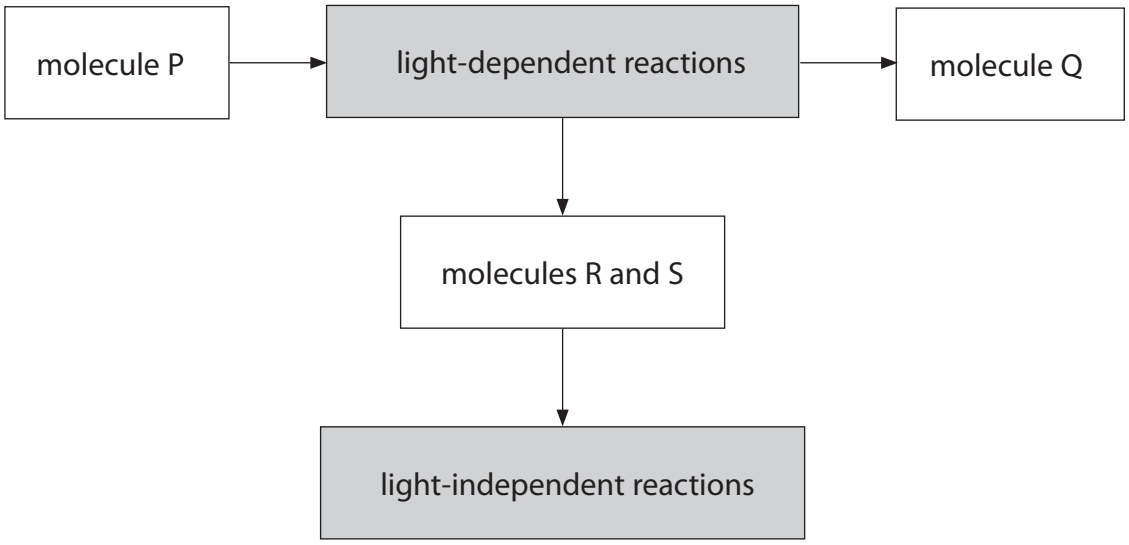
1 (a) The diagram below shows some of the steps in the process of photosynthesis.



(i) Name molecules **P** and **Q** in the diagram.

(1)

molecule P .....

molecule Q .....

(ii) Place a cross ☒ in the box next to the names of molecules **R** and **S** in the diagram.

(1)

☒ **A** ADP and oxidised NADP

☒ **B** ADP and reduced NADP

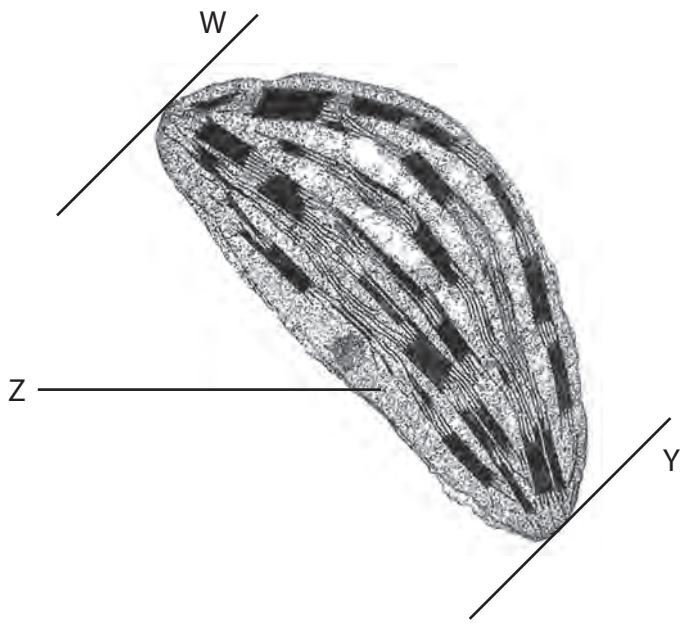
☒ **C** ATP and oxidised NADP

☒ **D** ATP and reduced NADP

(iii) Describe the role of RUBISCO in the production of GALP in the light-independent reaction.

(4)

(b) The electronmicrograph below shows a chloroplast.



Magnification ×7500

(i) Place a cross ☒ in the box next to the name of the part labelled **Z**.

(1)

☒ **A** cytoplasm

☒ **B** matrix

☒ **C** stroma

☒ **D** thylakoid

(ii) The equation below can be used to calculate the magnification of this chloroplast.

magnification = image length ÷ actual length

Use this equation to calculate the actual length of this chloroplast, between the lines labelled **W** and **Y**.

Show your working.

(3)

length of chloroplast = ...

