AQA GCSE Combined Science (Trilogy)

GCSE Biology
Required Practicals

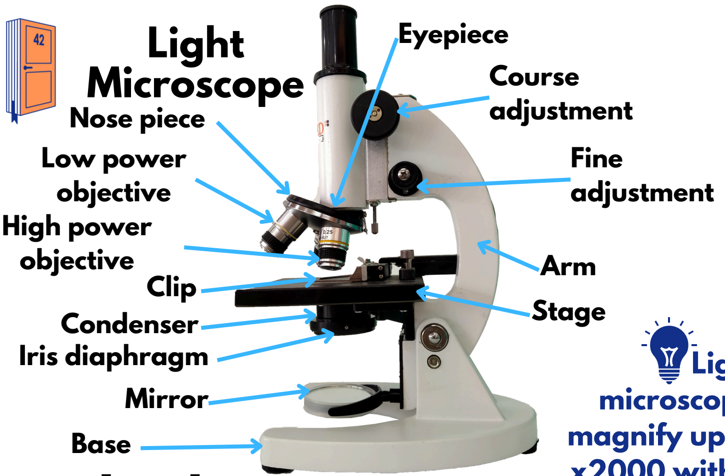
Name: ______________________________

Class: ______________________________



Contents Page

Page 2 - 3	Microscopy
Page 4 - 5	Osmosis
Page 6 - 7	Food Tests
Page 8 - 9	Enzymes
Page 10 - 11	Photosynthesis
Page 12 - 13	Reaction Time
Page 14 - 15	Field Investigations
Page 15 - 22	Answers



Light microscopes magnify up to x2000 with a 200nm resolving power.

Method:

Preparing the slide

1) Peel a **single epidermal layer off the onion** using forceps.

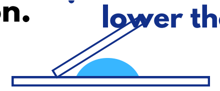
2) On a **microscope slide**, add a **drop of water** from a dropping pipette then use forceps to **mount the layer**.

Make sure the tissue is flat.

3) Add **2 drops** of **iodine solution to** stain subcellular structures.

4) Place the **cover slip** on.

Place one edge down on the slide and slowly lower the other.



5) Remove **excess stain** with filter paper.

Make sure there are no glass smudges or air bubbles.

6) Clip the slide on the microscope's **stage**.

Using the light microscope

7) Turn the nosepiece to the **lowest power objective** lens.

8) Looking from **the side**, use the **coarse adjustment knob** to bring **up** the stage **just below** the lens.

9) Look down **the eyepiece** and move the stage **down** with the coarse adjustment knob until cells are roughly in focus.

Never use the coarse adjustment knob with a higher power objective as it could crush the slide!

10) Rotate the nosepiece to a **higher power objective** lens.

11) Rotate the **fine adjustment knob** until the cells are in **clear focus**. Turn to a low power objective(**x40** magnification) to look cells.

12) When you have found cells, switch to **higher power** (**x100** or **x400**).

13) Make a clear, labelled drawing. Include visible **component parts** of the cell and the **magnification**.

If you cannot see the cells, return to a lower power objective to bring them back into centre view and focus it before returning to the higher power objective.

REQUIRED PRACTICAL 1 MICROSCOPY

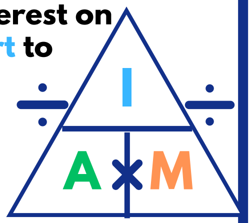
Math Skills - Calculating the size of an object

1) To get the magnification, multiply the objective magnification by the eyepiece len magnification.

E.g. objective lens = x10 magnification
eyepiece lens = x4 magnification
Overall magnification = 4 x 10 = x40

2) Measure the **cell/object** of interest on your diagram **in mm** and **convert** to micrometres (multiply by 1000).

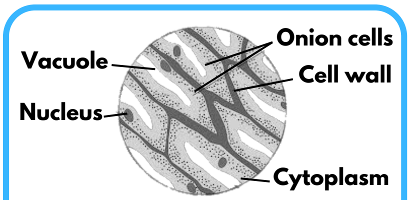
E.g. image cell length = ~5mm
5mm x 1000 = 5000μm



3) Calculate the magnification:

Actual length (A) = Length in image (I) ÷ Magnification (M)

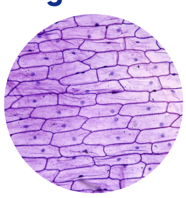
E.g. Actual length = 5000/40 = 125μm



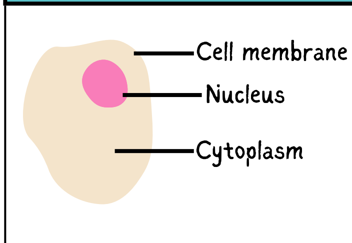
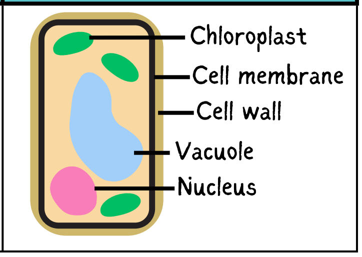
Using x400 magnification

Unit	No. of units in one metre (1m)	
centimetre (cm)	100	1×10^2
milliemetre (mm)	1000	1×10^3
micrometre	1 000 000	1×10^6
nanometre (nm)	1 000 000 000	1×10^9

Epidermal onion cell under a light microscope x100 magnification



What components can you see under a light microscope?

Animal cell	Plant cell
	

Top tips for Biological Drawings

- Use a sharp pencil
- Draw what you can see
- Use clear, unbroken lines
- Draw all structures in proportion
- Label all features with straight, uncrossed lines.
- Make it as large as possible - at least half of the space available.

Exam Style Questions - Microscopy

1. A bacterium is viewed under a light microscope using a 40x objective and a x10 eyepiece. The image is 1.5mm long. Calculate the actual length of the image. (2 marks)

2. A student is provided with a pre-prepared microscope slide of a section through a leaf. Describe how the student should use a light microscope to study cells in the leaf section. (4 marks).

3. A student prepared some animal cells to view using a light microscope.
a. Name two pieces of laboratory equipment the student may have used to prepare the cells to view under a light microscope. (2 marks)

1.
2.

b. The student tried to look the cells using the microscope. Suggest two reasons the student could not any cells when looking through the eyepiece. (2 marks)

4. A student views onion cells using a light microscope during an experiment. Part of the risk assessment identified Iodine solution as a potential hazard because it is an irritant.
State the risk that this can cause and explain what can be done to minimise this risk. (2 marks)

5. Give a reason for each of the following steps when preparing onion cells to view under a light microscope. (2 marks)
a) Using a thin layer of epidermis -

b) Lowering the cover slip at an angle -

Equipment

- Potato
- Labels (& pen)
- Five boiling tubes
- Paper towels
- 10cm³ measuring cylinder
- Test tube rack
- Scalpel
- Cork borer
- Ruler with mm scale
- White tile
- Range of sugar/sodium chloride solution 0.25-0.1mol/dm³
- Top pan balance (accurate to at least 0.01g)
- Distilled water

Math Skills - % Gain/Loss of Mass

Worked example:

Initial mass of potato cylinder in 1 M solution = 13.54g.
Final mass of potato cylinder in 1 M solution = 10.30g.

$$\% \text{ change in mass} = \frac{\text{Final mass} - \text{Initial mass}}{\text{Initial mass}} \times 100$$

$$= \frac{10.30 - 13.54}{13.54} \times 100$$

$$= -23.92\% \ (23.92\% \text{ lost})$$

Method:

1) Use the cork borer to cut five potato cylinders of equal diameter. Trim any remaining potato skin.

