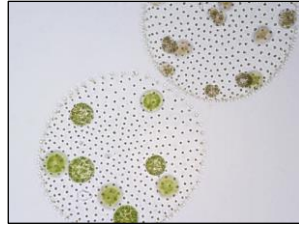
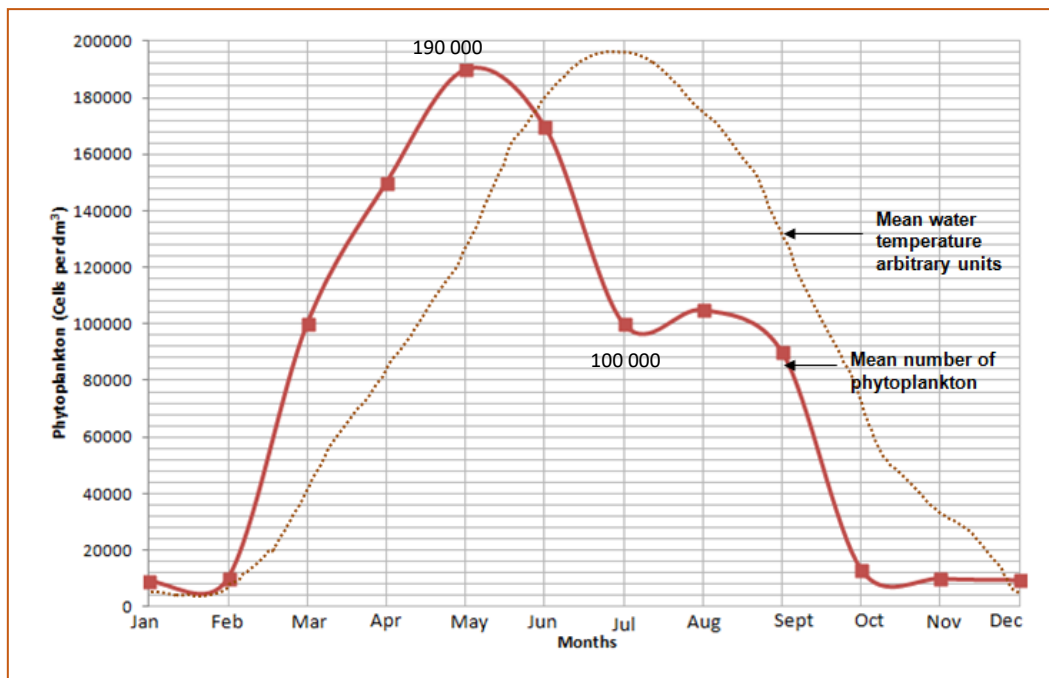


A: Bioenergetics Part 1 - Photosynthetic reaction, rate of photosynthesis and use of glucose from photosynthesis.

1. Phytoplankton are microscopic aquatic plants. They utilise the energy transferred from the sun for photosynthesis.



Scientists working in the North Sea collected 500 samples of sea water at the same depth and location every month for a whole year. They measured the number of phytoplankton and water temperature for each sample and calculated the mean. The graph shows the mean number of phytoplankton and water temperature per month.



- a) Explain why the numbers of phytoplankton are lower in winter months. (2)

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b) Calculate the percentage decrease in numbers of phytoplankton between May and July. Write your answer to 3 significant figures. (3)

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c) Suggest the cause and reason why the numbers of phytoplankton fall at the start of summer. (2)

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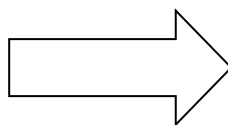
2. Van Helmont was a scientist born in the Netherlands in 1580. It was generally believed at that time that plants gained mass by eating soil.

Van Helmont designed an experiment to test this idea. The results of his experiment are seen below.



Willow plant in an iron pot.
 Willow plant has a mass of 2.5kg
 Mass of dry soil is 91kg

Only water was added for five years.



