Education Services Ltd

EB Education Revision Guide

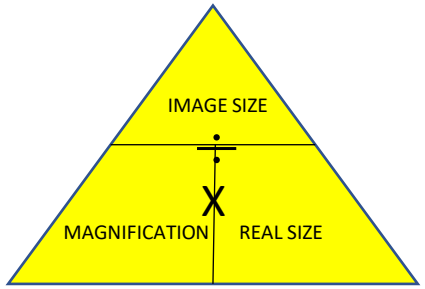
How to work with Required Practicals: Part 1
Combined (AQA Biology Paper 1)

...helping everybody achieve Even Better

Assessed Required Practical Activities
Paper 1
Foundation

Required practical activity 1: use of a light microscope.
Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.
Required practical activity 5: investigate the effect of light on the rate of photosynthesis of an aquatic plant such as pondweed

Practical 1: Using a Microscope



What you need to know

- Be able to label a light microscope (see diagram)
- Be able to explain how to set up a microscope slide and look at it under a microscope (always start with the lowest magnification).
- Remember and rearrange the equation
- Know the units and how to convert between them

  1m = 1000mm

  1mm = 1000µm

  1µm = 1000nm

You may need a ruler to measure the size of images and work out their real size.

- Explain that we can see the nucleus and cell wall but not the mitochondria as they're far too small and not stained.
- Explain how we could see smaller parts of cells by using an electron microscope which has much more resolution and magnification.

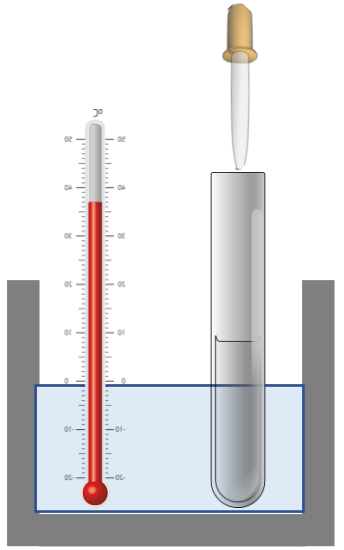
REMEMBER:
Use a stain to make things visible.
Get the specimen as flat and thin as possible.
Start on the smallest lens, focus, then move up a lens.

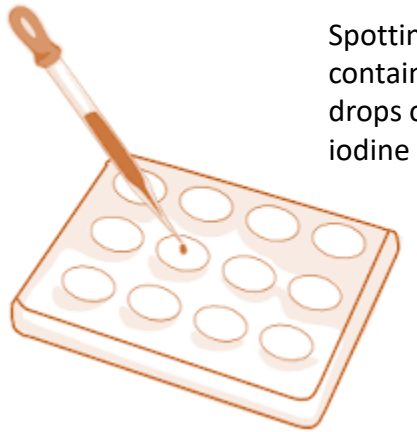
Practical 3: Enzymes

What you need to know

This practical investigates the effect of pH on enzyme activity.

- Enzymes increase the rate of reactions in the body by lowering the activation energy required. All enzymes have an optimum pH. If the pH is too low (too acidic) or too high (too alkaline) – the enzyme will denature. This means the active site will change shape, and the substrate can no longer fit into the active site.
- You may need to explain that a water bath is needed in order to maintain the correct temperature, This is because temperature will also change the reaction rate. If the temperature is too high the enzyme will denature. If it is too low, the reaction rate will be slower as there will be less frequent collisions.
- You may need to explain why it is not possible to decide the exact optimum pH in the experiment if you test at pH 2, 3, 4 etc. This is because the optimum pH could be between two of these, for example it could be between pH 7 and pH8. You would need to test at different pH's in between to decide the optimum.





Spotting tile containing drops of iodine

Starch reacts with amylase in a water bath.
Samples are taken from the mixture every 30 seconds and added to the iodine in the spotting tile.
Iodine goes black = starch present – this happens when starch has not been digested yet or if the pH is too low or too high.
Iodine stays brown = no starch present (the starch has been digested). The quicker it remains brown, the faster the rate of reaction. This will happen at pH 7-9.
This is repeated for a range of different pH solutions.