2) Trim all cylinders to same length (around 3cm). Accurately measure length and mass of each cylinder. Record in your table.

Label clearly

3) Measure 10cm³ of each concentration of sugar or salt solution and put into boiling tubes.

4) Measure 10cm³ of the distilled water and put into the fifth boiling tube.

5) Add one potato cylinder to each boiling tube.

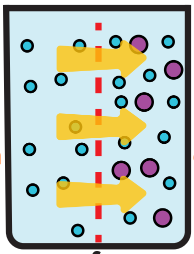
6) Leave potato cylinders in the boiling tubes for a pre-determined time.

At least 30 minutes

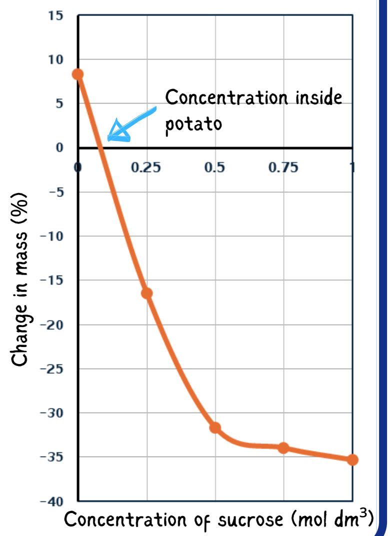
7) Remove potato cylinders and blot them dry with paper towels.

Blotting reduces surface water, increasing accuracy and repeatability

8) Measure the new mass and length of each potato cylinder again. Record in your table.

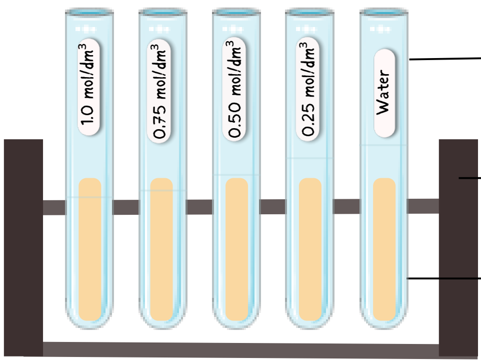


Graphical Representation of Results



Point at which the line of best fit crosses the x axis represents the concentration inside the potato (no change in mass)

REQUIRED PRACTICAL 2
OSMOSIS



Results Table

	1.0mol/dm³ sugar solution	0.75mol/dm³ sugar solution	0.5mol/dm³ sugar solution	0.25mol/dm³ sugar solution	Distilled water
Initial length (cm)	3.10	3.20	3.15	3.00	3.30
Final length (cm)	2.43	2.61	2.64	3.12	3.80
Change in length (cm)	-0.67	-0.59	-0.51	+0.12	+0.50
% change in length (%)	-21.61	-18.44	-16.19	+4.00	+15.15
Initial mass (g)	6.12	5.98	5.97	6.11	5.95
Final mass (g)	3.96	3.95	4.08	5.10	6.44
Change in mass (g)	-2.16	-2.03	-1.89	-1.01	+0.49
% change in mass (%)	-35.29	-33.95	-31.66	-16.53	+8.24

Increasing reliability of results - collect sets of results from at least two other groups allows you to get a mean of results.

Analysis of Results

1. Calculate change in mass (initial - final length)
2. Calculate % change in mass (see Math skills)
3. Write a concluding statement about what happened. Relate this to the theory of osmosis:

"The results show that when the solution concentration is low, water enters the potato cells. This is due to osmosis as the solute concentration of the potato cells is greater than the surrounding solution. In contrast, when the solute concentration of solution is higher than the potato cells, osmosis results in water moving from the potato to the surrounding solution."

Exam Style Questions - Osmosis

1. A student investigated the effect of different salt concentrations on chicken eggs.
They followed the following protocol:

- **Dissolved the shells from the chicken eggs in acid overnight.**
- **Blotted the eggs dry for 1 minute and weighed each egg.**
- **Placed each group in salt solution of different concentrations (ranging from 1-5 arbitrary units)**
- **Left them in the solutions for 24 hours**
- **Removed the eggs blotted them dry for 1 minute before re-weighing each egg.**
- **Calculated change in mass and percentage change in eggs.**

a) Suggest why they blotted the eggs for 1 minute before weighing and how this may have caused errors in the results? (2 marks)

____

____

____

b) Suggest one improvement the student could make to their investigation. (1 mark)

____

____

The table below shows the students' results.

	Concentration of salt in arbitrary units				
	1.00	2.00	3.00	4.00	5.00
Initial mass of egg (g)	80.20	81.10	80.14	81.22	80.12
Final mass of egg (g)	87.74	84.33	78.32	74.33	69.23
Change in mass (g)	+7.54	+3.23	-1.82	-6.89	-10.89
% change in mass (%)	+9.40%	+3.9%	-2.27%	?	-13.59

c) The student calculated the percentage change in mass at each salt concentration. Why is the percentage change in mass more useful than change in mass in grams? Refer to information from the table in your answer. (2 marks)

____

____

d) Calculate the percentage change in mass of the egg in the salt concentration of 4.00 arbitrary units. (2 marks)

____

____

____

____

e) The mass of the eggs decrease in salt concentrations with a concentration of 3.00+ arbitrary units. Explain what caused this. (3 marks)

____

____

____

____

____

____

____

REQUIRED PRACTICAL 3
FOOD TESTS

Using qualitative reagents to test for the presence of carbohydrates, lipids and proteins in food samples. These can be used to identify the food groups of a pre-prepared sample of foods.

Qualitative Tests → **Test for presence of key biological molecules**

Benedict's Test

Test for glucose (sugars)

Method:

1) Set up a Bunsen burner water bath.
2) Put some of the food sample into a test tube.
3) Add a few drops of Benedict's solution to the test tube.
4) Put the test tube in the water bath and heat at a temperature higher than 80°c for 5 minutes.
5) Note down any colour change in your table of results.

Equipment

- Pre-prepared food samples
- Traditional water bath (water and Bunsen burner)
- Benedict's solution
- Pipettes
- Thermometer
- Test tube for each food item

➕ **Positive result** - Green - Brick red

➖ **Negative result** - Light blue (no change)

Iodine Test

Test for starch

Method -

1) Put some of the food sample into a test tube.
2) Add a few drops of iodine solution.
3) Note any colour change in your results table.

Equipment

- Test tube per food item
- Iodine solution
- Pipettes
- Pre-prepared food samples

➕ **Positive result** - Blue-black

➖ **Negative result** - Orange-brown (no change)

Preparing samples

1. Break up the food using a pestle and mortar
2. Transfer to a test tube and add distilled water.
3. Stir the mixture with a glass rod.
4. Filter the mixture with a funnel and filter paper.

This increases the surface area of food samples

Recording data

Name of food tested	Colour with Benedict's solution	Colour with iodine solution	Cloudy layer with ethanol?	Colour with Biuret solution
Olive oil	Blue	Orange	✓	Blue
Caster sugar	Red	Orange	✗	Blue
Biscuit	Yellow	Orange	✓	Blue
Tofu	Blue	Orange	✗	Purple
Potato	Blue	Blue-black	✗	Blue

Hazards

Biuret test

- Copper (II) sulfate is an eye irritant
- Contains sodium hydroxide which is corrosive → Wash skin which gets into contact
- Always wear goggles

Emulsion test

- Ethanol is highly flammable → Keep away from Bunsen in Benedict's test /turn off Bunsen burner

Iodine test

- Iodine is an eye irritant → Always wear goggles

Benedict's Test

- The flame can result in burns → Always wear goggles, avoid lose clothing

Concluding statement (e.g. Biscuit)

"The biscuit contained sugar and lipid because it tested positive in both Benedict's test for sugar (blue -> yellow) and the emulsion test for lipids (an emulsion was created). It did not contain starch because it tested negative in the iodine test (no change in colour). Also, it did not contain protein because the results for the Biuret test were negative (solution stayed blue)."