(iii) Describe how the membranes inside the chloroplast are involved in photosynthesis.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

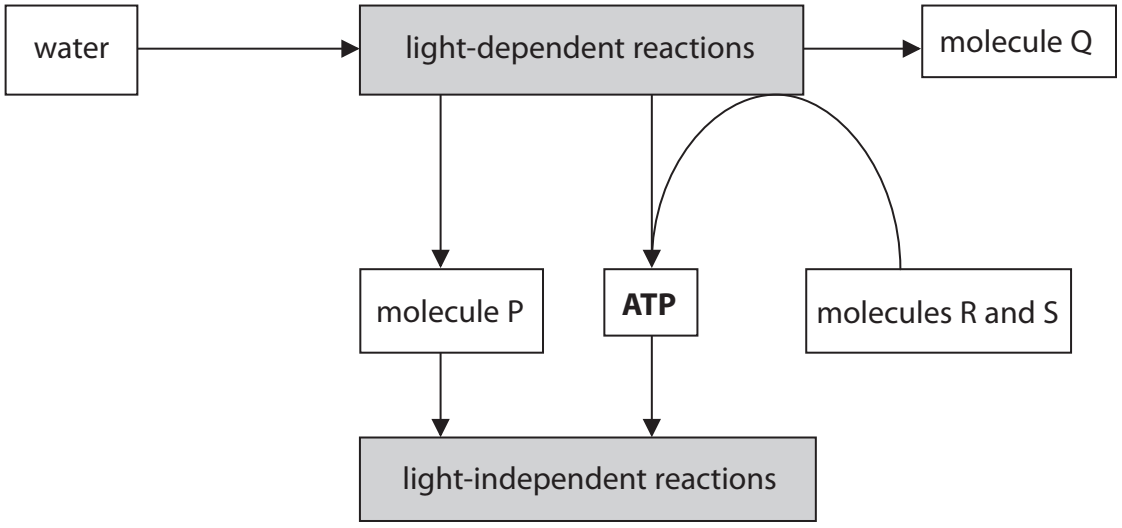
.....

.....

.....

(Total for Question 1 = 13 marks)

2 (a) The diagram below shows some of the steps in the process of photosynthesis.



(i) Place a cross ☒ in the box next to the name of molecule **P** in the diagram.

(1)

☒ **A** carbon dioxide

☒ **B** oxidised NADP

☒ **C** reduced NADP

☒ **D** RUBISCO

(ii) Name the molecules **R** and **S** in the diagram.

(1)

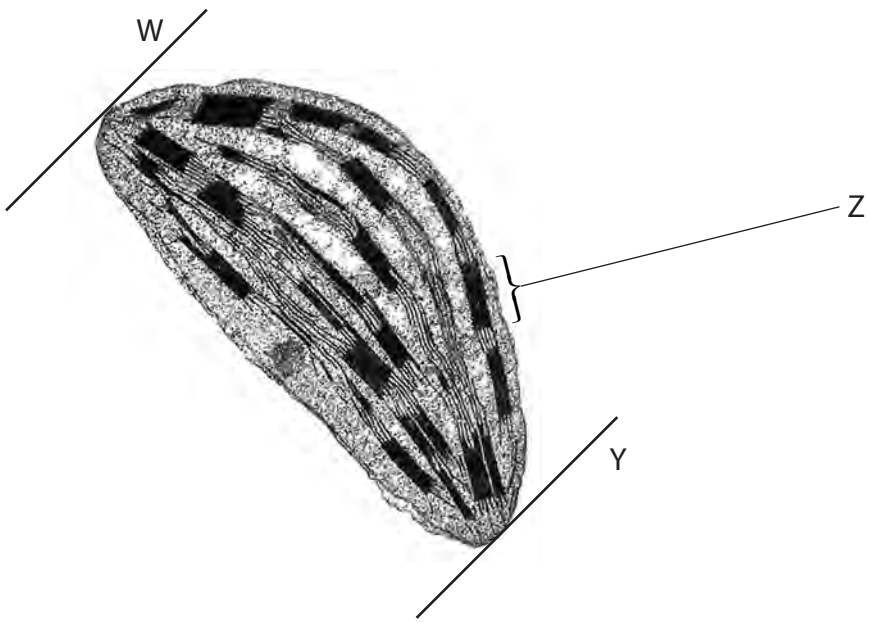
molecule **R** .....

molecule **S** .....

(iii) Describe how molecule **Q** is produced.

(4)

(b) The electronmicrograph below shows an image of a chloroplast.



(i) Place a cross ☒ in the box next to the name of the part labelled **Z**.

(1)

☒ **A** granum

☒ **B** ribosome

☒ **C** starch grain

☒ **D** stoma

(ii) The equation below can be used to calculate the magnification of this chloroplast.

image length = actual length × magnification

The actual length of this chloroplast is 0.007 mm.

