Solutions

Each answer shows the steps, then the **result**.

2.1

- light intensity; carbon dioxide concentration; temperature

2.2

- count the oxygen bubbles given off per minute (or collect/measure the volume of oxygen)

2.3

- **light intensity**

2.4

- it absorbs heat from the lamp, so the temperature stays constant

3.1 B

- When the curve levels off, light is no longer limiting – another factor is

3.2 B

- Above the optimum the enzymes denature, so the rate falls

3.3

(a)

- moving the lamp closer raises the light intensity, so more light energy is available for the light-dependent stage, increasing the rate

(b)

- any two: temperature; CO_2 concentration; same piece of pondweed; same time counted

3.4

- add DCPIP to an illuminated chloroplast suspension; the dye is reduced by the light-dependent stage and loses its blue colour; time how long the colour takes to disappear at each condition – faster loss means a faster rate

3.5

- intensity $\propto \dfrac{1}{d^2}$, so compare $\dfrac{1}{10^2}$ with $\dfrac{1}{20^2}$

$$\frac{1/10^2}{1/20^2} = \frac{20^2}{10^2} = \frac{400}{100} = \mathbf{4}$$

3.6

- burning paraffin releases carbon dioxide, raising its concentration when it is the limiting factor
- burning also releases heat, raising the temperature towards the optimum for photosynthesis enzymes
- so the rate of photosynthesis increases, giving more sugars for growth and a higher yield