

3 Plants have several different photosynthetic pigments in their chloroplasts.

(a) A student separated and identified the chloroplast pigments present in a leaf extract from a spinach plant using two slightly different methods.

Method A

- A type of chromatography known as thin layer chromatography (TLC) was used to separate the pigments.
- A mixture of ether and cyclohexane was used as a solvent in TLC.

Method B

- The student repeated TLC but treated the spinach leaf extract with a chemical. The chemical causes a magnesium ion in a pigment to be replaced by two hydrogen ions.
- The student used a leaf from the same spinach plant, and used the same solvent as in method A.

The student calculated R_f values and compared these to reference values to identify the pigments.

Fig. 3.1 shows the results for method A and method B.

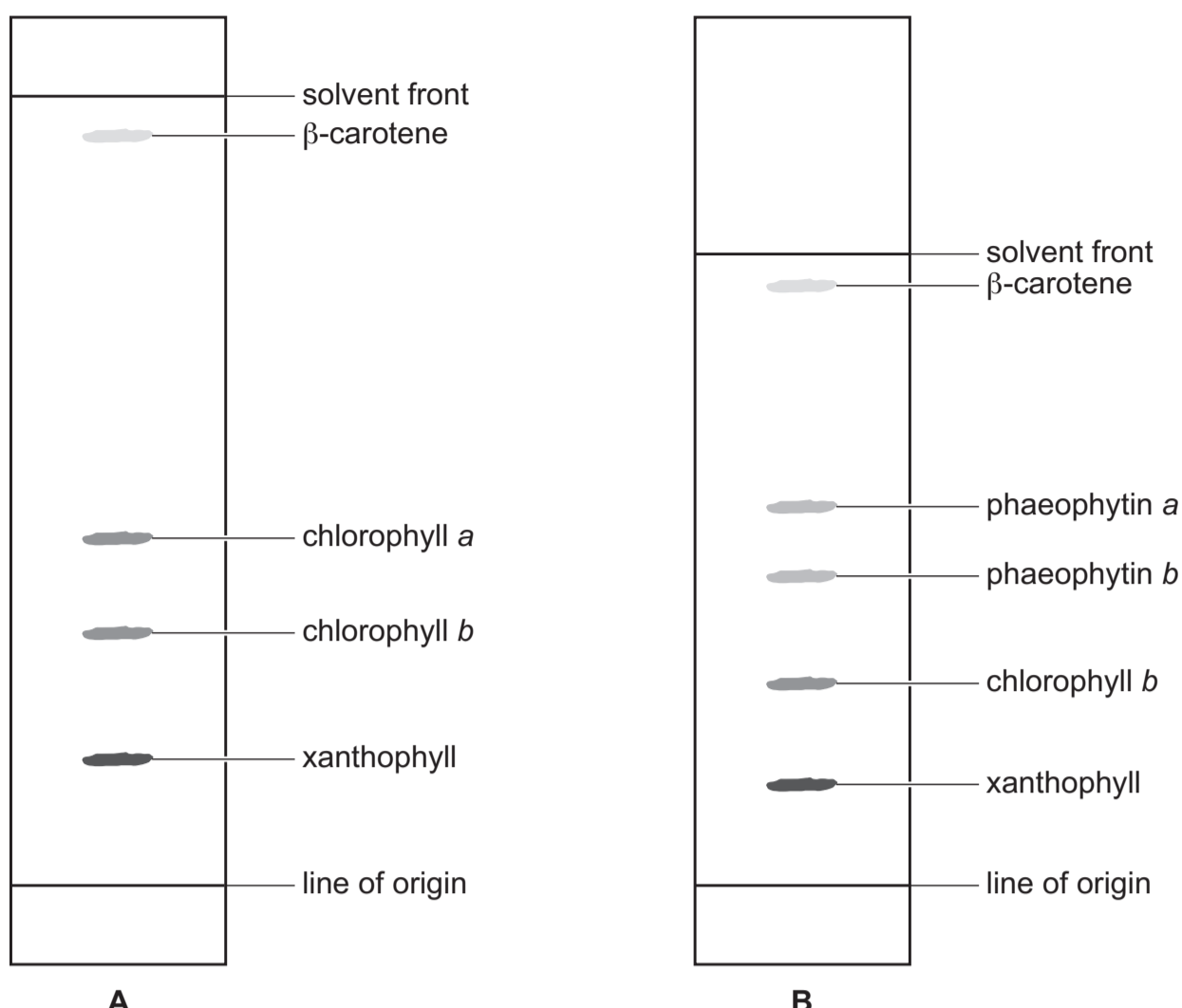


Fig. 3.1

(i) Calculate the R_f value of β -carotene in Fig. 3.1.

