Questions are for both separate science and combined science students unless indicated in the question

Q1.

A student investigated the effect of different factors on photosynthesis.

The student used three leaves growing on the same plant.

Each leaf was treated in a different way.

After 48 hours the student tested each leaf for starch.

Table 1 shows the results.

Table 1

Leaf tested	Treatment	Result after 48 hours
1	Upper and lower surfaces covered with black paper	No starch present
2	Upper and lower surfaces covered and sealed with transparent plastic	No starch present
3	**Not** covered	Starch present

(a) Explain the results for the three leaves.

(5)

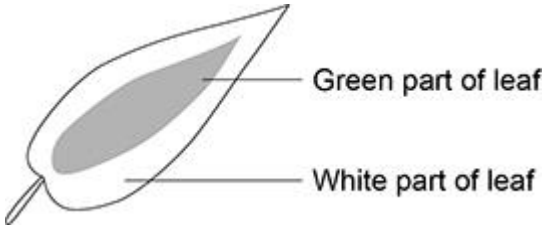
In another investigation the student used a different type of plant.

The plant was left uncovered in the light for 48 hours.

After 48 hours the student tested a leaf from the plant for starch.

Figure 1 shows the leaf before it was tested for starch.

Figure 1



(b) Complete **Table 2** to show the results you would expect for the starch test on the leaf in **Figure 1**.

Table 2

Part of leaf tested	Result after 48 hours
Green	
White	

(1)

(c) Explain the results you gave in part (b).

_____

_____

_____

_____

(2)

In some leaves, the green parts become yellow because of an ion deficiency.

(d) Which ion is deficient in a plant with yellow leaves? **(biology only) (HT only)**

_____

(1)

(e) Give the scientific term that describes the yellow colour of the leaves. **(biology only) (HT only)**

_____

(1)

(f) The rate of photosynthesis is affected by different factors.

How could the oxygen produced during photosynthesis be used to measure the **rate** of photosynthesis?

_____

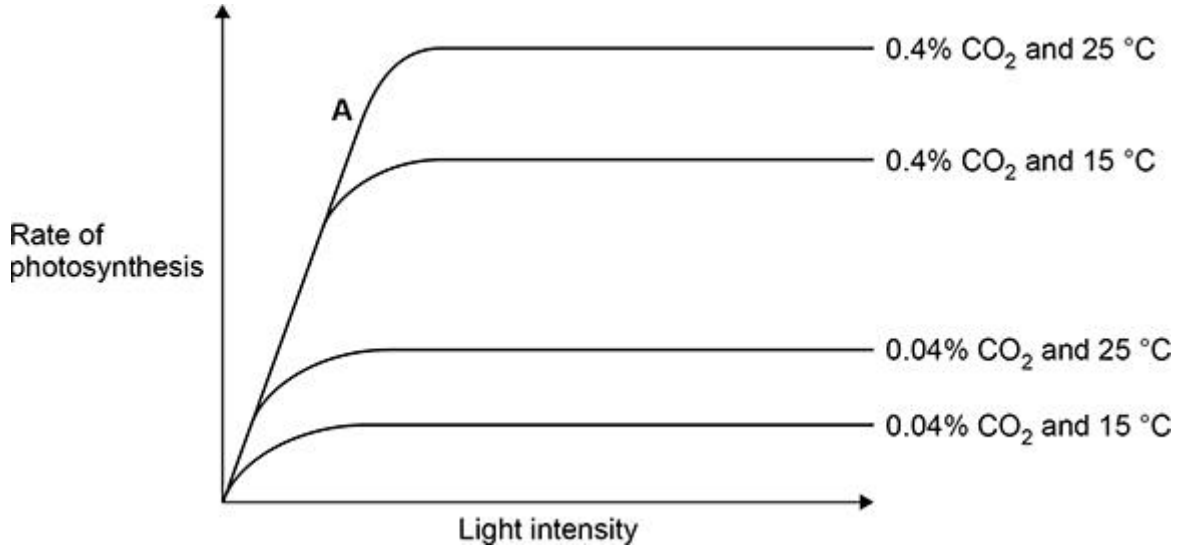
_____

(1)

Light, carbon dioxide and temperature are limiting factors of photosynthesis.