Emulsion Test

Test for lipids

Method:

1) Put some of the food sample into a test tube.
2) Add a few drops of ethanol.
3) Add a equal volume of distilled water.
4) Shake the solution gently.
5) Note down any colour change in your results table.

Equipment

- Test tube per food item
- Distilled water
- Ethanol
- Pre-prepared food samples

➕ **Positive result** - Cloudy emulsion

➖ **Negative result** - Colourless (no change)

Biuret Test

Test for proteins

Method:

1) Put some of the food sample into a test tube.
2) Add 1cm³ of Biuret solution A and 1cm³ of Biuret solution B to the test tube.
3) Shake the tube gently.
4) Note down any colour change in results table.

Equipment

- Test tube per food item
- Pre-prepared food samples
- 10cm³ measuring cylinder
- Biuret solution A and B

➕ **Positive result** - Lilac-purple

➖ **Negative result** - Blue (no change)

Exam Style Questions - Enzymes

**1) Describe how you would test a sample of food to show it contains lipids.
Give the reason for any safety precautions you would take. (4 marks)**

____

____

____

____

____

____

____

**2) The table below shows information about tests that identify three different types of biological molecule.
Complete the table to show the names of the types of molecules that are tested, reagents used and results obtained. (5 marks)**

Molecule tested	Reagents	Positive result	Negative result
Lipid	i. ____________ ii. ____________	iii. ____________	Clear liquid
Protein	Biuret solution	iv. ____________	Blue
Starch	Benedict's solution	Green - Brick red solution	v. ____________

3) Describe the test that is used to indicate the presence of starch. State the observation that would be made if starch was present. (2 marks)

Description of test - ____

____

Observation if starch is present - ____

____

**4) The table below shows the results of qualitative tests on a unknown food sample A.
Explain what conclusions can be made from the information in the table. (2 marks)**

	Colour with Benedict's solution	Colour with iodine solution	Cloudy layer with ethanol?	Colour with Biuret solution
Food sample A	Light Blue	Orange	Yes	Blue

____

____

____

____

5) Describe the test you would use to find out if protein is present in food. (2 marks)

____

____

____

____

____

Aim: Investigate the effect of pH on the rate of reaction of amylase

Equipment

- x 10 test tube
- Thermometer
- x3 labelled buffered solutions at a range of pH values
- Test tube rack
- Glass rods
- Stop clock
- Iodine solution (indicator)
- Water bath
- Pasteur pipettes
- Amylase solution
- Labels
- 5cm³ measuring cylinder
- Starch solution
- Spotting tile

Enzymes

Biological catalysts which speed up chemical reactions in living organisms

Amylase

→ Produced in the salivary gland and pancreas

Starch
↓ Amylase
Maltose

Iodine

- Iodine is an eye irritant
- Always wear goggles

Independent variable	→	the pH
Dependent variable	→	time taken for starch to be digested
Control variables	→	• Temperature (35˚C) • Concentration • Volume of starch and amylase

Method:

Buffer solutions keep the reaction at a fixed pH

35˚C is close to body temperature

Preparation

1) Heat water bath to 35˚C.

2) Put 2cm³ of each buffered solution into separate test tubes. (Label each tube with the pH value)

3) Add 4cm³ of starch solution to 5 different tubes. (Label each as 'Starch')

4) Leave a thermometer in one of the starch test tubes to monitor the temperature throughout.

5) Add 10cm³ of Amylase solution to one, different test tube. (Label as "Amylase")

6) Place all tubes into a water bath. Allow all solutions to reach 35˚C.

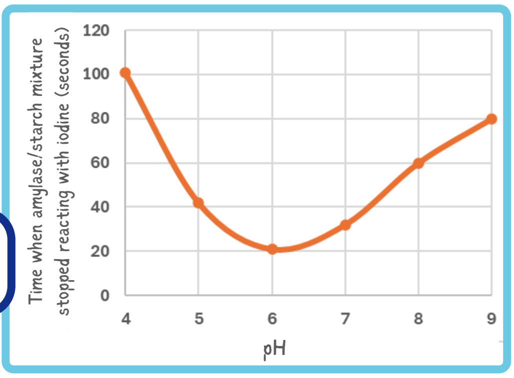
7) Meanwhile, put one drop of iodine solution into each spotting tile depression.

'Zero time' mixture. Used as a comparison colour for test buffers

REQUIRED PRACTICAL 4 ENZYMES

Results (combined with another group)

pH of solution	Time for amylase to completely break down the starch (seconds)
4	101
5	42
6	21
7	32
8	59
9	81



Continuous Sampling

8) Put a drop of starch solution in the first depression of the tile.

9) When at 35˚C, add the 2cm³ of your first pH buffered solution to one starch tubes and mix with a glass rod.

11) Use the pipette to add 2cm³ of amylase solution to the mixture. Start the stop clock immediately.

12) Stir continuously for 10 secs then remove one drop of the mixture with the glass rod.

After mixing, the tube must be kept in the water bath

13) Put this drop on the second depression of the tile.

14) Every 10 seconds, use the glass rod to remove one drop and put each on the next depression of the tile.

Rinse glass rod with water between droplets!

Repeat sampling until the iodine does not change colour.

This indicates all starch has been converted to sugars

Repeat steps 9-14 with the other buffer solutions with new pipettes, glass rods and spotting tiles.

Analysis of Results

"The results show that the time taken for all the starch to be digested by the amylase decreases from ph4 to pH6, and then increases again. Therefore, the optimum pH for this enzyme is pH 6."

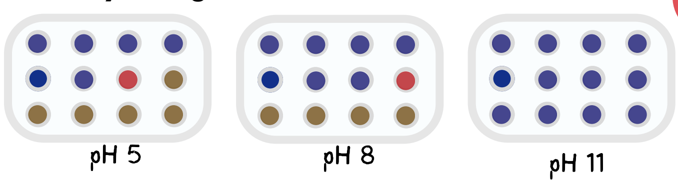
Potential improvements?

- Using more accurate measuring apparatus e.g. a calorimeter
- Taking mean of several repeats at each pH
- Using a narrower range of pH

Brown → Blue-black
Starch is present

Brown → Brown
Starch is no longer present

What you might see...



Exam Style Questions - Enzymes

1) Amylase is the enzyme tht controls the breakdown of starch to glucose. Describe how the student could investigate the effect of pH on the breakdown of starch by amylase. (4 marks)

2) Students investigated the effect of bile on the digestion of fat by lipase. They followed the following protocol:

- **Mixed milk and bile in a beaker**
- **Put the pH sensor of a pH meter into the beaker**
- **Add lipase solution**
- **Recorded the pH at 2-minute intervals**
- **Repeated steps 1 to 4, but used water instead of bile.**

a) Suggest two variables that the student should have controlled in this investigation. (2 marks)

b) They students found that by the end of each test the beaker with water and bile both had the same pH of 7.6. Suggest a reason for this. (1 mark)

3) A student wanted to investigate the effect of temperature on the activity of amylase. To do this, they timed how to it took for an iodine solution to turn yellow-brown in the presence of starch and amylase at different temperatures.

Table 1 shows the results.