Willow plant in same iron pot.
 Willow plant has a mass of 77.3kg
 Mass of dry soil is 90.043kg

a) Write a conclusion for this experiment using only the information provided. Explain your reasoning. (4)

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b) List **two** extra investigations that would be needed to prove that the plant gained mass due to photosynthesis occurring. (2)

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3. There is a total of 7000×10^9 tonnes of carbon dioxide in the atmosphere and photosynthesis converts 100×10^9 tonnes per year into carbon compounds such as carbohydrates, protein or lipids. We call this carbon fixing.

a) Calculate as a percentage how much carbon is fixed per year from the atmosphere. Express your answer to 2 significant figures. (2)

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b) Suggest **two** reasons why the amount of carbon dioxide in the atmosphere stays relatively constant. (2)

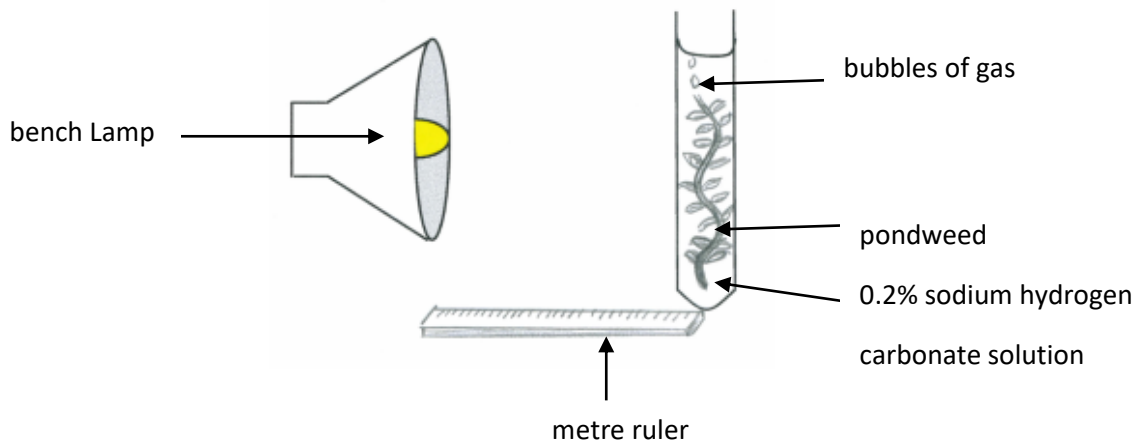
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4. A student carried out the practical which involved testing the effect of light intensity on the rate of photosynthesis. The pond weed was left to settle for 15 minutes in between each set of results being collected. The equipment was set up as shown below:

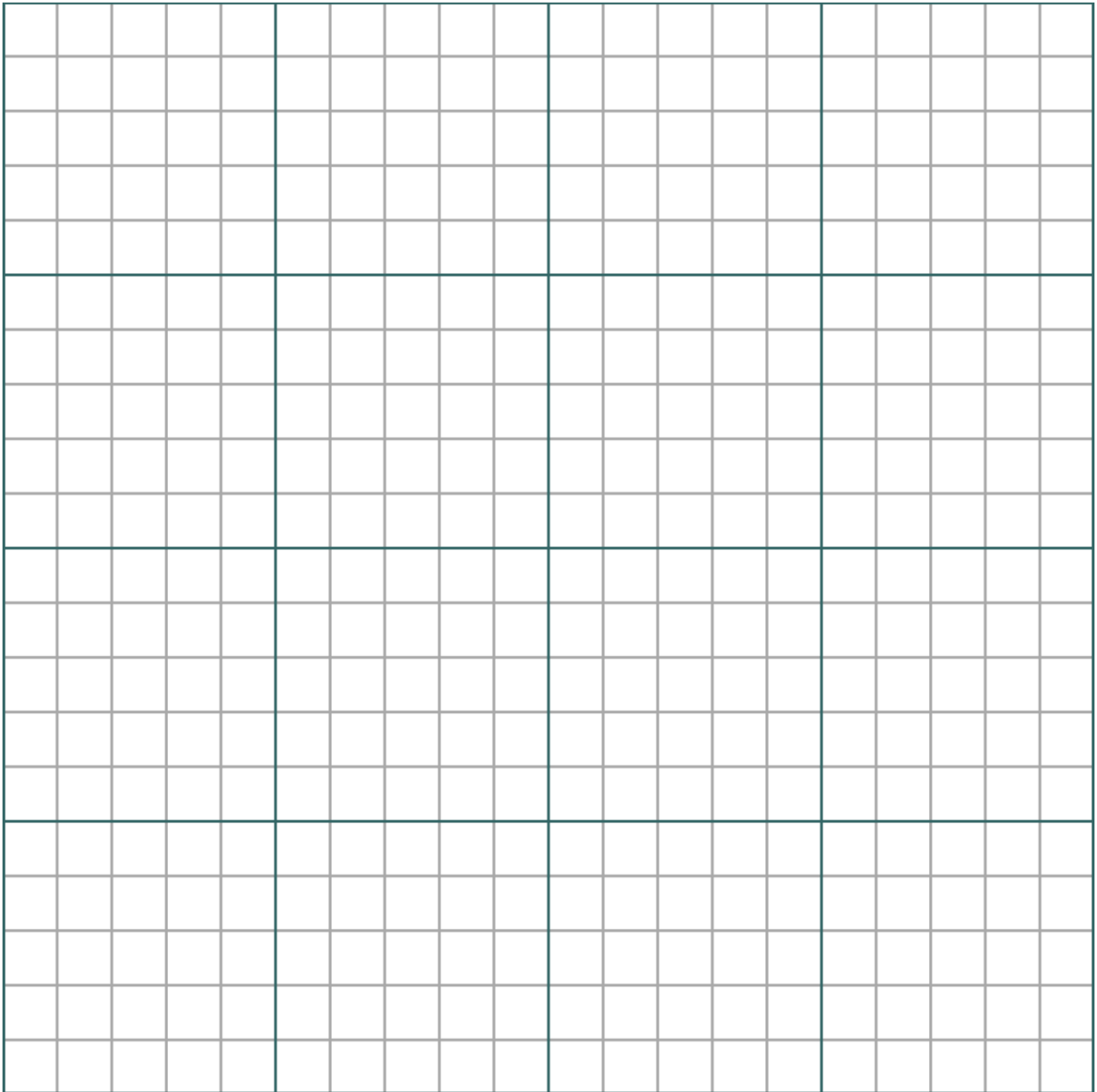


The student recorded the results in the table below:

Distance of lamp from boiling tube (cm)	Number of bubbles counted in 1 minute				Light Intensity (in standard form) $1/d^2$
	Trial 1	Trial 2	Trial 3	Mean number of whole bubbles	
20	10	15	18		
40	10	12	16		
60	9	10	14		
80	6	7	10		
100	3	4	6		

- Determine the mean number of bubbles of gas collected for each distance and record in the table. (2)
- Calculate the light intensity for each experiment and record in the table (5)

c) Plot a graph to show the effect of light intensity on the rate of photosynthesis. (4)



d) Use your graph to estimate the number of whole bubbles which would be released from the pondweed when the lamp was at a distance of 30cm. (3)

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e) All the data shows an increase in number of bubbles collected during trial 3. Suggest **two** reasons why this may have occurred. Explain how this could be verified **and** how would you improve the method for the future. (6)

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f) Photosynthesis is an endothermic reaction. Explain what this statement means. (2)

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Extended Response question

5. A farmer in the UK decided to grow lemon trees in two greenhouses in order to sell the fruit locally. He had grown some lemon trees outside but these had not produced sufficient lemons to make it worthwhile. He decided to heat one of the greenhouses to 35°C and the other to 45°C. There were the same numbers of lemon trees in each greenhouse and all other factors were kept constant. Both greenhouses contained healthy plants. The lemons were all sold at 55p each.

