Model Answers: Easy

1a

(a) The parts of a chloroplast labelled A - C are…

- A = Stroma; [1 mark]
- B = Thylakoid/thylakoid membrane; [1 mark]
- C = Thylakoid stack/granum (accept grana, the plural or granum, here); [1 mark]

[Total: 3 marks]

It can be confusing to differentiate between thylakoids and grana here, but be sure that you know the difference! A single membrane-bound disc is known as a thylakoid (surrounded by a thylakoid membrane), and these thylakoids stack together to form a granum. More than one stack together are referred to as the plural, grana.

1b

(b) Chloroplasts contain more than one different photosynthetic pigment because…

- Different pigments absorb different wavelengths of light / to absorb multiple wavelengths of light **OR** to maximise the absorption of light across different wavelengths; [1 mark]

[Total: 1 mark]

Being able to absorb multiple wavelengths of light allows plants to maximise the amount of light energy that they can absorb, and reduces the amount of light energy that just bounces off a leaf. Different pigments can also be useful in allowing a leaf to be adapted to different environments, e.g. being underwater where fewer wavelengths of light are available.

1c

(c) The R_f values for pigments **X** and **Y** in **Fig. 2** are…

- X = 0.55; [1 mark]
- Y = 0.94; [1 mark]

OR (in the absence of both of the above marking points)

Just one correct answer / 10.7 ÷ 19.5 / 18.33 ÷ 19.5; [1 mark]

[Total: 2 marks]

$$R_f = \frac{\text{distance moved by the pigment}}{\text{distance moved by the solvent}}$$

distance moved by pigment X = 10.7 cm

Y = 18.33 cm

distance moved by the solvent = 19.5 cm

Substitute into the equation:

Pigment X

$R_f = \frac{10.7}{19.5} = 0.55$

[1 mark]

Pigment Y

$Rf = \frac{18.33}{19.5} = 0.94$

[1 mark]

[Total: 2 marks]

1d

(d) Pigments X and Y from Fig. 2 are...

- **X** = chlorophyll b; [1 mark]
- **Y** = carotene; [1 mark]

Accept 'error carried forward' from part (c)

[Total: 2 marks]

Accept 'error carried forward' here, meaning that if you calculated the wrong answer to part (c), you can still be given a mark for correctly identifying a pigment that matches with your calculated R_f value.

2a

(a) The majority of plants look green to human eyes because...

- Chlorophyll reflects (the most) light in the green wavelengths of the (visible) spectrum; [1 mark]

[Total: 1 mark]

Chlorophyll reflects green light more strongly than **other colours**. This is because chlorophyll **absorbs** light most strongly in the **blue** and **red** portions of the visible spectrum.

2b

(b) From the data it can be concluded that light colour has the following effect on the growth of *Arabidopsis thaliana*...

Any **two** of the following:

- *A. thaliana* growth (as determined by height, shoot length and biomass) is greatest under red light **OR** red light enhances *A. thaliana* growth the most **OR** *A. thaliana* growth is greatest in red light and poorest in blue light; [1 mark]
- There is a relationship / (positive) correlation between light wavelength and *A. thaliana* growth; [1 mark]
- Any set of data points from the table to support the above points, e.g. *A thaliana* grows 7.4 cm under red light/630 nm, 3.5 cm under orange light/600 nm and 2.3 cm under blue light/450 nm; [1 mark]

[Total: 2 marks]

2c

(c) The waste oxygen is produced by...

- Photolysis (of water); [1 mark]

Allow: splitting of water

[Total: 1 mark]

All of the oxygen generated in photosynthesis comes from **photolysis**; the **splitting** (hence '**lysis**') of molecules of water in the presence of light (hence '**photo**'). This process also releases electrons and protons required for other stages of photosynthesis.

2d

(d) The two products of the light-dependent stage of photosynthesis are...

- ATP; [1 mark]
- NADPH / reduced NADP; [1 mark]

[Total: 2 marks]

Remember, the whole purpose of the light-dependent reactions is to produce ATP and reduced NADP, which are then used to complete the process of photosynthesis through the light-independent reactions.

3a

(a) The enzyme marked Enzyme X in Fig. 1 is...

- Rubisco / ribulose bisphosphate carboxylase; [1 mark]

[Total: 1 mark]

3b

(b) The molecules required at the positions marked Y and Z are...

- ATP; [1 mark]
- NADPH / reduced NADP; [1 mark]

Answers may be given in either order

[Total: 2 marks]

Note that it doesn't matter which molecule is identified as Y and which as Z, provided that the correct molecules are named.

3c

(c) Two uses for hexose sugars inside plant cells include:

Any **two** of the following:

- Conversion into starch for storage; [1 mark]
- Conversion into sucrose for transport around the plant; [1 mark]
- Conversion into cellulose for cell walls; [1 mark]
- Respiration to produce ATP: [1 mark]

[Total: 2 marks]

3d

(d) One other product that can be made during the Calvin cycle:

Two marks per correct pair

- Amino acids; [1 mark]
- Which are used for protein synthesis; [1 mark]

OR

- Lipids / glycerol / fatty acids; [1 mark]
- Which can be used to build cell membranes/the waxy cuticle; [1 mark]

OR

- ADP / NADP; [1 mark]
- Can enter back into the light dependent reactions; [1 mark]

[Total: 2 marks]