Temperature in °C	Time taken for solution to turn yellow-brown
15	5
30	2
45	7
60	12
75	Remained blue-black

Table 1

a) Explain why the iodine solution remained blue-black in the investigation at 75˚C. (2 marks)

b) Explain how amylase breaks down starch. Answer in terms of the 'lock and key theory'. (3 marks)

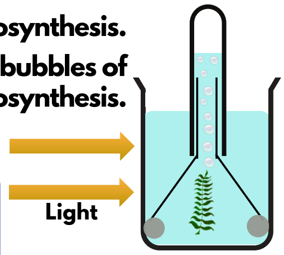
c) Describe how the student could extend the investigation to determine the ffect of a different factor on amylase activity. (2 marks)

Equipment

- Beaker
- Filter funnel
- Plasticine
- 1 or 10cm³ measuring cylinder
- Stop clock
- Metre ruler
- 10cm piece of pondweed
- Light source

Aim: Investigate the effect of light intensity on rate of photosynthesis

Oxygen is a by-product of photosynthesis.
By using water plants, you can see and collect bubbles of colourless gas released to measure the rate of photosynthesis.



- **Independent variable** → Light intensity (distance from lamp)
- **Dependent variable** → Rate of photosynthesis (rate of gas production)
- **Control variables** →
  - Temperature
  - Light colour
  - Carbon dioxide concentration

Hazard:
- Keep electrical equipment away from water
- Ensure hands are dry

Method:

Preparation

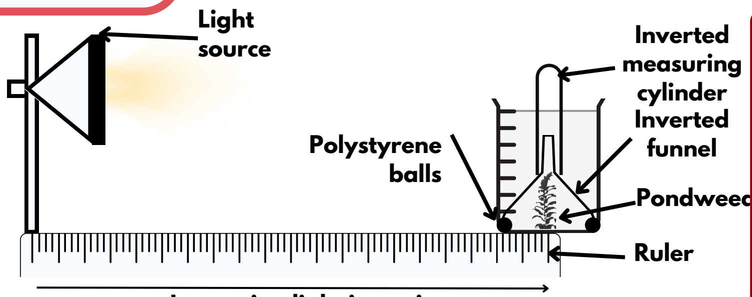
Raise filter from the bottom of the beaker with plasticine

1) Place 10cm piece of pondweed (cut edge at top) into a beaker of water.

2) Cover the pondweed with the filter funnel, inverted.

3) Fill measuring cylinder with water and invert to top the inverted filter.

4) Place the light source 1m from the beaker, using the 1m ruler to measure.



What is happening?
The rate of photosynthesis increases as the light moves closer, demonstrating the light is the limiting factor.
Eventually, no matter how close the light, the rate stays the same. Here, light is no longer the limiting factor (could be amount of chlorophyll temperature or CO2 concentration)

REQUIRED PRACTICAL 5
PHOTOSYNTHESIS

Procedure

Too slow? Increase rate of reaction with:
- Sodium hydrogen carbonate solution
- Warmer water

5) When set up, start the stop watch and:
- Count the number of bubbles released in 3minutes
- Record the volume of gas produced and collected in the measuring cylinder during the three minutes

Inverse Square Law

As distance of light increases, light intensity decreases - an inverse relationship. However, this is not linear. The light intensity increases or decreases in inverse proportion to the square of the distance

Double (x2) the distance

$$\frac{1}{2^2} = \frac{1}{4}$$

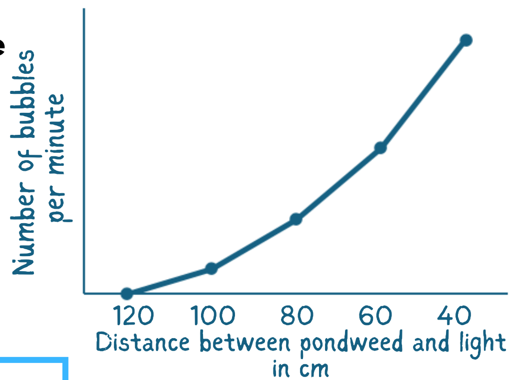
Light intensity falls by a quarter (1/4)

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

6) Move the light source to 80cm away from the beaker.

7) Refill the measuring cylinder with water and carefully reposition all elements as you did in steps 1-4.

13) Repeat step 5 at 80cm, then at 60, 40 and 20cm.
Record results after each distance:



Analysis of Results
"As distance decreases, light intensity increases and so the rate of photosynthesis increases. This is because energy transferred by light is needed for photosynthesis to take place."

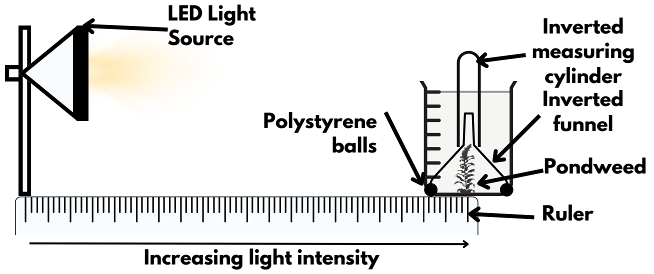
	Increasing Light Intensity					
	120cm	100cm	80cm	60cm	40cm	20cm
Number of gas bubbles	0	1	4	8	11	11
Volume of gas cm^3	0.00	0.80	2.35	4.60	8.00	8.10

Measuring volume of gas is more accurate as some bubbles produced a too small or quick to come out to be counted accurately

Potential improvements?
- Use a gas syringe to collect volume of gas produced.
- Taking mean of several repeats at each distance.
- Place a heat shield (glass tank) between lamp and plant to prevent the light source heating the plant
- Use an LED bulb to minimise heat energy released.
- Monitor temperature of water with a thermometer to check for temperature rise.

Exam Style Questions - Photosynthesis

1) Students investigated the rate of photosynthesis in pondweed at different light intensities. They used the following set up:



They counted the number of oxygen gas bubbles produced in 3 minutes whilst the light source was placed at different distances from the pondweed.
Table 1 shows the results:

	Distance from pondweed					
	120cm	100cm	80cm	60cm	40cm	20cm
Number of gas bubbles	0	1	4	8	11	11

a) Describe the pattern shown in Table 1. (2 marks)

b) Suggest how the experiment could be modified to investigated the effect of carbon dioxide concentration instead of light intensity on the rate of photosynthesis? (1 mark)

c) The LED light source does not get hot. Why is this important? (1 mark)

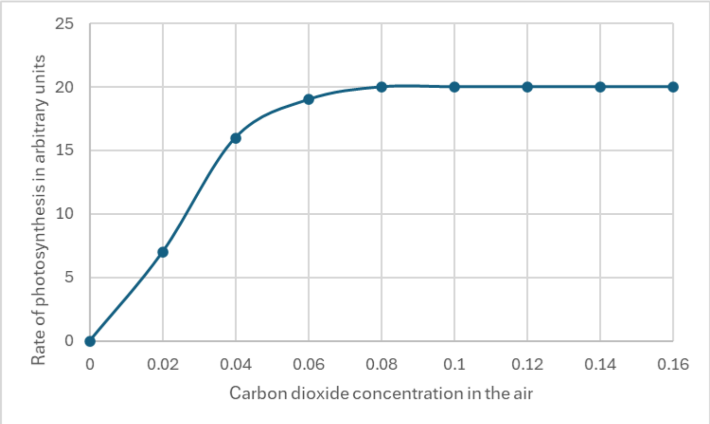
d) What could be the limiting rate of photosynthesis when the light source is 40cm away from the pondweed? Give one factor. (1 mark)

e) Suggest how the students could modify the apparatus to measure the rate of photosynthesis more accurately. (1 mark)

2) The graph shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20˚C.