Practical 5: Photosynthesis

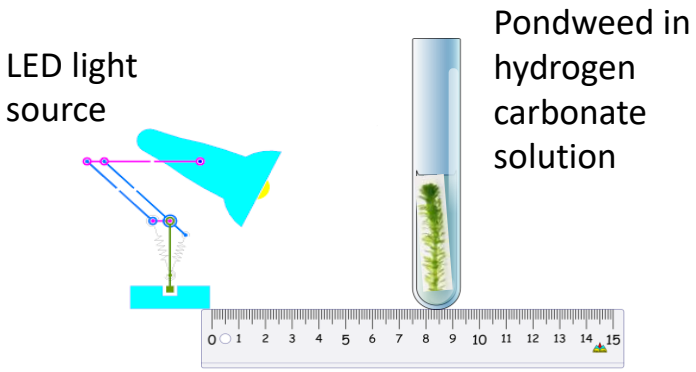
What you need to know

- Photosynthesis takes place in the chloroplasts and needs light energy to take place.
- You need to explain how light intensity affects the rate of photosynthesis.
- You may need to explain how to make the results more accurate. This could be done by using a gas syringe to measure the volume of oxygen produced in a given time, as it is difficult to count very small bubbles, and the bubbles could be different sizes. The heat produced by the lamp could also affect the number of bubbles produced. You could place a glass screen in front of the pondweed to prevent the heat getting through.
- You may also be asked to discuss why the rate of photosynthesis will not increase indefinitely even if you keep increasing the light intensity. This is because there are other limiting factors such as carbon dioxide concentration and temperature.

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

Carbon dioxide + water $\longrightarrow$ glucose + oxygen

Diagram



The lamp is placed at different distances away from the pondweed, and the number of oxygen bubbles produced is counted. The closer the lamp is, the higher the light intensity, and the faster the bubbles are produced – meaning the rate of photosynthesis is higher.

Your turn:

1. The diagram below shows human cheek cells seen under a light microscope.

a) Label a nucleus and a cell membrane on the diagram.

b) Mitochondria and ribosomes cannot be seen in the cells pictured above.

What type of microscope is needed to see mitochondria and ribosomes?

……

c) What is an advantage to using this type of microscope?

……

d) The cheek cells are magnified 250 times. The width of the image of the cell is 45mm.

Calculate the actual width of the cell in µm.

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e) A bacterial cell is 40 times smaller than a red blood cell, which has a diameter of 8µm.

Calculate the diameter of the bacterial cell.

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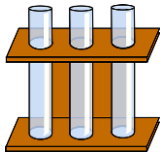
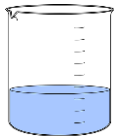
Your turn:

2. Biological washing powders can contain protease enzymes.
Describe how you could investigate the optimum pH for removing stains from clothes. The apparatus below can be used.

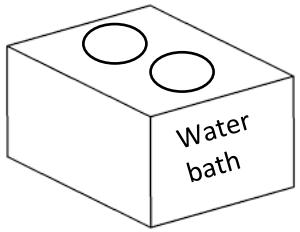


Protein stain



Detergent

Pieces of cloth



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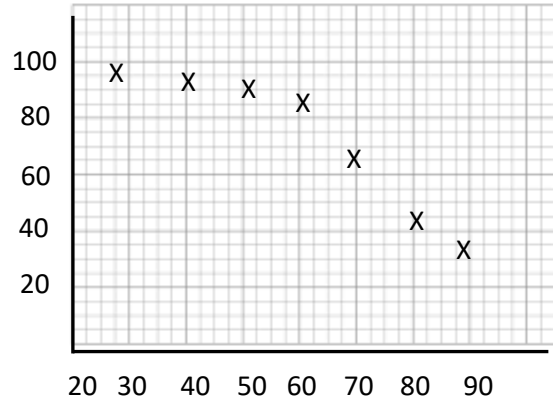
3. The stability of a protease enzyme, extracted from plants, was investigated by scientists.

- Samples of the enzyme were pre-incubated at different temperatures for 30 minutes.
- Each sample was then put on ice for another 10 minutes.
- The % remaining activity of the enzyme in each sample was then measured by incubating each sample with protein at 37°C for 5 hours.



It was recommended that the enzyme could be used in detergents at 60 °C
Why might the scientists have recommended this temperature?