	Greenhouse A (35°C)	Greenhouse B (45°C)
Number of lemons produced in one year	1050	879
Cost to heat the greenhouse per year	£438.00	£492.80
Profit made		

- a) Using the data given calculate the profit that the farmer made from each greenhouse and complete the table. (4)
- b) The farmer was surprised by the results.

Use your knowledge of limiting factors to explain the results and suggest three changes the farmer should make to increase productivity and profit for the following year in Greenhouse A. (6)

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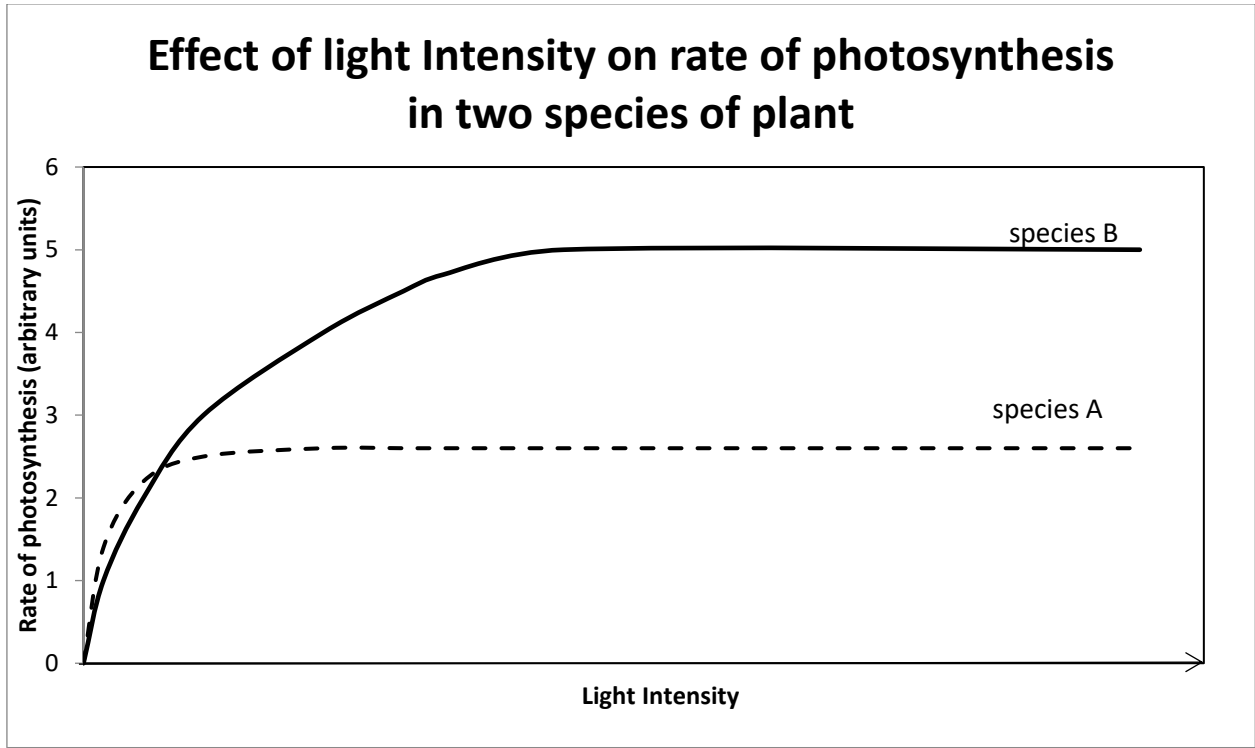
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6. The following graph shows the effect of light intensity on the rate of photosynthesis for two plant species.



a) Explain which plant is most likely to thrive in sunny positions in a garden. (3)

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b) Suggest why species A is unable to further increase the rate of photosynthesis even though it is in the same environmental conditions as species B and both receive the same amount of water. (2)