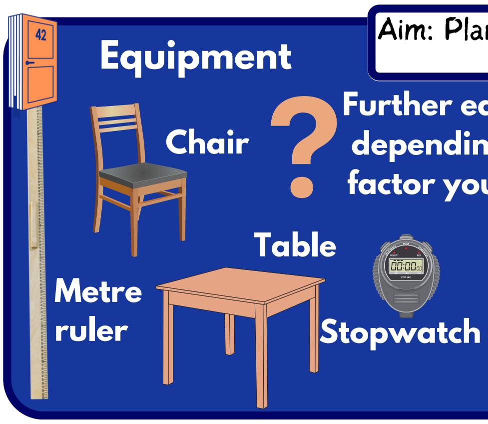
a) What is the maximum rate of photosynthesis of the tomato plant shown in the graph? (1 mark)

b) Describe the effect of increasing the concentration of carbon dioxide on the rate of photosynthesis. You should include numbers from the graph in your description. (3 marks)



Aim: Plan & carry out an investigation into the effect of a factor on human reaction time.

Equipment



Further equipment depending on the factor you change

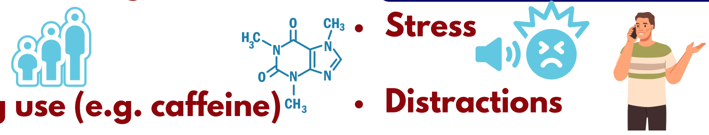
Do not eat or drink in the lab

Reaction time is the taken to respond to a visual stimulus

- Choose a factor to investigate that you believe has an effect on reaction time
- Carry out experiments to measure reaction time

Factors affecting reaction time:

- Age
- Drug use (e.g. caffeine)
- Stress
- Distractions



What is happening?

Visual stimulus - Ruler falling → Receptor - Eye (photoreceptors) sees the ruler falling → Sensory neurones send message along the optic nerve from the eye to the brain. Brain processes this information. → Brain sends signal through motor neurones to close the hand.

Creating a Hypothesis

A hypothesis predicts a relationship between two variables:

1. **Observe** which variables might be having an effect on variable.
2. **Select** a variable to investigate.
3. **Create a question** you want to answer, followed by a **prediction backed by scientific reasoning** - this is your hypothesis.

Independent variables include:

Background noise
1. Perform experiment in silence
1. Repeat experiment with loud background music

Caffeine consumption
1. Carry out experiment
2. Repeat after the person has drank a caffeinated drink

Dependent variable → Distance caught (equates to reaction time)

Control variables include:

- Use of dominant hand
- Height the ruler is dropped from
- Ruler orientation
- Practice time

REQUIRED PRACTICAL 6
REACTION TIME

Method:

Preparation

1) In a pair, decide who is Person 1 and Person 2.

2) Person 1 sits down on a chair and puts the forearm of their dominant arm across the table, with their hand overhanging the edge.

3) Person 2 holds a ruler vertically (from a chair) with the bottom end (0cm mark) between Person 1's thumb and 1st finger.

4) Person 2 tells Person 1 to be ready to catch the ruler.

5) When ready, Person 2 releases the ruler.

6) Person 1 catches the ruler as quickly as possible.

7) Record the number on the ruler level with Person 1's thumb on a table.

8) Repeat steps 2-7 several times with Person 1 catching the ruler.

9) Swap roles, so Person 2 catches the ruler and Person 1 drops it.

10) Use a conversion table to convert ruler measurements into reaction time.

11) Make the necessary changes in order to investigate the chosen variable.

12) Repeat steps 1-10 with the new variable.

Example Results Table (Indepedent variable - noise)

	Ruler measurements in cm				Reaction time in seconds			
Drop test attempt	Person 1 No noise	Person 2 No noise	Person 1 Noise	Person 2 Noise	Person 1 No noise	Person 2 No noise	Person 1 Noise	Person 2 Noise
1	29		52		0.24		0.33	
2	26		42		0.23		0.29	
3	31		45		0.25		0.30	
4	31		25		0.25		0.23	
5	26		39		0.23		0.28	

Repeat as many times as possible

This experiment often results in lots of errors because many factors can affect results.

Extract from table

Ruler eading (cm)	Reaction Time (s)
1	0.05
2	0.06
3	0.08
4	0.09
5	0.10

Analysis of Results

The lower the reaction time, the faster the reaction time. For example in the table above:

"Person 1's reaction time was faster before it was caught with noise, with average time before noise was 0.24 seconds compared to 0.29 seconds. This supports the hypothesis that noise increases the reaction time of Person 1."

Considerations

It is very difficult to control variables.

E.g. Results could show someone is faster after the independent variable was changed but because they have practiced catching the ruler, not because of the independent variable.

Lots of participants and attempts are needed to produce reliable results.

Potential Improvements

Measure reaction time in milliseconds to increase accuracy.

Alternative practical

Use a computer programme.

Participants click the mouse when the colour on the screen changes

Exam Style Questions - Reaction Time

1) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 9 times before swapping roles and repeating the process.
State three variables the students controlled in this practical. (3 marks)

2) Give two reasons why a computer program to measure reaction time is more likely to be more valid than the the ruler drop method. (2 marks)

3) Table 1 shows the results of an investigation of a group of students investigating the effect of caffeine on reaction time. In their experiment, they completed the ruler drop test before drinking a strong cup of coffee and 15 minutes after drinking the coffee.

Distance ruler fell (cm)	Distance ruler fell (cm)
Before drinking coffee	After drinking coffee
15	13
19	17
13	11
21	8
18	17
25	10
12	14
21	13
Mean = 18.0	Mean = 12.8

Table 1

a) What do the means suggest about the effect of caffeine on reaction time? (1 mark)

b) Give one reason why a scientist might not accept this conclusion. (1 mark)

4) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 4 more times before swapping roles and repeating the process. Table 2 shows Student 1's result.

Attempt number	Distance ruler dropped in mm
1	109
2	114
3	123
4	125
5	120

Table 2

a) What was the median result?

b) Calculate the mean reaction time to 3sf, using the equation:

$$\text{reaction time in s} = \sqrt{\frac{\text{Mean drop distance (cm)}}{490}}$$

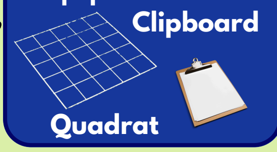
(4 marks)

1. Investigating the population size of a plant species using random sampling:

Aims: Measure the population size of a common species in a habitat.

1) In a group of 3, collect two numbers, one from each bag containing lots of different numbers.

Equipment



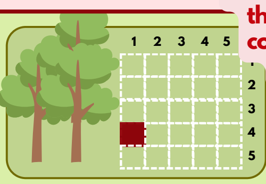
Quadrat
A frame with a known area
Usually 0.5m x 0.5m ($0.25m^2$) or 0.25m x 0.25m ($0.625m^2$)

Used for plants & slow moving animals

Estimates species abundance

Used to measure the impact of conservation projects

2) Use the numbers to locate the first position of your quadrat in the area prepared by your teacher (e.g. 1 and 4 corresponds to red area)
- Note the total study area



3) Lay the quadrat on the ground randomly within that area. Replace the numbers in the bag.

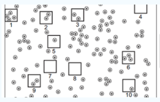
4) Count or estimate (species dependent) and record the number of the chosen plant species inside the quadrat.

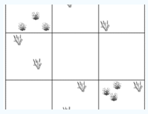
Repeat steps 1-4 until you have recorded the number of the plant species in 10 quadrats.

5) Use the calculation in 'maths skills'

Method for measuring sample size

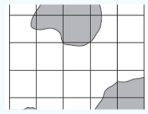
Count number of individuals.





Species richness - record number of different plant or animal species.