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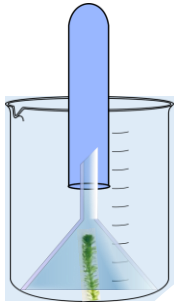
Your turn:

4a) Plants require light to carry out photosynthesis.
What is the correct equation for photosynthesis?

glucose + oxygen	→	carbon dioxide + water
carbon dioxide + glucose	→	oxygen + water
water + carbon dioxide	→	oxygen + glucose
oxygen + water	→	carbon dioxide + glucose

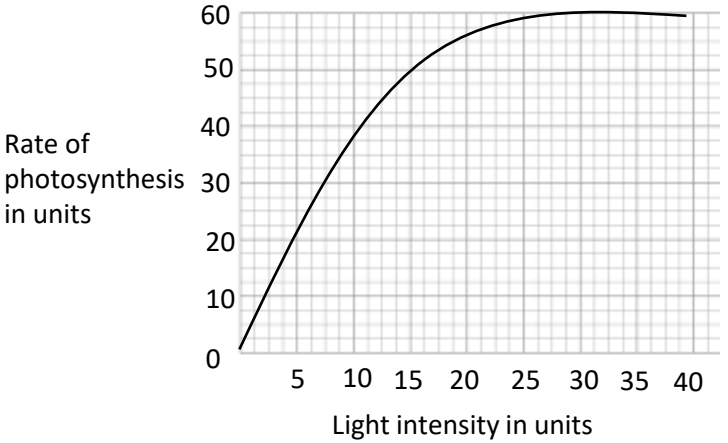
b) The apparatus below can be used to measure the rate of photosynthesis

.



Light intensity affects the rate of photosynthesis.
Describe a method to investigate this.

b) Results from a similar investigation are below.



The scientist concluded that "light stops being a limiting factor at a light intensity of 25 units."
What evidence supports this conclusion.

What could be a limiting factor at 25 units?

……

Answers:

1. The diagram below shows human cheek cells seen under a light microscope.

a) Label a nucleus and a cell membrane on the diagram.

b) Mitochondria and ribosomes cannot be seen in the cells pictured above.

What type of microscope is needed to see mitochondria and ribosomes?

Electron

c) What is an advantage to using this type of microscope?

Higher magnification/higher resolution

d) The cheek cells are magnified 250 times. The width of image of the cell is 45mm.

Calculate the actual width of the cell in µm.

45/250 = 0.18

180 µm

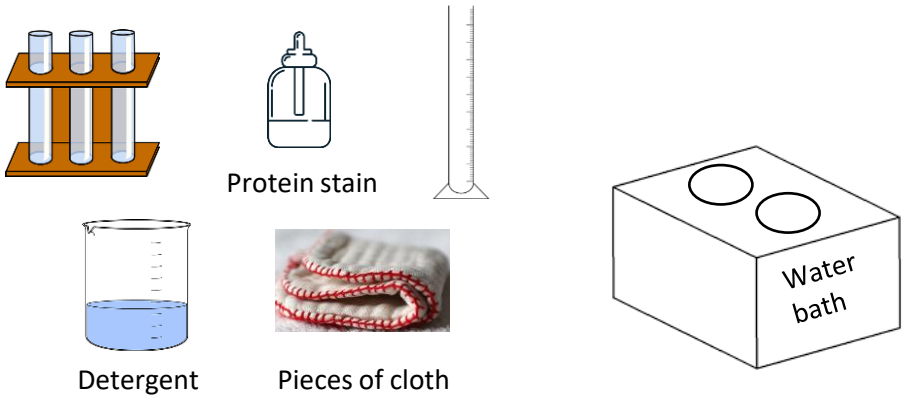
e) A bacterial cell is 40 times smaller than a red blood cell, which has a diameter of 8µm.

Calculate the diameter of the bacterial cell.

8/40 = 0.2 µm

Answers:

2. Biological washing powders can contain protease enzymes.
Describe how you could investigate the optimum pH for removing stains from clothes. The apparatus below can be used.

