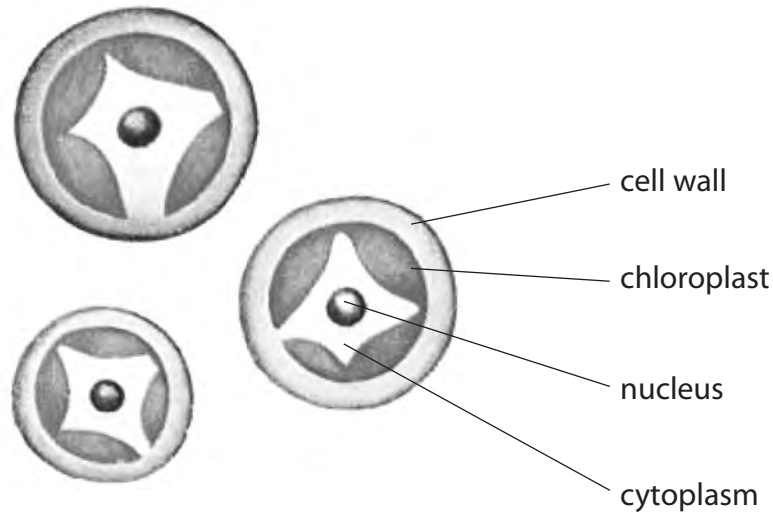


1 *Pleurococcus* is a unicellular organism that can be found on the bark of trees. Where *Pleurococcus* is growing, it appears as green patches on the bark. Each of the patches is a colony of genetically-identical cells of *Pleurococcus*, formed from a single original cell.

The diagram below shows some of the individual cells of *Pleurococcus* as they might appear using a light microscope.



(a) Place a cross ☒ in the box next to the names of the two structures that show that *Pleurococcus* would be classified as a eukaryotic organism.

(1)

- A cell wall and chloroplast
- B cell wall and cytoplasm
- C chloroplast and nucleus
- D cytoplasm and nucleus

(b) Explain how a colony of genetically-identical *Pleurococcus* cells could develop from a single original cell.

(2)

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- (c) The distribution of *Pleurococcus* on 20 trees was investigated. The percentage cover of *Pleurococcus* was measured using a quadrat measuring 10 cm × 10 cm, divided into 100 small squares.

This quadrat was placed at eight points around the trunk of each tree. Each point on the tree faced a different direction. At each point, light intensity and moisture content were measured at mid-day.

The mean results are shown in the table below.

Point	Direction	Mean percentage cover (%)	Mean light intensity / arbitrary units	Mean moisture content / arbitrary units
1	North	89	6.6	8.8
2	North-east	86	6.4	8.6
3	East	84	6.9	8.7
4	South-east	67	7.3	7.5
5	South	46	8.7	5.2
6	South-west	51	8.4	5.1
7	West	60	8.1	7.0
8	North-west	78	7.6	8.2

- (i) Suggest how this 10 cm × 10 cm quadrat was used to obtain the percentage cover of *Pleurococcus* at each point.

(2)

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(ii) Place a cross ☒ in the box next to the best conclusion that can be drawn from these results, about the distribution of *Pleurococcus*.

(1)

- A** it is affected by both light intensity and moisture content
- B** it is affected by light intensity more than moisture content
- C** it is affected by moisture content more than light intensity
- D** it is not affected by either light intensity or moisture content

(iii) Suggest how more evidence for the relationship between light intensity and the distribution of *Pleurococcus* could be obtained.

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(iv) Name **one** biotic factor and suggest how this factor might affect the distribution of *Pleurococcus* on the trees.