Percentage cover - % of quadrat covered by a species e.g. grass cover



Evaluating data

Validity:
- Was only one variable affecting data?
- Did repeats produce similar results?
- Does sample give an accurate representation of total area?
- Does data answer your hypothesis?

Reproducibility
- Have other class members obtained the same results?

Repeatability
- Are results the same each time you repeated it?

Accuracy
- How did you keep the test fair?

Precision
- How close are results to your mean?

Quadrat number	Number of individual of chosen plant species
1	6
2	5
3	5
4	5
5	4
6	6
7	5
8	4
9	5
10	5

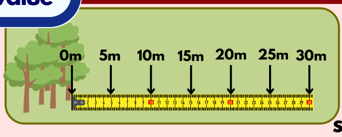
Mean = (sum of all values / no. values)

Median = middle value of range

Mode = most frequent value

REQUIRED PRACTICAL 7 FIELD INVESTIGATIONS

Aim: Use sampling techniques to investigate the effect of a factor on the distribution of this species.

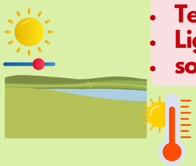


Transect
A line represented by a tape measure on which regular samples (systematic samples) are taken

Measures species distribution

Equipment

Abiotic factors:-
- Water immersion
- Temperature
- Light intensity
- soil pH



Biotic factors:-
- Trampling
- Grazing
- Competition

2. Investigating the effect of light intensity on plant distribution using a transect line:

1) Put the 30m tape measure in a line from the base of a tree to an open area of ground.

2) Put the quadrat against the transect line. One corner of the quadrat should touch the 0m mark on the tape measure.

3) Count the number of plants (dependent variable) inside the quadrat or estimate % grass cover. Record on your table.

4) Use the light meter to measure the light intensity (independent variable) at this position. Record on your table.

5) Move the quadrat 5m along the transect line. Repeat steps 3-4.

6) Continue this process up to the end of the transect line.

Sampling

Sampling looks a small section of a population to draw conclusions about the entire population.
- Quadrats use random sampling.
- Transects use random & systematic sampling.

Math Skills - Estimating population size

$$\text{estimated population size} = \frac{\text{total area}}{\text{area sampled}} \times \text{no. plants counted}$$

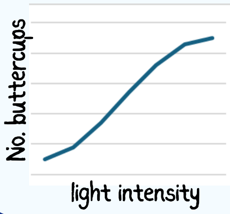
Total area = 20m x 20m = $400m^2$

Area sampled: 0.25 x 0.25m = 10 x $0.625m^2$ = $0.625m^2$

Number of buttercups counted across 10 samples = 50

$$\text{estimated population size} = \frac{400}{0.625} \times 50 = 32000$$

Analysis of results:
1. Plot a graph of your results
   a. x-axis: light intensity
   b. y-axis: number of plants
2. Describe the relationship in your graph



'As light intensity increases, the number of buttercups increase.'

Distance along transect (m)	No. of individuals	Light intensity
0		
5		
10		
15		
20		
25		
30		

Limitations of Transects and Quadrats
- Random sampling can cause anomalies
- Time constraints cause small sample sizes
- Risk of harming animals
- Sometimes hard to identify individuals

Exam Style Questions - Field Investigations

1) Describe how a quadrat can be used to obtain quantitative data. (3 marks)

2) A student investigated the number of snails in six 1m² areas of their garden. The garden has a total area of 60m². Describe how the student should use this information to estimate the number of snails in the garden. (2 marks)

3) Red squirrels eat seeds from the cones of conifer trees. To provide food for winter, they create stores of cones called 'larders' in the ground. Each squirrel will store and protect one larder.

A group of scientists involved with the conservation of red squirrels in Scotland monitored squirrel populations in different types of woodland. They used the following method:

- **Ten woods of each woodland type were surveyed**
- **In each, scientists measured two transects, each 600m long and 10m wide**
- **One scientist walked along the transects, counting the number of larders they observed.**

a) Calculate the total area surveyed in one woodland? (1 mark)

b) Name one variable controlled in this investigation. (1 mark)

c) The scientists recorded the number of larders instead of the number of squirrels. Explain how this improved the accuracy of the investigation? (2 marks)

d) Explain how counting the number of larders could lead to inaccurate results. (2 marks)

3) a) Describe how a student could use a 1m x 1m quadrat and 30m tape measure to collect data on the distribution of daisy plants in a field. (3 marks)

b) Give two environmental factors that could affect the distribution of daisies? (2 marks)

Exam Style Questions - Microscopy (Answers)

1. A bacterium is viewed under a light microscope using a 40x objective and a x10 eyepiece. The image is 1.5mm long. Calculate the actual length of the image. (2 marks)

Mark One – Magnification - 40 x 10 = x400
Mark Two - Image = 1.5mm = 1500μm. Actual length = 1500/400 = 3.75μm

2. A student is provided with a pre-prepared microscope slide of a section through a leaf. Describe how the student should use a light microscope to study cells in the leaf section. (4 marks).

Mark One - Clip the slide onto the microscope stage.
Mark Two - Rotate the nose piece to get the lower power objective below the eye piece.
Mark Three - Use the coarse adjustment knob to focus the image.
Mark Four - Rotate to a higher power objective and focus using the fine adjustment knob.

3. A student prepared some animal cells to view using a light microscope.
a. Name two pieces of laboratory equipment the student may have used to prepare the cells to view under a light microscope. (2 marks)

One mark for any of the following, up to a maximum of two marks:

- (Microscope) slide
- Cover slip
- Dye/stain
- (Mounted) needle
- (Dropping) pipette/dropper
- Scalpel
- Forceps/tweezers
- Allow 'swab'

b. The student tried to look the cells using the microscope. Suggest two reasons the student could not any cells when looking through the eyepiece. (2 marks)

One mark for any of the following, up to a maximum of two marks:

- No cells in field of view
- Mirror not in correct position
- Slide not in correct position
- (Objective) lens not clicked into place
- (Objective) lens dirty
- Looking at a large air bubble
- Microscope not focused
- Cells not stained
- (Light) microscope not plugged in
- Magnification too low

4. A student views onion cells using a light microscope during an experiment. Part of the risk assessment identified Iodine solution as a potential hazard because it is an irritant. State the risk that this can cause and explain what can be done to minimise this risk. (2 marks)

Mark One - May cause allergic reaction/skin rash.
Mark Two - Wash skin immediately after contact/wear gloves/clean up spills/use dropper bottle.

5. Give a reason for each of the following steps when preparing onion cells to view under a light microscope. (2 marks)
a) Using a thin layer of epidermis - **One mark** - help see individual cells/allow light to penetrate.
b) Lowering the cover slip at an angle - **One mark** - stain/see parts of the cell (allow named subcellular structures).

Exam Style Questions - Osmosis (Answers)

1. A student investigated the effect of different salt concentrations on chicken eggs.
They followed the following protocol:

- Dissolved the shells from the chicken eggs in acid overnight.
- Blotted the eggs dry for 1 minute and weighed each egg.
- Placed each group in salt solution of different concentrations (ranging from 1-5 arbitrary units)
- Left them in the solutions for 24 hours
- Removed the eggs blotted them dry for 1 minute before re-weighing each egg.
- Calculated change in mass and percentage change in eggs.

a) Suggest why they blotted the eggs for 1 minute before weighing and how this may have caused errors in the results? (2 marks)

One mark for each of the following, up to a maximum of two marks:

- Removes the solution/liquid/water (from the outside of the egg)
- It could remove/leave variable amounts from each egg

b) Suggest one improvement the student could make to their investigation. (1 mark)

One mark for any of the following:

- Equal sizes of egg
- Use more than one egg (for each solution)/repeats
- Use more accurate baalnce
- Use smaller concentration interviews
- Use a control/distilled water group

The table below shows the students' results.

