The chart below shows the quantity of two of the pigments produced when exposed to a day of continuous dark, a day of 16 hours light and 8 hours dark and a day of continuous light. This was repeated in both aerobic and anaerobic conditions.



[Source: Reprinted from *Journal of Plant Physiology*, Vol 161, Parsanna *et al.*, “Modulation of pigment…” pages 1125–1132,
 copyright (2002), with permission from Elsevier.]

(a) Identify the light conditions that cause most chlorophyll to be made when the cyanobacterium is cultivated anaerobically.

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(1)

(b) Calculate the percentage increase in chlorophyll grown anaerobically in the light, compared with anaerobically in the dark.

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(1)

(c) Compare pigment production in different aerobic conditions.

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(2)

(d) Discuss why having more than one photosynthetic pigment is an advantage to cyanobacterium.

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(3)

(Total 7 marks)