(2)

Biotic factor

Effect

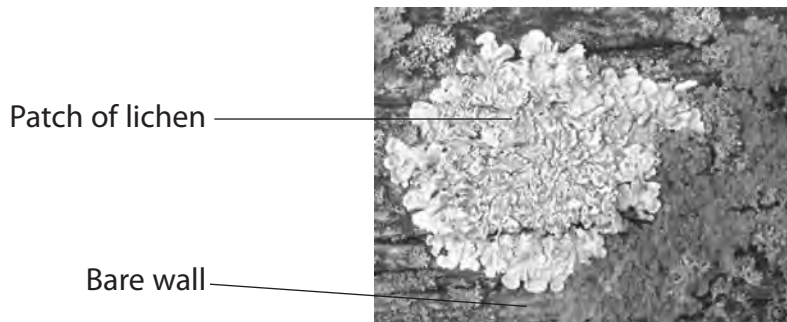
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(Total for Question 1 = 11 marks)

- 2 Lichen consists of two organisms, an alga and a fungus, growing together. The alga photosynthesises producing carbohydrate for the two organisms and the fungus absorbs and retains water so that the lichen does not dry out.

The photograph below shows a patch of lichen growing on a wall.



Magnification $\times 1$

Algae and fungi are eukaryotic organisms.

- (a) Place a cross in the box next to the names of cell structures that would be used to classify algae and fungi as eukaryotic organisms.

(1)

- A** cytoplasm and large (80S) ribosomes
- B** cytoplasm and small (70S) ribosomes
- C** nucleus and large (80S) ribosomes
- D** nucleus and small (70S) ribosomes

- (b) Place a cross in the box next to one difference in cell structure between these two eukaryotic organisms.

(1)

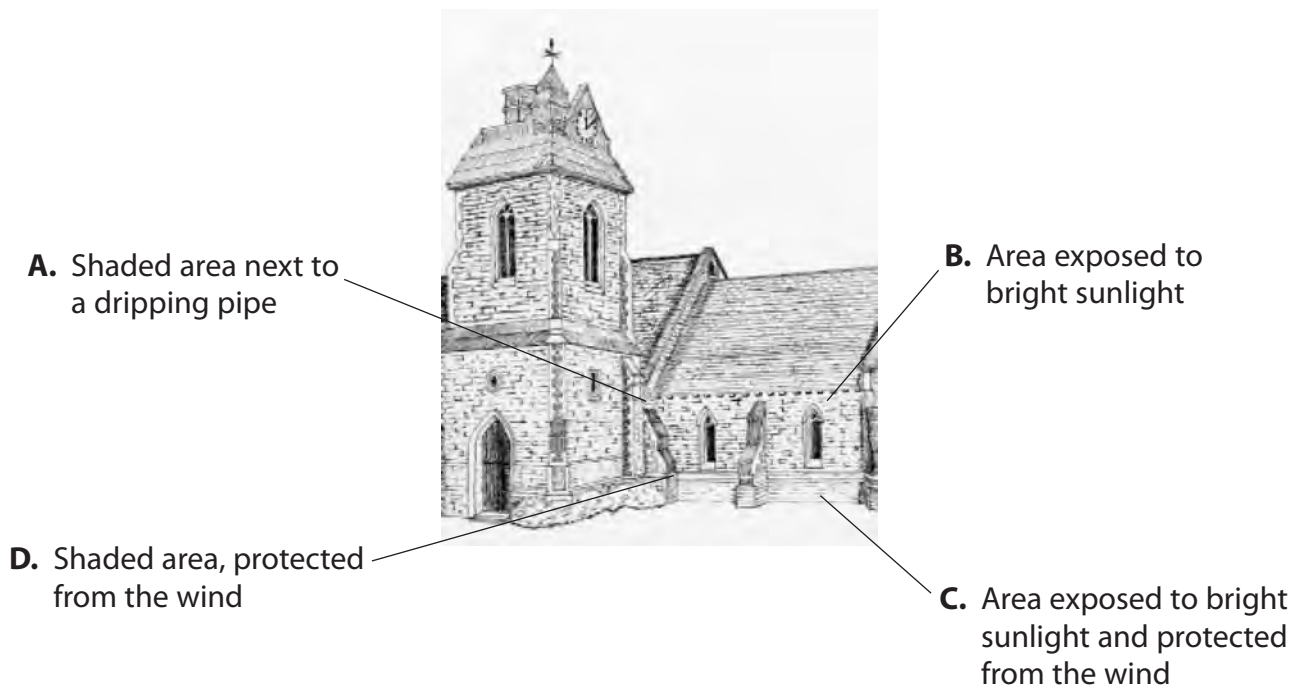
- A** algae have chloroplasts, fungi do not
- B** algae have circular DNA, fungi have linear DNA
- C** fungi have chloroplasts, algae do not
- D** fungi have circular DNA, algae have linear DNA