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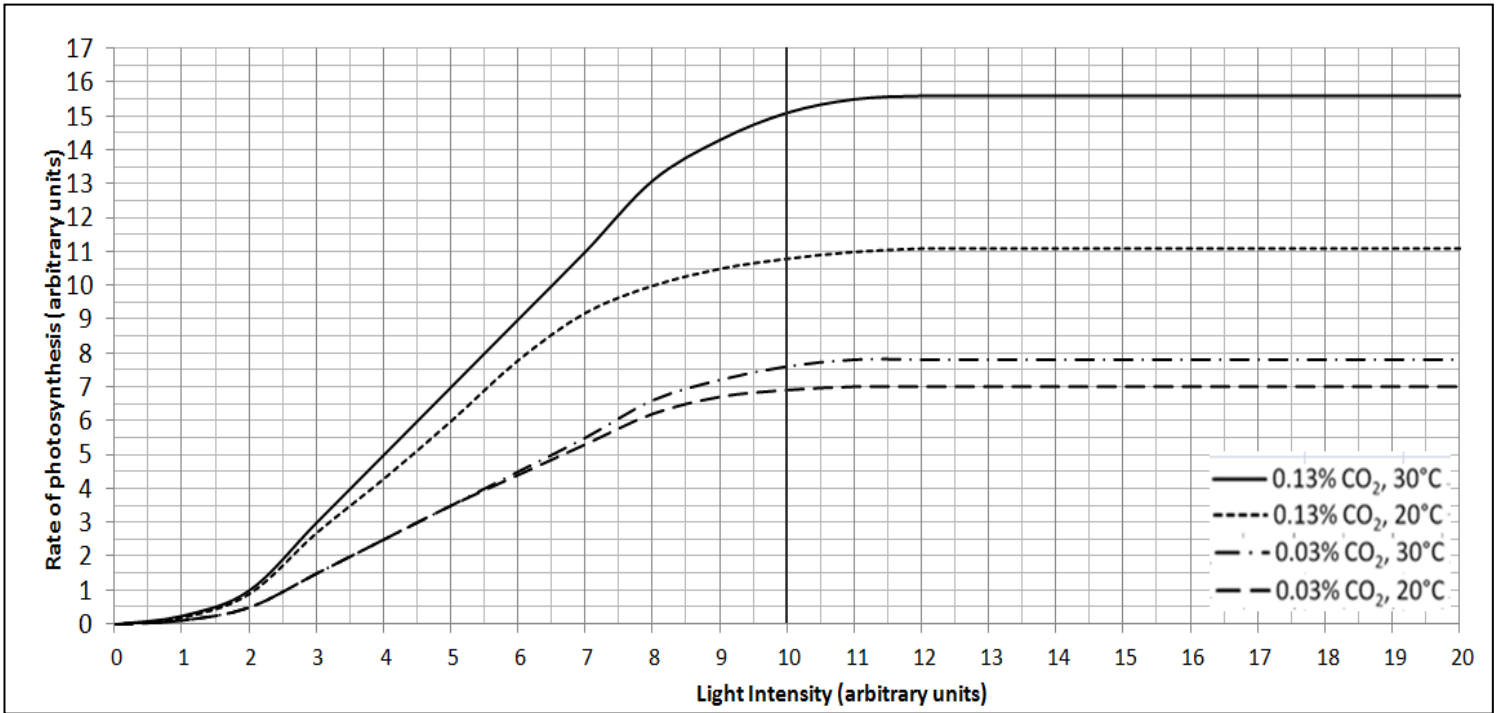
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7. The graph shows the effect of temperature and carbon dioxide concentration on the rate of photosynthesis.