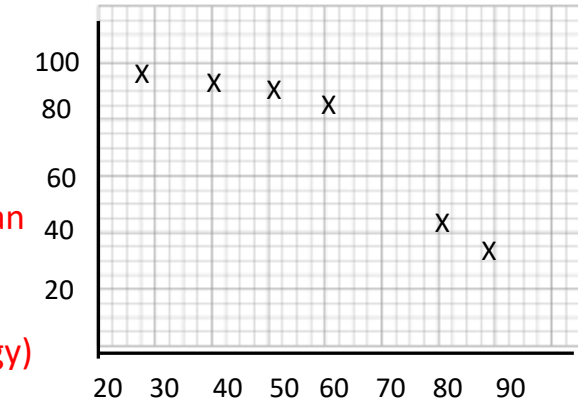


Use the measuring cylinder to measure equal volumes of the same detergent solution into the test tubes.
Apply the same number of drops of the same protein stain to each piece of cloth.
Include stainless cloth as a control.
Use forceps to transfer cloths.
Place the cloths in the test tubes. Add different buffer solutions to each test tube to provide different pH's
Use a water bath to maintain a constant temperature.
Leave the cloths in the detergent solution for the same length of time and see how much of the stain has been removed OR time how long it takes to remove the stain at each pH.
Repeat and calculate mean.

3. The stability of a protease enzyme, extracted from plants, was investigated by scientists.

- Samples of the enzyme were pre-incubated at different temperatures for 30 minutes.
- Each sample was then put on ice for another 10 minutes.
- The % remaining activity of the enzyme in each sample was then measured by incubating each sample with protein at 37°C for 5 hours.

It was recommended that the enzyme could be used in detergents at 60 °C
Why might the scientists have recommended this temperature?



Rate of reaction is high at 60 °C / higher than at lower temperatures so there are more collisions.
Higher temperatures would increase (energy) costs
or
It might damage cloth above 60°C
Higher temperatures / 60 °C is better (than lower temperatures) to remove other stains / named stains
or
better for killing bacteria / infection control

Answers:

4a) Plants require light to carry out photosynthesis.
What is the correct equation for photosynthesis?

glucose + oxygen	→	carbon dioxide + water
carbon dioxide + glucose	→	oxygen + water
water + carbon dioxide	→	oxygen + glucose
oxygen + water	→	carbon dioxide + glucose

b) The apparatus below can be used to measure the rate of photosynthesis

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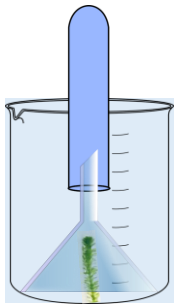
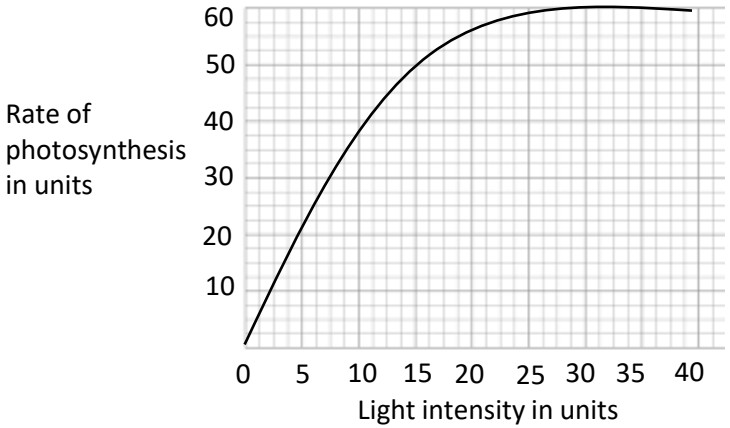


Light intensity affects the rate of photosynthesis.
Describe a method to investigate this.

- Place the lamp at different distances from the pondweed and measure the distances using a ruler. Count the number of bubbles of oxygen produced by the pondweed OR measure the amount of gas produced using a gas syringe at each distance in a given time.
- Keep the same lamp with the same colour light.
- Place a heat filter in front of the lamp to ensure the temperature does not increase.
- Control the supply of carbon dioxide in the water – and ensure the same in each experiment.
- Use the same size and type of pondweed for each experiment.
- Repeat each experiment at least 3 times.
- Calculate the mean from each experiment.

Your turn:

b) Results from a similar investigation are below.



The scientist concluded that "light stops being a limiting factor at a light intensity of 25 units."

What evidence supports this conclusion.

Rate does not increase further when light intensity increases beyond 25 units

What could be a limiting factor at 25 units?