(c) Lichens can reproduce sexually and asexually. Sexual reproduction involves meiosis and asexual reproduction involves mitosis.

Suggest advantages to lichens of being able to reproduce both sexually and asexually.

(2)

(d) The diagram below shows the conditions at four positions, A, B, C and D, on a building.



(i) Place a cross ☒ in the box next to the position where the lichen is likely to be most abundant.

(1)

- A**
- B**
- C**

(ii) The abundance of lichen on the walls of this building can be measured by determining the percentage cover of lichen.

Suggest how the percentage cover of lichen could be determined.

(3)

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(iii) Explain how light intensity could be measured at the surface of the wall.

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(iv) Suggest how the data collected could be used to show whether there is a relationship between the abundance of lichen and light intensity.

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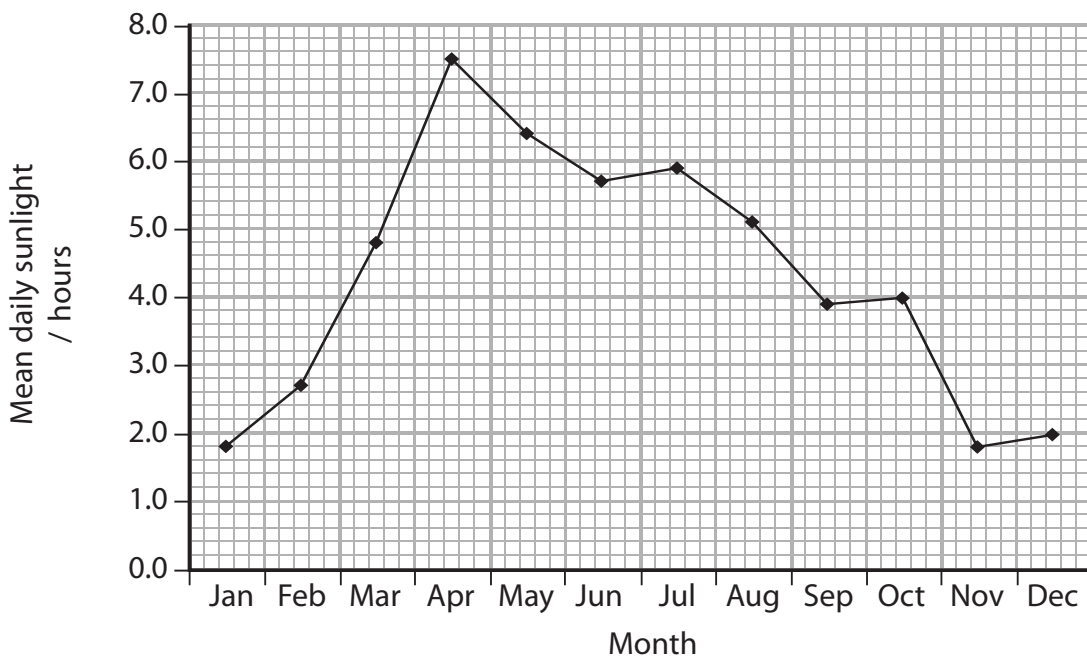
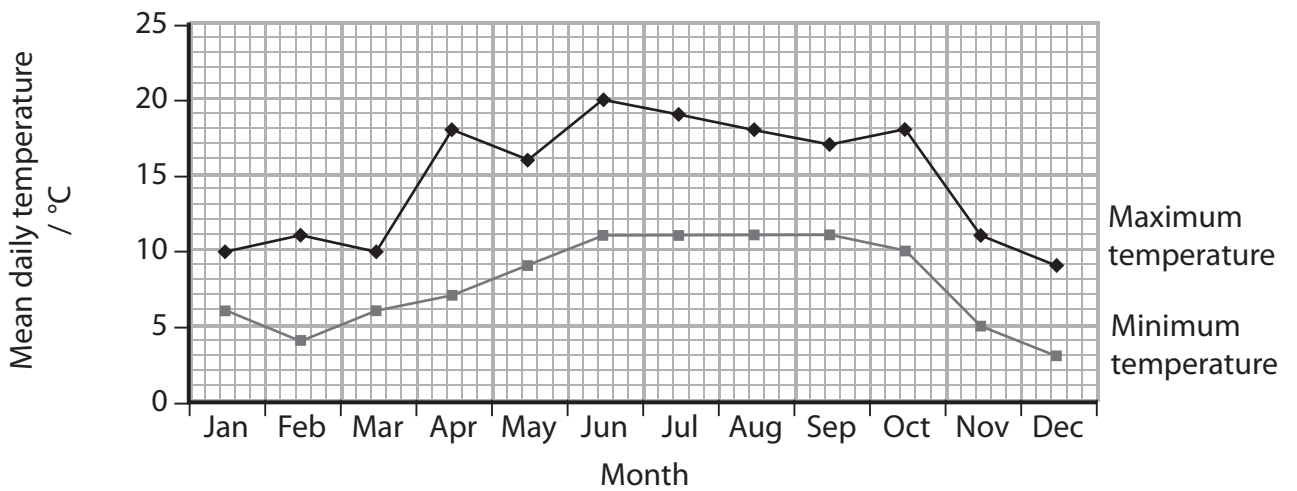
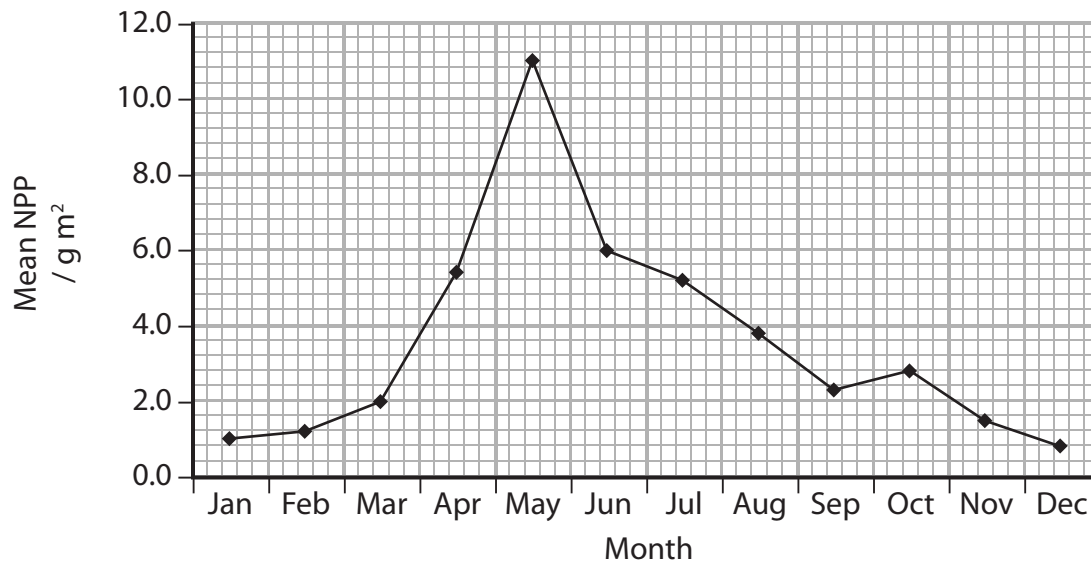
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(Total for Question 2 = 13 marks)

3 The graphs below show data collected at a weather station in North Wales during 2007.

The monthly means of net primary productivity (NPP), daily maximum and minimum temperatures and sunlight hours are shown for grassland at this weather station.



