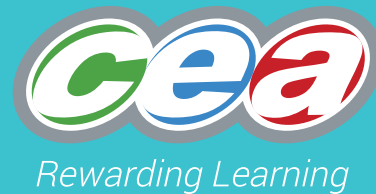


GCSE



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# Biology Practical Manual

## Unit 3: Practical Skills

- 1.2 Investigate the need for light and chlorophyll in photosynthesis by testing a leaf for starch



## **Practical 1.2**

**Investigate the need for light and chlorophyll in photosynthesis by testing a leaf for starch.**

Chlorophyll is the green pigment found in plants. It allows plants to absorb energy from the sunlight.

Photosynthesis is the process where a green leaf uses the energy from the sun to make glucose from water and carbon dioxide.

The glucose is stored as starch in the vacuole of the plant cells.

De-starching means that the plant uses up all the stored starch and does not make any more to replace it. This happens when the plant is placed in the dark for 24 hours. No photosynthesis can occur so no starch is made and the plant uses all stored starch to stay alive.

***To test a leaf for the presence of starch:***

**Apparatus:**

- a green plant (as long as leaves are not too waxy any plant will do; geraniums work well)
- glass beaker (250ml or larger)
- tongs
- ethanol
- funnel
- kettle (to boil water) or tripod, gauze, Bunsen burner (to boil water)
- white tile
- iodine solution

**Method:**

1. Remove a leaf from the plant and place it in the beaker.
2. Boil water in a kettle and pour the boiling water onto the leaf.
3. Leave the leaf in the boiling water for 10 minutes; if it cools add in more boiling water. This will break down the cell walls.

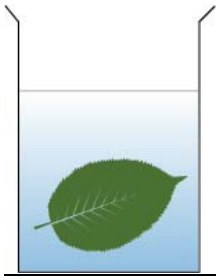
***Alternative step 2 & 3***

2. *Set up a tripod, gauze and beaker. Half fill the beaker with water and place the leaf in it.*
3. *Light the Bunsen burner and place it under the tripod. Boil the water and leaf for 10 mins.*

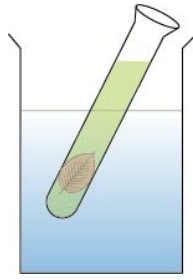
4. Use the tongs to remove the leaf from the boiling water.
5. Place it into a test-tube.
6. Use a funnel and carefully fill the test tube with enough ethanol to cover the leaf.
7. Place the test-tube of ethanol with the leaf into the beaker of boiling water.
8. If the water has cooled add more boiling water from the kettle.

**Do not use the Bunsen burner to heat the ethanol. It is extremely flammable.**

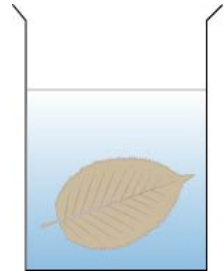
9. The ethanol will boil as it is heated to its boiling point of 78°C by the hot water. The boiling ethanol will dissolve the chlorophyll from the leaf.
10. Remove the leaf from the ethanol and rinse it in the beaker of hot water. This will soften the leaf which will be brittle following boiling in ethanol.
11. Place the leaf on a white tile.
12. Drop iodine on to the leaf. Record the colour change.



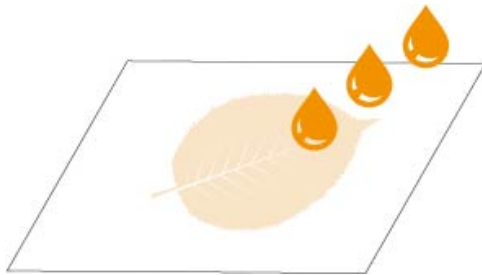
STEP 3: place leaf in boiling water



STEP 7: Place the test-tube of ethanol with the leaf in the beaker of boiling water



STEP 10: Rinse the leaf in hot water



STEP 12:  
Drop iodine onto the leaf

## Results

After step 3: Boiling, the leaf will still look green.

After step 10: After boiling in ethanol the leaf will be pale green or even white as the chlorophyll has been removed.

After step 12: Iodine is orange/brown.

## Conclusion

If starch is present: iodine changes to blue/black.

If no starch is present: iodine remains orange/brown.

*To investigate the need for light in photosynthesis:*

1. De-starch the plant by placing it in a dark cupboard over-night.
2. Test a leaf for starch.
3. Leave the plant in sunlight or next to a lamp for a few hours.
4. Test a leaf for starch.

**Results:**

1. The leaf from the 'dark' plant has no colour change when tested with iodine.
2. The leaf from the 'light' plant has changed to blue/black when tested with iodine.

**Conclusion:**

Light is needed for photosynthesis to occur. When the plant photosynthesises, food will be made and stored in the leaf.

***To investigate the effect of light intensity on photosynthesis:***

**Apparatus:**

1. Place *Elodea* (Canadian pond weed) in a basin of water and, place a funnel and measuring cylinder on top.
2. Record the distance from the lamp to the plant.
3. Bubbles of oxygen will be released from the pondweed as it is photosynthesising.
4. Count the number of bubbles produced in 1 minute OR record the time taken to collect 10cm<sup>3</sup> of oxygen in the measuring cylinder.
5. Move the lamp further away from the plant.
6. Repeat step 4.
7. Move the lamp further away again.
8. Compare the results

**Results (sample results table)**

<b>Distance of lamp from the plant/cm</b>	<b>Number of bubbles in 1 minute</b>
10	
20	
30	

**Conclusion**

As the lamp moves further from the plant the number of bubbles of oxygen produced every minute decreases OR it takes longer to collect 10cm<sup>3</sup> of oxygen when the lamp is further away from the plant.

Therefore the rate of photosynthesis will vary as the light intensity varies. The lower the light intensity the slower the rate of photosynthesis and vice versa.

*To investigate the need for chlorophyll in photosynthesis:*



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Use a variegated leaf: one with green parts (with chlorophyll) and white parts (no chlorophyll) such as the geranium shown.

1. De-starch the plant by placing it in a dark cupboard over-night.
2. Test a leaf for starch.
3. Leave the plant in sunlight or next to a lamp for a few hours.
4. Test a leaf for starch.

**Results:**

1. The pale section of the leaf has no colour change when tested with iodine.
2. The green section of the leaf has changed to blue/black.

**Conclusion:**

Chlorophyll is needed for photosynthesis to occur. When the plant photosynthesises, food will be made and stored in the leaf.



## **Additional investigation**

*To prove that carbon dioxide is needed for photosynthesis:*

### **Apparatus**

1. De-starch the plant by placing it in a dark cupboard over-night.
2. Stand it in a bright room.
3. Place a leaf in a clear plastic bag while it is still attached to the plant.
4. Place a small dish of sodium hydroxide inside the bag with the leaf and seal.
5. Leave the plant for a few hours.
6. Test the leaf inside the bag for starch.
7. Test any other leaf from the plant for starch and compare the results.

### **Results:**

1. The leaf inside the bag does not change colour with iodine.
2. The leaf from any other part of the plant does change colour with iodine.

### **Conclusion**

The sodium hydroxide absorbs carbon dioxide from the air so the leaf in the bag has no carbon dioxide. It cannot photosynthesise and therefore does not make any starch.