	Concentration of salt in arbitrary units				
	1.00	2.00	3.00	4.00	5.00
Initial mass of egg (g)	80.20	81.10	80.14	81.22	80.12
Final mass of egg (g)	87.74	84.33	78.32	74.33	69.23
Change in mass (g)	+7.54	+3.23	-1.82	-6.89	-10.89
% change in mass (%)	+9.40%	+3.9%	-2.27%	?	-13.59

c) The student calculated the percentage change in mass at each salt concentration. Why is the percentage change in mass more useful than change in mass in grams? Refer to information from the table in your answer. (2 marks)

Mark One - Different (starting) masses/sizes/weights (at different concentration)
Mark Two - Allows comparisons/show patterns/shows trends

d) Calculate the percentage change in mass of the egg in the salt concentration of 4.00 arbitrary units. Give you answer to 2 decimal points. (2 marks)

Two marks for correct answer = (-)8.48%
One mark if answer is wrong but calculation is correct:

- (6.89 / 81.22) * 100

e) The mass of the eggs decrease in salt concentrations with a concentration of 3.00+ arbitrary units. Explain what caused this. (3 marks)

Mark One - Water loss
Mark Two - By osmosis/diffusion
Mark Three - From dilute region in the egg to a more concentrated solution outside

- Allow correct description in terms of high to low water concentration/water potential
- Allow salt solution is hypertonic

Exam Style Questions - Food Tests (Answers)

1) Describe how you would test a sample of food to show it contains lipids.
Give the reason for any safety precautions you would take. (4 marks)

Level 2 (3-4 marks): Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

- **Must contain reference to ethanol, a positive result (cloudy emulsion) and a reason for a safety precaution**

Level 1: (1-2 marks): Facts, events or processes are identified and simply stated but their relevance is not clear.

Indicative content:

- Grinding up the food
- Add distilled water and ethanol reagent (allow C6H5OH) to food (sample)
- Lipids cause a cloudy emulsion to appear
- Wear goggles to protect eyes
- Clean up spills immediately
- Ethanol is highly flammable
- Avoid wearing baggy clothing

2) The table below shows information about tests that identify three different types of biological molecule.
Complete the table to show the names of the types of molecules that are tested, reagents used and results obtained. (5 marks)

One mark for each correct name:

Molecule tested	Reagents	Positive result	Negative result
Lipid	i. Ethanol ii. Water	iii. Cloudy emulsion	Clear liquid
Protein	Biuret reagent	iv. Lilac/purple solution	Blue solution
Starch	Benedict's reagent	Green - Brick red solution	v. Blue solution

3) Describe the test that is used to indicate the presence of starch. State the observation that would be made if starch was present. (2 marks)

Description of test -
One mark - Add/use iodine (solution)
Observation if starch is present -
One mark - (Orange to) blue-black

4) The table below shows the results of qualitative tests on a unknown food sample A.
Using the information in the table, state what conclusions can be made from the information in the table. (3 marks)

	Colour with Benedict's solution	Colour with iodine solution	Cloudy layer with ethanol?	Colour with Biuret solution
Food sample A	Light blue	Orange	Yes	Blue

One mark for each of the following, up to a maximum of two marks:

- The food sample contains lipids and proteins.
- The qualitative tests for lipids and proteins were positive.
- The food sample does not contain sugar or starch.
- The quantitative tests for sugars and starch were negative.

5) Describe the test you would use to find out if protein is present in food. (2 marks)

Mark one - Add Biuret reagent to food sample (allow sodium/potassium hydroxide solution + cooper sulfate)
Mark two - Lilac/purple colour shows protein is present

Exam Style Questions - Enzymes

1) Amylase is the enzyme tht controls the breakdown of starch to glucose. Describe how the student could investigate the effect of pH on the breakdown of starch by amylase. (4 marks)

One mark for each of the following:

- **Range of at least 3 pH values / use of buffer solutions**
- **Named controlled variables (e.g. amount / concentration of starch or amylase, use water bath/electric heater to control temperature)**
- **Use iodine to make qualitative observations**
- **Observe colour changes at different pH**
- **Do repeats at each pH**

2) Students investigated the effect of bile on the digestion of fat by lipase. They followed the following protocol:

- **Mixed milk and bile in a beaker**
- **Put the pH sensor of a pH meter into the beaker**
- **Add lipase solution**
- **Recorded the pH at 2-minute intervals**
- **Repeated steps 1 to 4, but used water instead of bile.**

a) Suggest two variables that the student should have controlled in this investigation. (2 marks)

One mark for each of the following up to a maximum of two marks:

- **Type of milk**
- **Volume of milk**
- **Volume of bile and water (should be the same)**
- **Volume of lipase**
- **Concentration of glucose**
- **Temperature**

b) They students found that by the end of each test the beaker with water and bile both had the same pH of 7.6. Suggest a reason for this. (1 mark)

One mark for any one of the following:

- **All milk/fat has been digested**
- **The same amount of fatty acids present**
- **(Lower pH) denatures the enzyme/lipase (allow enzyme won't work at a low pH)**
- **All reactants used up**

3) A student wanted to investigate the effect of temperature on the activity of amylase. To do this, they timed how to it took for an iodine solution to turn yellow-brown in the presence of starch and amylase at different temperatures.

Table 1 shows the results.

Temperature in °C	Time taken for solution to turn yellow-brown
15	5
30	2
45	7
60	12
75	Remained blue-black

Table 1

a) Explain why the iodine solution remained blue-black in the investigation at 75˚C. (2 marks)

Mark one - Enzyme / amylase is denatured OR enzyme/amylase has stopped working

Mark two - Starch is broken down OR starch is still present

b) Explain how amylase breaks down starch. Answer in terms of the 'lock and key theory'. (3 marks)

Mark one - Starch / substrate binds to active site (of enzyme)

Mark two - Because shape of active site and substrate are complementary (allow shape of starch/subustrate and active site allow them to fit together)

Mark three - A chemical reaction occurs to produce smaller molecules OR bonds between starch molecules are broke to produce smaller molecules (allow sugars/maltose)

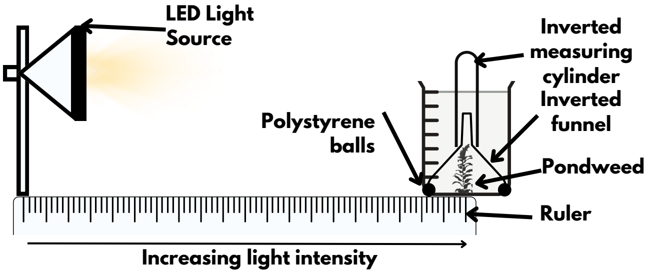
c) Describe how the student could extend the investigation to determine the ffect of a different factor on amylase activity. (2 marks)

Mark one - Keep temperature constant

Mark two - Change a named factor (e.g. pH, enzyme) and test a range of values of this factor (e.g. concentration, substrate, inhibitor concentration)

Exam Style Questions - Photosynthesis

1) Students investigated the rate of photosynthesis in pondweed at different light intensities. They used the following set up:



They counted the number of oxygen gas bubbles produced in 3 minutes whilst the light source was placed at different distances from the pondweed.
Table 1 shows the results:

	Distance from pondweed					
	120cm	100cm	80cm	60cm	40cm	20cm
Number of gas bubbles	0	1	4	8	11	11

a) Describe the pattern shown in Table 1. (2 marks)