If light intensity is kept constant at 10 units, calculate the percentage increase in photosynthetic rate when:

a) temperature is increased from 20°C to 30°C and carbon dioxide is kept constant at 0.03%. (2)

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b) carbon dioxide is increased from 0.03% to 0.13% and temperature is kept constant at 20°C. (2)

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B. Bioenergetics part 2 – Respiration, response to exercise and metabolism

1. Describe the differences between anaerobic and aerobic respiration in animal cells. (4)

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2. 'Some uses for the energy transferred from respiration are the same in plants and animals and some are different.' Explain what this statement means. (3)

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3. Explain why the mitochondria in cells are important. (3)

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4. Suggest how the rate of respiration in an animal cell might change over a typical 24 hour period. (2)

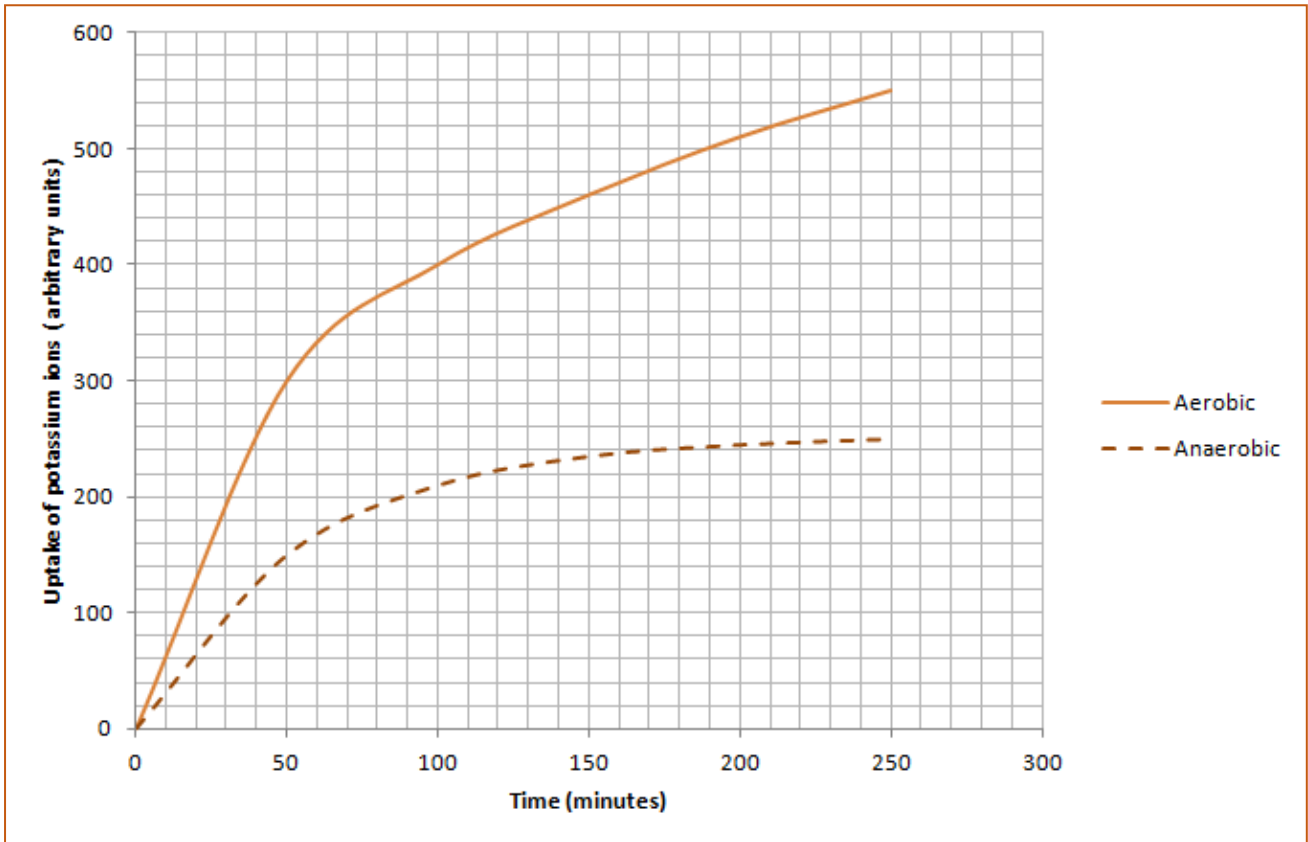
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5. A scientist was investigating the rate of active uptake of potassium ions by wheat root hair cells in aerobic and anaerobic conditions. The results are shown in the graph.



a) Explain why the roots of a plant must have a good supply of oxygen in order to take in mineral salts. (3)

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b) The rate of potassium ion transfer from the soil to the root hair cell between 150 and 200 minutes in the anaerobic experiment was 0.2 arbitrary units per minute.