Carbon dioxide concentration or temperature or amount of chlorophyll

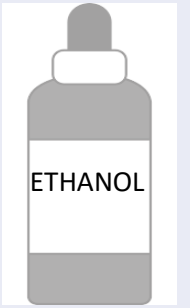
Assessed Required Practical Activities
Paper 1
Higher

Required practical activity 3: use qualitative reagents to test for a range of carbohydrates, lipids and proteins.
Required practical activity 4: investigate the effect of pH on the rate of reaction of amylase enzyme
Required practical activity 5: investigate the effect of light on the rate of photosynthesis of an aquatic plant such as pondweed

Practical 3: Food Tests

What you need to know

- Be able to describe how to test foods for the presence of starch, protein, reducing sugars (glucose) or fats.
- To explain whether the test is qualitative or quantitative. Most food tests are qualitative – they tell you whether it contains the substance, but do not tell you how much there is. The reducing sugar test will give you an indication of how much sugar is in the food – because of the different colour in the results.
- You may get asked questions on the difficulty of judging colour changes, or how you could make mistakes during the experiments.

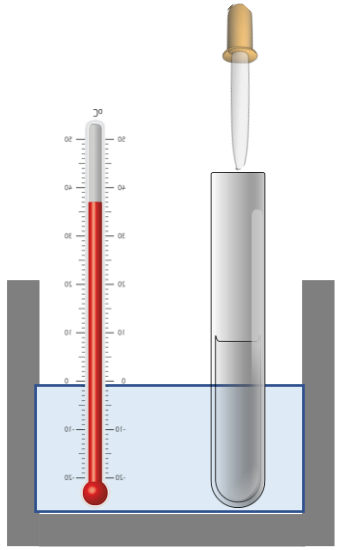
Chemical	Tests for:	Method	Result	Chemical	Tests for:	Method	Result
	Starch	Add iodine solution directly to the substance	Turns blue black if starch is present		Protein	Add Biuret's solution to the sample (liquid)	Turns purple if protein present
	Reducing sugar	Add Benedict's solution to the sample (liquid) Heat for 2 minutes in a water bath	Turns brick red (green, yellow orange if less sugar)		Lipid	Add ethanol to the liquid sample and shake Add water	Turns cloudy, milky if lipid present

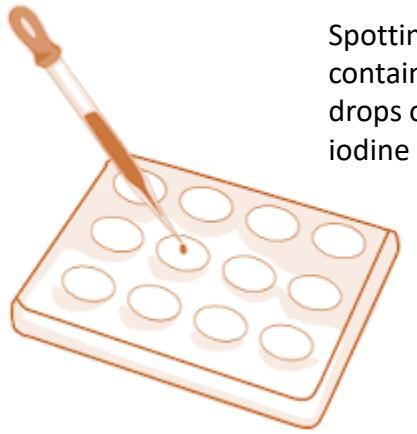
Practical 4: Enzymes

What you need to know

This practical investigates the effect of pH on enzyme activity.

- Enzymes increase the rate of reactions in the body by lowering the activation energy required. All enzymes have an optimum pH. If the pH is too low (too acidic) or too high (too alkaline) – the enzyme will denature. This means the active site will change shape, and the substrate can no longer fit into the active site.
- You may need to explain that a water bath is needed in order to maintain the correct temperature, This is because temperature will also change the reaction rate. If the temperature is too high the enzyme will denature. If it is too low, the reaction rate will be slower as there will be less frequent collisions.
- You may need to explain why it is not possible to decide the exact optimum pH in the experiment if you test at pH 2, 3, 4 etc. This is because the optimum pH could be between two of these, for example it could be between pH 7 and pH8. You would need to test at different pH's in between to decide the optimum.





Spotting tile containing drops of iodine

Starch reacts with amylase in a water bath.
Samples are taken from the mixture every 30 seconds and added to the iodine in the spotting tile.
Iodine goes black = starch present – this happens when starch has not been digested yet or if the pH is too low or too high.
Iodine stays brown = no starch present (the starch has been digested). The quicker it remains brown, the faster the rate of reaction. This will happen at pH 7-9.
This is repeated for a range of different pH solutions.

