Solutions

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

2.1

- ATP and reduced NADP

2.2

- rubisco

2.3

- Light-dependent: the thylakoid membranes of the grana; light-independent: the stroma

2.4

- Rubisco; carbon dioxide combines with RuBP to give two molecules of GP

2.5

- Water; photolysis

3.1 B

- The Calvin cycle takes place in the stroma

3.2 B

- Only non-cyclic photophosphorylation makes reduced NADP and releases oxygen (from photolysis)

3.3

(a)

- $R_f = \dfrac{4.8}{12.0} = 0.40$

(b)

- different pigments absorb different wavelengths, so more of the light energy is trapped

3.4

- fixation — rubisco joins CO_2 to RuBP (5C) to make two GP (3C); reduction — GP is reduced to TP using ATP and reduced NADP; regeneration — most TP is used (with ATP) to remake RuBP

3.5

(a)

- It takes place in the thylakoid membranes; light excites electrons in chlorophyll, which pass along an electron transport chain releasing energy to make ATP; photolysis of

water replaces the lost electrons and releases oxygen; the products passed on are ATP and reduced NADP

(b)

- Fixation, reduction and regeneration; RuBP has 5 carbons, GP has 3 and TP has 3

(c)

- GP rises, because no ATP or reduced NADP is available to reduce it to TP; RuBP falls, because it continues to be used in fixation for a short time but is no longer regenerated

(d)

- RuBP rises, because it is no longer used up in fixation; GP and TP fall, because no new GP is being formed

(e)

- Stacking gives a very large surface area within a small volume, so many more photosystems and electron carriers can be held, increasing the rate of the light-dependent stage