Determine the rate of transfer of potassium ions between 150 and 200 minutes for aerobic respiration. Show your working. (3)

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6. A patient was linked to a heart rate monitor whilst doing exercise. Explain why the patient's heart rate increased from 75 beats per minute to 120 beats per minute. (5)

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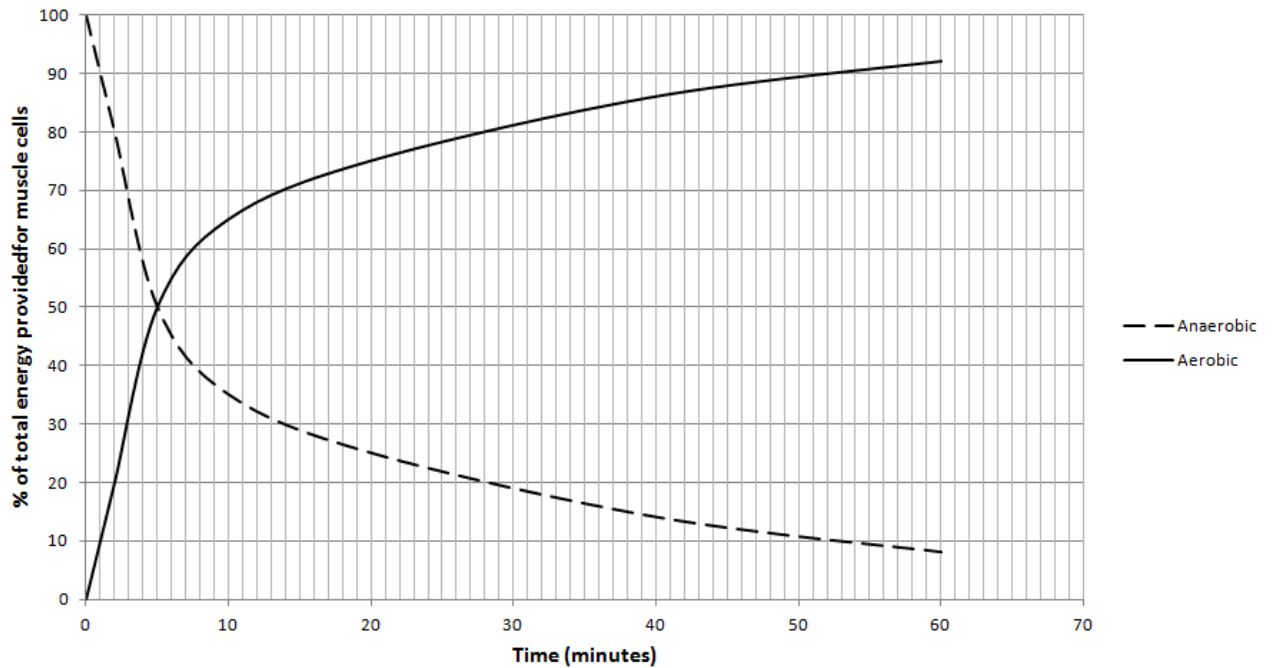
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7. Extended response question:

Wild dogs tend to rely on stamina and wear down their prey with a long chase which can be up to an hour. Their muscles fatigue slowly as they pace themselves.

This graph shows how much energy is being produced for muscle cells from anaerobic and aerobic respiration during exercise.



Using the information provided and your own knowledge describe and explain how energy is being transferred to the muscles in the dog at the start, middle **and** end of a 60 minute hunt. Include word equations in your answer. (6)

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