Practical 5: Photosynthesis

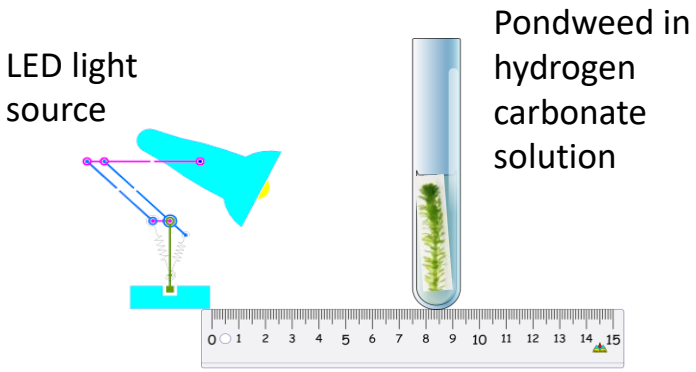
What you need to know

- Photosynthesis takes place in the chloroplasts and needs light energy to take place.
- You need to explain how light intensity affects the rate of photosynthesis.
- You may need to explain how to make the results more accurate. This could be done by using a gas syringe to measure the volume of oxygen produced in a given time, as it is difficult to count very small bubbles, and the bubbles could be different sizes. The heat produced by the lamp could also affect the number of bubbles produced. You could place a glass screen in front of the pondweed to prevent the heat getting through.
- You may also be asked to discuss why the rate of photosynthesis will not increase indefinitely even if you keep increasing the light intensity. This is because there are other limiting factors such as carbon dioxide concentration and temperature.

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

Carbon dioxide + water $\longrightarrow$ glucose + oxygen

Diagram



The lamp is placed at different distances away from the pondweed, and the number of oxygen bubbles produced is counted. The closer the lamp is, the higher the light intensity, and the faster the bubbles are produced – meaning the rate of photosynthesis is higher.

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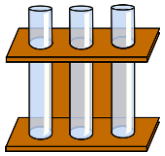
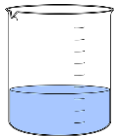
Your turn:

1. Biological washing powders can contain protease enzymes.
Describe how you could investigate the optimum pH for removing stains from clothes. The apparatus below can be used.

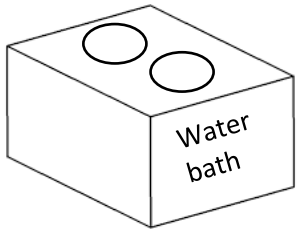


Protein stain



Detergent

Pieces of cloth



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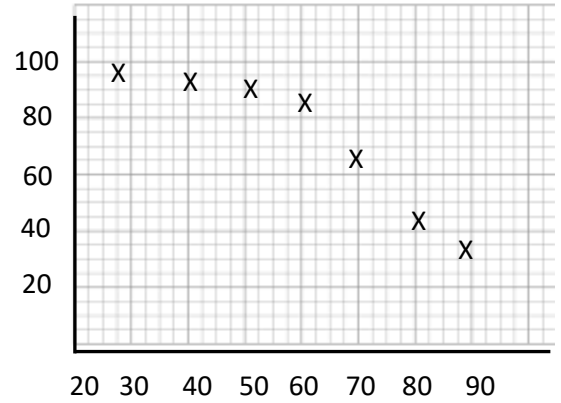
2. The stability of a protease enzyme, extracted from plants, was investigated by scientists.

- Samples of the enzyme were pre-incubated at different temperatures for 30 minutes.
- Each sample was then put on ice for another 10 minutes.
- The % remaining activity of the enzyme in each sample was then measured by incubating each sample with protein at 37°C for 5 hours.



It was recommended that the enzyme could be used in detergents at 60 °C
Why might the scientists have recommended this temperature?

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Your turn:

3. Isobel is analysing the content of egg whites.
Describe fully an investigation she could carry out to find out if there is protein present in the egg whites.

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4. Rosie was provided with some test tubes containing samples of glucose at different concentrations:
0M , 0.03M, 0.1M, 1M
She was asked to investigate which test tube contained which glucose solution.
Describe the tests she could carry out.

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The table below shows what she observed.
Complete the table.