One mark for each of the following:
- **Number of bubbles per three minutes increases as the distance from pondweed decreases/light intensity increases**
- **The number of bubbles per three minutes levels off at 40cm.**

b) Suggest how the experiment could be modified to investigated the effect of carbon dioxide concentration instead of light intensity on the rate of photosynthesis? (1 mark)

One mark for each of the following:
- **Sodium hydrogen carbonate**
- **Different masses**

c) The LED light source does not get hot. Why is this important? (1 mark)

One mark - Pondweed remains at a constant temperature

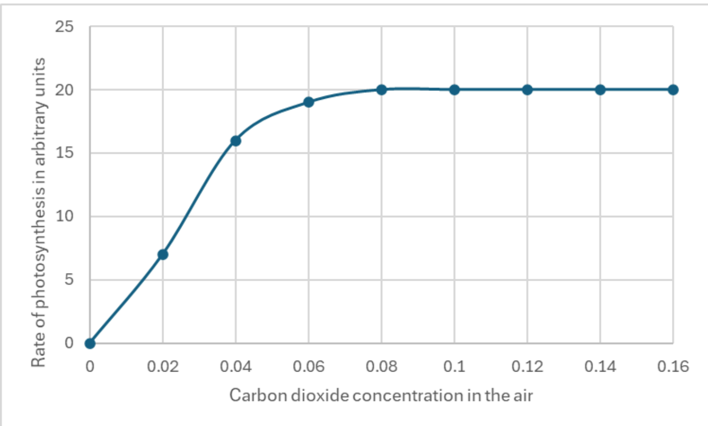
d) What could be the limiting rate of photosynthesis when the light source is 40cm away from the pondweed? Give one factor. (1 mark)

One mark for one of the following:
- **Temperature**
- **Carbon dioxide concentration**
- **Amount of chlorophyll**

e) Suggest how the students could modify the apparatus to measure the rate of photosynthesis more accurately. (1 mark)

One mark for one of the following:
- **Measuring cylinder**
- **Syringe**
- **Scale on the side**

2) The graph shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20˚C.



a) What is the maximum rate of photosynthesis of the tomato plant shown in the graph? (1 mark)

One mark - 20

b) Describe the effect of increasing the concentration of carbon dioxide on the rate of photosynthesis. You should include numbers from the graph in your description. (3 marks)

Mark one - Increases
Mark two - Levels off/reaches a maximum/ remains constant/stays the same/plateaus/stops increasing
Mark three - goes up to/reaches a maximum/levels off at 20 arbitary units OR at 0.07-0.08 concentration

Exam Style Questions - Reaction Time

1) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 9 times before swapping roles and repeating the process.
State three variables the students controlled in this practical. (3 marks)

One mark for each of the following, up to a maximum of three marks:

- Drop ruler from the same height
- Keep arm resting in the same way
- Drop the ruler without any force
- Use the same ruler
- Use dominant hand
- Line up hand/thumb with ruler at the same point each time.

2) Give two reasons why a computer program to measure reaction time is more likely to be more valid than the the ruler drop method. (2 marks)

Mark one for one of the following:

- Participant cannot pre-anticipated the colour is about to change/no indication before the colour changes
- Participant might be able to tell when the other person is about to/is preparing to drop the ruler

Mark two for one of the following:

- Measurement is more precise on the computer
- Resolution of computer timer is higher than manually stopping a stopwatch

3) Table 1 shows the results of an investigation of a group of students investigating the effect of caffeine on reaction time. In their experiment, they completed the ruler drop test before drinking a strong cup of coffee and 15 minutes after drinking the coffee.

Distance ruler fell (cm)	Distance ruler fell (cm)
Before drinking coffee	After drinking coffee
15	13
19	17
13	11
21	8
18	17
25	10
12	14
21	13
Mean = 18.0	Mean = 12.8

Table 1

a) What do the means suggest about the effect of caffeine on reaction time? (1 mark)

One mark - caffeine decreases reaction time/caffeine causes quicker reactions

b) Give one reason why a scientist might not accept this conclusion. (1 mark)

One mark - Idea that results before and after caffeine consumption overlap/ wide set of results
Accept reference to only one set of results/one person/small sample

4) Two students performed a practical to investigate reaction time using the following method:

- Student 1 sits with their arm resting on the table so that their hand hangs over the edge.
- Student 2 holds the ruler so that the 0cm mark is level with student 1's thumb and finger.
- Student 2 drops the ruler and student 1 catches as fast as they can.
- The distance on the ruler is recorded.

They followed these steps 4 more times before swapping roles and repeating the process. Table 2 shows Student 1's result.

Attempt number	Distance ruler dropped in mm
1	109
2	114
3	123
4	125
5	120

Table 2

a) What was the median result? (1 mark)
One mark - 120

b) Calculate the mean reaction time to 3sf, using the equation:

$$\text{reaction time in s} = \sqrt{\frac{\text{Mean drop distance (cm)}}{490}}$$ (4 marks)

Mark one - Mean = 118.2mm
Mark two - $\sqrt{\frac{11.82}{490}}$

Mark three - 0.1553
Three marks for 0.1553 with no working.
Mark four - 0.155
Four marks for 0.155 with no working.

Exam Style Questions - Field Investigations

1) Describe how a quadrat can be used to obtain quantitative data. (3 marks)

Any three from:
- Position quadrat
- Using a random number generator
- Count the number of plants you are investigating
- Estimate the percentage cover of the species

2) A student investigated the number of snails in six $1m^2$ areas of their garden. The garden has a total area of $60m^2$. Describe how the student should use this information to estimate the number of snails in the garden. (2 marks)

- **Mark One -** Calculate a mean/average
- **Mark Two -** Multiply (mean) by 60/the total area

OR
- **Mark One -** Add together the total number of snails in the six areas
- **Mark Two -** Multiple by 10 (total area/sample area = 60/6 = 10)

OR Mark One - 60/6 = 10
Mark Two - 10 x total number of snails in the six areas.

3) Red squirrels eat seeds from the cones of conifer trees. To provide food for winter, they create stores of cones called 'larders' in the ground. Each squirrel will store and protect one larder.

A group of scientists involved with the conservation of red squirrels in Scotland monitored squirrel populations in different types of woodland. They used the following method:
- Ten woods of each woodland type were surveyed
- In each, scientists measured two transects, each 600m long and 10m wide
- One scientist walked along the transects, counting the number of larders they observed.

a) Calculate the total area surveyed in one woodland? (1 mark)

One mark - $12,000m^2$

b) Name one variable controlled in this investigation. (1 mark)

One mark for one of the following:
- Length/width/size of transect
- Number of transects

c) The scientists recorded the number of larders instead of the number of squirrels. Explain how this improved the accuracy of the investigation? (2 mark)

Any two from:
- Squirrels are mobile
- Squirrels could be counted twice
- Squirrels hide

d) Explain how counting the number of larders could lead to inaccurate results. (2 marks)

Any two from:
- Number of larders seen likely to be lower than actual
- Unlikely all could be spotted from 5m away
- Old larders could be counted
- Squirrels moved on/died
- Young squirrels do not make their own larder
- Squirrels may not have made a larder

3) a) Describe how a student could use a 1m x 1m quadrat and 30m tape measure to collect data on the distribution of daisy plants in a field. (3 marks)

Any three from:
- Place the 30m tape measure across the field
- Place quadrats next to the tape
- Count/record the number of daisy plants in the quadrat
- Repeat at regular intervals/named interval

b) Give two environmental factors that could affect the distribution of daisies? (2 marks)

Any two from:
- Temperature/warmth/heat
- Water/rain
- Minerals/ions/salt
- Trampling
- Herbivores
- Competition
- Herbicide/SO2
- Wind
- pH (of soil)