Figure 2 shows how the rate of photosynthesis is affected by light, carbon dioxide and temperature.

Figure 2



(g) At point **A** on **Figure 2**, light is a limiting factor.

What is meant by a 'limiting factor'? **(HT only)**

_____

_____

(1)

(h) Explain the effect of increasing temperature and increasing carbon dioxide concentration on the rate of photosynthesis shown in **Figure 2**. **(HT only)**

(4)

(i) Photosynthesis investigations often use a light source.

The spreading out of light from a source obeys the inverse square law.

The inverse square law links light intensity to distance from the light source.

Which of the following shows the inverse square law? **(HT only)**

Tick (✓) **one** box.

$\text{light intensity} \propto \frac{1}{\text{distance}^2}$ ☐

$\text{light intensity} \propto \text{distance}^2$ ☐

$\frac{1}{(\text{light intensity})^2} \propto \text{distance}^2$ ☐

$\frac{1}{(\text{light intensity})^2} \propto \frac{1}{\text{distance}^2}$ ☐

(1)

(Total 17 marks)

Q2.

This question is about photosynthesis.

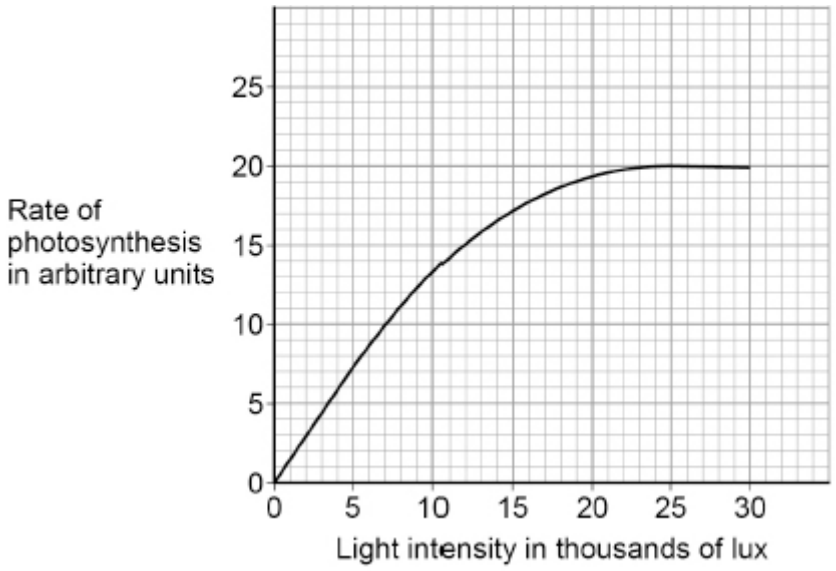
(a) Complete the symbol equation for photosynthesis.

6 _____ + 6 _____ → $C_6H_{12}O_6$ + 6 _____

(1)

Figure 1 shows how the rate of photosynthesis changes with light intensity.

Figure 1



(b) Which part of the graph could be represented by the equation $y = mx + c$?

Tick (✓) **one** box.

From 0 to 5 000 lux ☐

From 10 000 to 15 000 lux ☐

From 15 000 to 20 000 lux ☐

From 20 000 to 25 000 lux ☐

(1)

A student investigated the effect of colour of light on the rate of photosynthesis in leaves.

Figure 2 shows how the investigation was set up.