	Tube 1	Tube 2	Tube 3	Tube 4
Observation	Yellow precipitate	Blue solution	Red precipitate	Green precipitate
Glucose concentration (M)				

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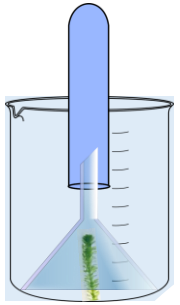
Your turn:

5a) Plants require light to carry out photosynthesis.
What is the correct equation for photosynthesis?

glucose + oxygen	→	carbon dioxide + water
carbon dioxide + glucose	→	oxygen + water
water + carbon dioxide	→	oxygen + glucose
oxygen + water	→	carbon dioxide + glucose

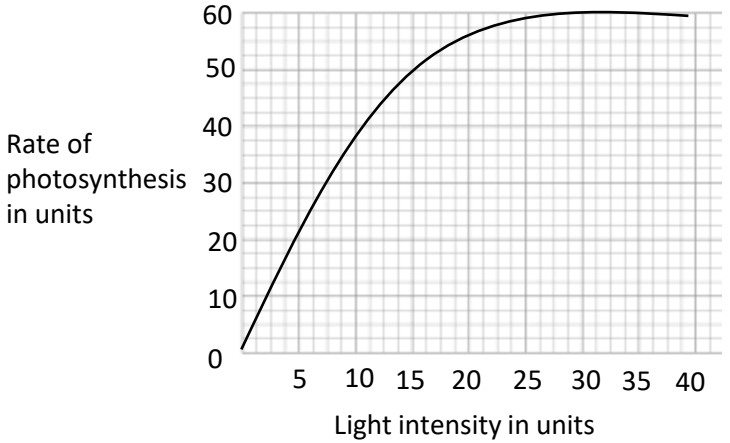
b) The apparatus below can be used to measure the rate of photosynthesis

.



Light intensity affects the rate of photosynthesis.
Describe a method to investigate this.

b) Results from a similar investigation are below.



The scientist concluded that “light stops being a limiting factor at a light intensity of 25 units.”
What evidence supports this conclusion.

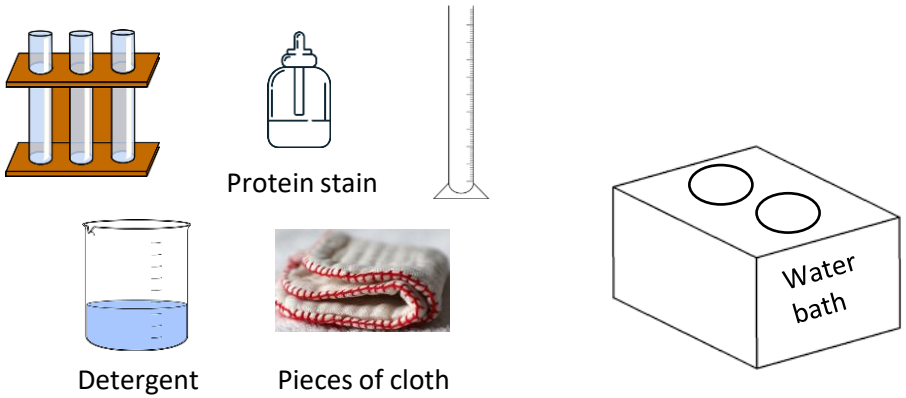
What could be a limiting factor at 25 units?

……

Education Services Ltd

Answers:

1. Biological washing powders can contain protease enzymes.
Describe how you could investigate the optimum pH for removing stains from clothes. The apparatus below can be used.



Use the measuring cylinder to measure equal volumes of the same detergent solution into the test tubes.
Apply the same number of drops of the same protein stain to each piece of cloth.
Include stainless cloth as a control.
Use forceps to transfer cloths.
Place the cloths in the test tubes. Add different buffer solutions to each test tube to provide different pH's
Use a water bath to maintain a constant temperature.
Leave the cloths in the detergent solution for the same length of time and see how much of the stain has been removed OR time how long it takes to remove the stain at each pH.
Repeat and calculate mean.

2. The stability of a protease enzyme, extracted from plants, was investigated by scientists.

- Samples of the enzyme were pre-incubated at different temperatures for 30 minutes.
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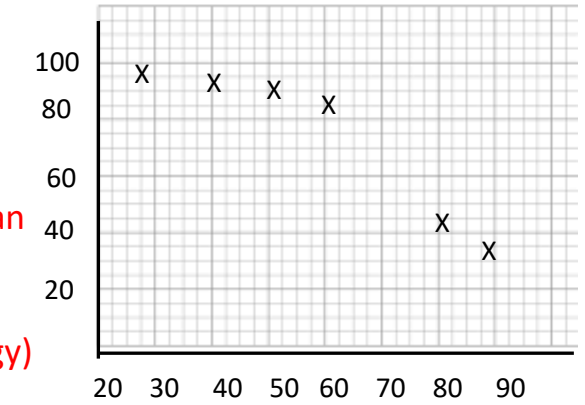


It was recommended that the enzyme could be used in detergents at 60 °C
Why might the scientists have recommended this temperature?