(a) (i) Explain what is meant by the term **net primary productivity**.

(2)

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(ii) Calculate the overall percentage increase in the mean NPP from January to May.

(3)

Answer %

(b) Suggest why an increase in temperature may cause an increase in NPP.

(2)

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(c) Using information from the graphs, describe and explain the relative effects of temperature and hours of sunlight on NPP in this grassland.

(4)

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(d) Temperature and hours of sunlight are abiotic factors.
Suggest **two** biotic factors that may influence NPP in this grassland.

(2)

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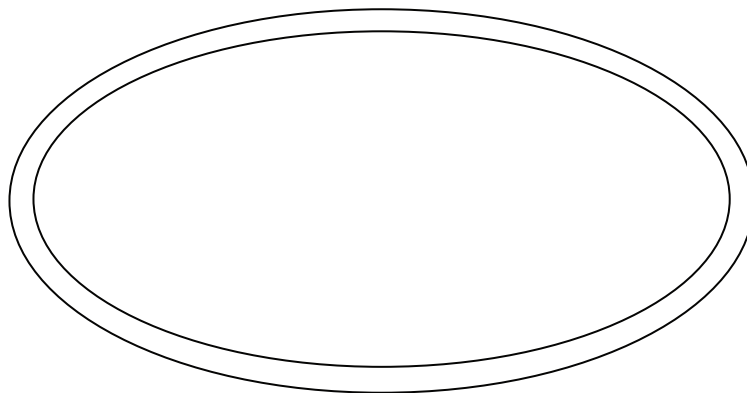
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(Total for Question 3 = 13 marks)

4 In seaweeds that are found on shores around Britain, photosynthesis occurs during the time that they are submerged at high tide. Seaweeds found near the top of the shore are submerged for short periods in shallow water. Seaweeds found lower down the shore are submerged for longer periods in deeper water.

(a) The diagram below shows the double-membrane envelope of a chloroplast.



(i) Complete the diagram to show the structures involved in the light-dependent reactions of photosynthesis. Label these structures.

(2)

(ii) The table below shows two statements taken from a student's essay about the light-dependent reactions of photosynthesis. Complete the following table by placing a tick (✓) in the correct column next to each statement to show whether it is true or false.

(2)

Statement	True	False
Electrons in chlorophyll are excited as light energy is absorbed		
The energy absorbed by chlorophyll is used to generate ADP and NADP		

(iii) Explain how oxygen is produced during the light-dependent reactions of photosynthesis.

(2)

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- (b) As light penetrates deeper water, red, orange and yellow wavelengths are absorbed by the seawater, whereas in shallow water most wavelengths penetrate.

The table below shows the relative rates of photosynthesis in a green seaweed, *Ulva lactuca*, and a red seaweed, *Schizymenia dubyi*, at different wavelengths of light.

The relative rates of photosynthesis are compared with the rate in light with a wavelength of 660 nm (red).

Seaweed	Relative rate of photosynthesis / arbitrary units		
	430 nm (blue)	540 nm (green)	660 nm (red)
<i>Ulva lactuca</i>	0.94	0.17	1.0
<i>Schizymenia dubyi</i>	0.38	3.40	1.0

- (i) Using the data in the table, suggest where each of these two seaweeds is most likely to be found on a seashore. Place a tick (✓) in the most appropriate box in each column.

(2)

Position on shore	<i>Ulva lactuca</i>	<i>Schizymenia dubyi</i>
Top of the shore		
Middle of the shore		
Lower down the shore		
All regions		

- (ii) Give reasons for your answers.

(4)

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(Total for Question 4 = 12 marks)