$R_f = \dots\dots\dots$ [2]

(ii) Suggest **two** explanations for the differences in appearance of chromatograms A and B in Fig. 3.1.

- 1
- 2

(iii) The student found some different R_f values for the chloroplast pigments of spinach in a scientific paper.

The values in the scientific paper were different from the reference values that the student originally used to identify the pigments on chromatograms A and B in Fig. 3.1.

Suggest **one** reason, other than measurement error, for the different R_f values.
 [1]

(b) Fig. 3.2 shows the absorption spectra of some chloroplast pigments.

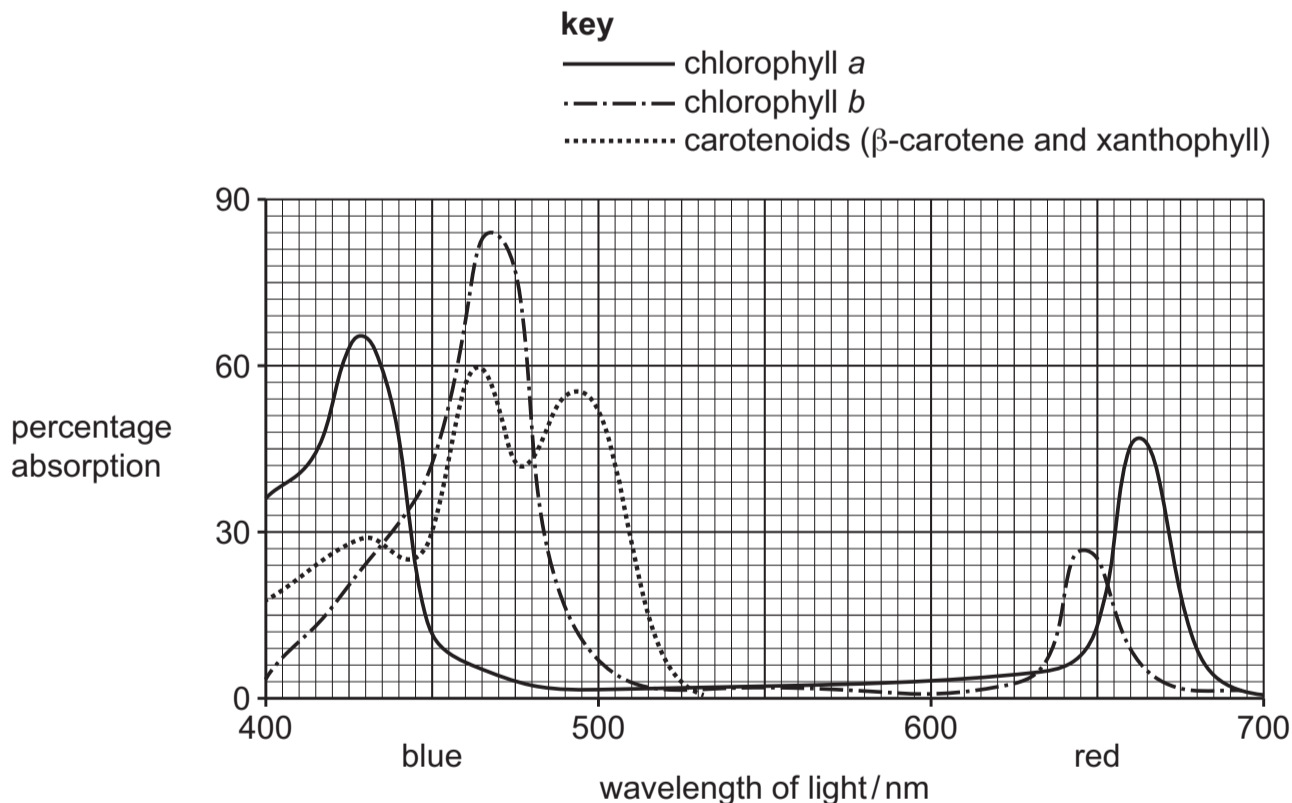


Fig. 3.2

Use Fig. 3.2 to compare the similarities and differences between the absorption spectra of chlorophyll a and carotenoids.

- [4]

(c) In some species of plant, the absorption of light stimulates seed germination.

The absorption of light increases the production of gibberellin in the embryo of a seed.

Describe the role of gibberellin in the germination of a seed.
 [4]