Rate of reaction is high at 60 °C / higher than at lower temperatures so there are more collisions.
Higher temperatures would increase (energy) costs
or
It might damage cloth above 60°C
Higher temperatures / 60 °C is better (than lower temperatures) to remove other stains / named stains
or
better for killing bacteria / infection control

Education Services Ltd

Answers:

3. Isobel is analysing the contents of egg whites.
Describe fully an investigation she could carry out to find out if there is protein present in the egg whites.

Add 2cm³ of Biurets reagent to a test tube. This will be blue.
Add some of the egg white to the Biurets solution in the test tube and mix thoroughly.. The blue colour will change to violet if protein is present. If protein is not present, the blue colour will remain.

4. Rosie was provided with some test tubes containing samples of glucose at different concentrations:
0M , 0.03M, 0.1M, 1M
She was asked to investigate which test tube contained which glucose solution.
Describe the tests she could carry out.

Warm the glucose solutions individually with Benedict's solution in a water bath and leave for 5 minutes. If the colour remains blue – no glucose present, there will be a range of colours to indicate how much glucose is in the others (green – red)

The table below shows what she observed.
Complete the table.

	Tube 1	Tube 2	Tube 3	Tube 4
Observation	Yellow precipitate	Blue solution	Red precipitate	Green precipitate
Glucose concentration (M)	0.1M	0M	1M	0.03M

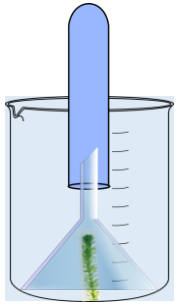
Answers:

5a) Plants require light to carry out photosynthesis.
What is the correct equation for photosynthesis?

glucose + oxygen → carbon dioxide + water
carbon dioxide + glucose → oxygen + water
water + carbon dioxide → oxygen + glucose
oxygen + water → carbon dioxide + glucose

b) The apparatus below can be used to measure the rate of photosynthesis

.

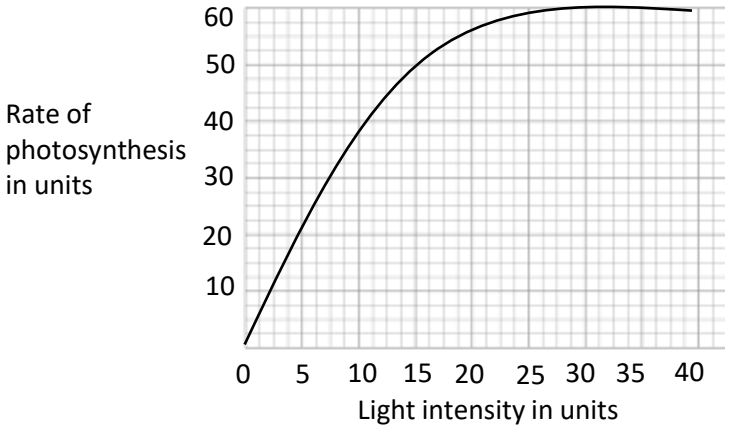


Light intensity affects the rate of photosynthesis.
Describe a method to investigate this.

- Place the lamp at different distances from the pondweed and measure the distances using a ruler. Count the number of bubbles of oxygen produced by the pondweed OR measure the amount of gas produced using a gas syringe at each distance in a given time.
- Keep the same lamp with the same colour light.
- Place a heat filter in front of the lamp to ensure the temperature does not increase.
- Control the supply of carbon dioxide in the water – and ensure the same in each experiment.
- Use the same size and type of pondweed for each experiment.
- Repeat each experiment at least 3 times.
- Calculate the mean from each experiment.

Your turn:

b) Results from a similar investigation are below.



The scientist concluded that "light stops being a limiting factor at a light intensity of 25 units."

What evidence supports this conclusion.

Rate does not increase further when light intensity increases beyond 25 units

What could be a limiting factor at 25 units?

Carbon dioxide concentration or temperature or amount of chlorophyll

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