Measure the image length between lines **W** and **Y**. Use this equation to calculate the magnification of the image.

(3)

magnification = ...

(iii) Describe the structure of chloroplasts in relation to their roles in photosynthesis.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

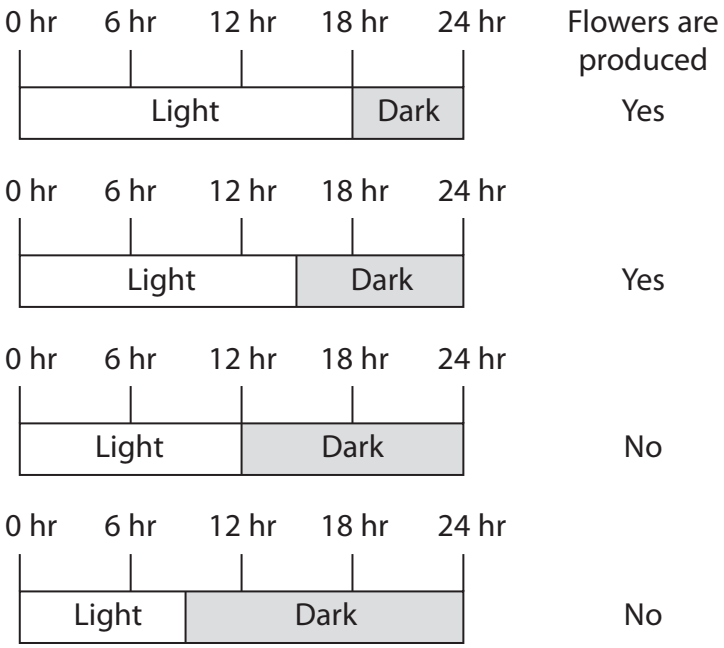
.....

(Total for Question 2 = 13 marks)

3 Both plants and animals are able to respond to stimuli using photosensitive pigments.

(a) The photosensitive pigment in plants can be involved in a range of responses to environmental cues. This includes flower production in response to day length.

The diagram below shows the results of a study on the effect of day length on flowering in one species of plant.



(i) Place a cross ☒ in the box to complete the conclusion made using these results.

The critical amount of daylight needed for the production of flowers is

(1)

☒ **A** between 15 and 18 hours

☒ **B** between 12 and 15 hours

☒ **C** between 9 and 12 hours

☒ **D** between 6 and 9 hours

(ii) The photosensitive pigment involved in making this plant species produce flowers is likely to be

(1)

☒ **A** IAA

☒ **B** chlorophyll

☒ **C** FAD

☒ **D** phytochrome

(iii) Suggest how the plants were grown to ensure this study was valid.

(2)

.....

.....

.....

.....

.....

.....

(iv) Suggest how this study could be changed to produce a more accurate conclusion.

(1)

.....

.....

.....

(b) For some plant species, day length is not an environmental cue for the production of flowers.

Suggest **one** environmental cue, other than day length, that could stimulate plants of these species to produce flowers.

(1)

.....

.....

.....

(c) Rhodospin is found in rod cells in the retina of mammalian eyes.

(i) State the location of rhodopsin within a rod cell.

(1)

.....

.....

(ii) In the table below, place a tick (✓) in the box if the statement applies to the description and place a cross (✗) in the box if the statement does not apply.

(3)

Description	**Statement**		
	Opsin binds to the rod cell membrane	**Rhodopsin bleaches**	**ATP used**
Rhodopsin responding to light			
Rhodopsin being reformed			

(Total for Question 3 = 10 marks)

4 The photograph below shows part of a leaf, as seen using a hand lens.

Magnification $\times 20$

(a) Suggest why each of the following is important for the production of carbohydrates in the photosynthetic cells.

(i) The thin lamina

(2)

(ii) Vessels in the midrib

(2)

(b) The photosynthetic cells contain many chloroplasts.

(i) Complete the table below by naming the part of the chloroplast where each of the reactions, **R**, **S** and **T**, takes place.

(3)

Reaction	Details	Part of the chloroplast
R	ADP + inorganic phosphate → ATP	
S	RuBP + CO_2 → 2 × GP	
T	2 × GP → 2 × GALP	

(ii) Place a cross ☒ in the box next to the name of reaction **R**.

(1)

☒ **A** carbon fixation

☒ **B** hydrolysis

☒ **C** phosphorylation

☒ **D** photolysis

(iii) Place a cross ☒ in the box next to the name of the enzyme involved in reaction **S**.

(1)

☒ **A** endonuclease

☒ **B** phosphorylase

☒ **C** RUBISCO

☒ **D** transcriptase

(iv) Suggest how GALP, formed by reaction **T**, can be used to synthesise the cellulose in plant cell walls.

(4)

(Total for Question 4 = 13 marks)