Figure 2

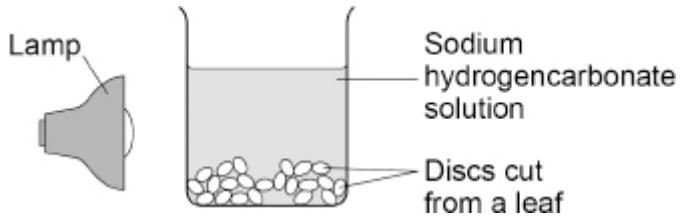


Table 1 shows the results.

Table 1

Colour of light	**Time taken for 10 leaf discs to reach the surface of the solution in seconds**
Blue	115
Green	831
Red	397

(c) Give **one** way the student could change the colour of the light shining on the leaf discs.

_____

_____

(1)

(d) Give the independent variable and the dependent variable in this investigation.

Independent variable _____

_____

Dependent variable _____

_____

(2)

(e) All of the air had to be removed from the leaf discs before placing them in the beaker.

Suggest **one** reason why.

_____

_____

(1)

(f) The leaf discs were placed in a beaker of sodium hydrogencarbonate ($NaHCO_3$) solution.

Explain why sodium hydrogencarbonate solution was used instead of water.

_____

_____

_____

_____

(2)

(g) Explain why the leaf discs moved to the surface of the solution during the investigation.

_____

_____

_____

_____

(2)

There are two types of chlorophyll in leaves.

Figure 3 shows the percentage of different wavelengths of light that the two types of chlorophyll absorb.

Figure 3

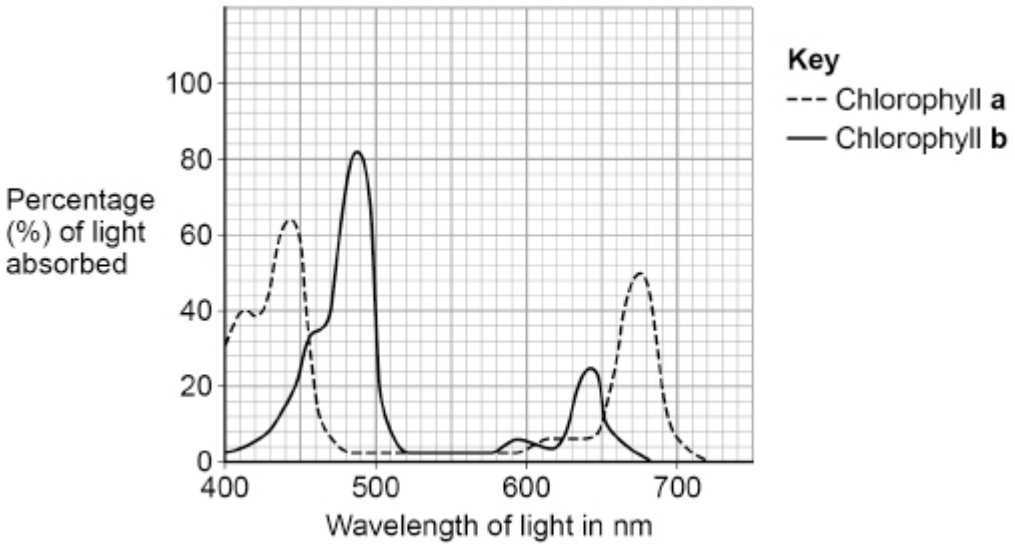


Table 2 shows the colour of different wavelengths of light.

Table 2

Range of wavelength of light in nm	Colour of light
380 – 435	violet
450 – 499	blue
500 – 570	green
571 – 590	yellow
620 – 720	red

(h) Suggest the advantage to a plant of having two types of chlorophyll.

_____

_____

(1)

(i) **Table 1** is repeated below.

Table 1

Colour of light	**Time taken for 10 leaf discs to reach the surface of the solution in seconds**
Blue	115
Green	831
Red	397

The leaf discs in the investigation are green.

Explain the results in **Table 1** for blue light and for green light.

Use data from **Figure 3** and **Table 2**.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 15 marks)