

To compare the results of starch test in 3 different types of leaves - fully green leaf, variegated leaf, leaf brought from home.

Apparatus: 250cm³ beaker Petri dish
Bunsen burner boiling tube
Forceps tripod stand
Glass rod wire gauze
Test tube holder

Materials: alcohol
Iodine solution
2 small leaves + 1 leaf brought from home
Leaf A = fully green leaf
Leaf B = variegated leaf
Leaf C = leaf brought from home/from school garden

Procedure:

1. Using your iPad, capture the original appearances of the three leaves by placing the leaves on the space provided on Table 1 (page 5).
2. Half fill a beaker with water and heat it until the water boils.
3. Put the leaves into the boiling water for 5 minutes.

What is the purpose of boiling the leaf?

Denature all the enzyme in the leaf, to prevent digestion of starch to glucose during the experiment

4. After 5 minutes, switch off the Bunsen flame.
5. Put the boiled leaves in separate boiling tubes each containing some alcohol.

Then place the boiling tubes in a beaker of hot water as shown in Figure 1 below. **Ensure that the Bunsen flame has been switched off.**



▲ Figure 1

Safety precautions:

- Never heat the boiling tube with alcohol directly over a Bunsen flame.
Why?
- The level of alcohol in the boiling tube should be lower than the level of hot water in the beaker.
Why?

This ensures that all the alcohol in the boiling is uniformly heated up

6. What is the color of the alcohol:

a. before the leaf is put in?

green ~~clear~~ colourless

b. 5 minutes after the leaf is put in?

green

7. What do you think the alcohol has done to the leaf?

Remove the chlorophyll from the leaf

8. As the leaf is now very brittle, gently remove it with a pair of forceps. Then, put the leaf back into hot water. What does this do to the leaf?

leaf then absorbs the water, has moisture

9. Remove the leaf and place it on a Petri dish. Add a few drops of iodine solution until the leaf is just covered with iodine.

- First, spread the leaf evenly in the Petri dish using a pair of forceps.
- Use just enough iodine to cover the leaf completely.

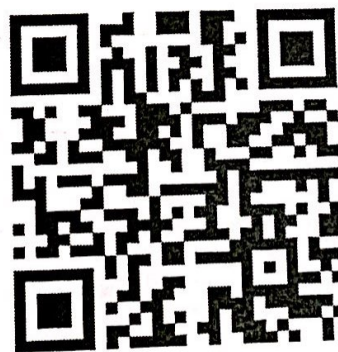
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not too much !!!

10. Record and discuss your observations in Table 2 below.

Table 2. Results and evaluation of starch test

Leaf	A	B	C
Observation(s)	The iodine turned from brown to blue-black on the leaf ✓ inside / central area ✓	The parts of the leaf that turned blue-black will correspond to the part of the leaf with the greener region ✓	The iodine remained brown ✓
Explanation and Conclusion	Blue - black coloration coloration shows the presence of starch. This means that photosynthesis has taken place ✓	The greener region of the leaf contains more chlorophyll, which allows photosynthesis to take place. The whiter region of the leaf do not contain chlorophyll, so it has less starch, and the iodine remained brown ✓	The starch made during photosynthesis the previous day has already been used up by the leaf ✓

11. Using your iPad, capture the image of the final appearances of Leaves **A**, **B** and **C** on Table 3 (page 7). Post up the image on the Padlet wall.



12. Based on your experimental results, **discuss, in detail**, any 1 factor which affects how much starch is detected in a leaf.

- Amount of chlorophyll in the leaf
- Amount of sunlight the leaf was exposed to

15. Challenge questions! (Choose any one!)

- During the experiment, you observed that the leaf appeared brittle after being submerged in alcohol. Why did this happen?
- What are some strengths of this starch test experiment?
- What are some limitations of this starch test experiment? Suggest improvements/alternative experiments that may be performed.

Choice of question: b

Answer:

This experiment can conclude if photosynthesis has taken place in the leaf in a quick and simple test. It also shows how the lack of chlorophyll affects the leaf's ability to photosynthesize. The variegated leaf has 2 different regions, the green and white regions. The green region has photosynthesized and produced glucose (stored as starch), this can be present in the results of the iodine test (blue-black colour).

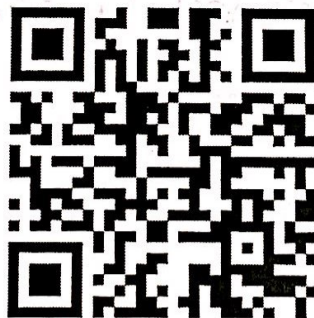
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10. Record and discuss your observations in Table 2 below.

Table 2. Results and evaluation of starch test

Leaf	A	B	C
Observation(s)	Brown to blue black in the middle of area of the leaf	- Remains brown in the external area - Brown to ^{blue-black} in the inner area - The parts of the leaf external area ^{external area} brown that turned blue-black	Remains brown in the entire leaf
Explanation and Conclusion	Blue-black colouration indicates the presence of starch in the leaves. This means that photosynthesis has taken place.	Blue-black colouration indicates the presence of starch and vice versa. This means that there is more chlorophyll in the inner area than external area	No blue-black colouration indicates the absence of starch. This means that photosynthesis did not take place. Leaf was plucked more than 12 hours before experiment was conducted

11. Using your iPad, capture the image of the final appearances of Leaves **A**, **B** and conduct **C** on Table 3 (page 7). Post up the image on the Padlet wall. All the starch would likely have been used up overnight



12. Based on your experimental results, **discuss, in detail**, any 1 factor which affects how much starch is detected in a leaf.

- Amount of chlorophyll in the leaf
- Amount of sunlight the leaf was exposed to
- Amount of carbon dioxide the leaf was exposed to
- Time at which the leaf was plucked
- Type of leaf; which would affect how long the plant should be boiled

13. Challenge questions! (Choose any one!)

- During the experiment, you observed that the leaf appeared brittle after being submerged in alcohol. Why did this happen?
- What are some strengths of this starch test experiment?
- What are some limitations of this starch test experiment? Suggest improvements/alternative experiments that may be performed.

Choice of question: 13

Answer:

- It can only determine the presence or absence of starch. It does not tell how much starch is present. It also doesn't tell you the rate of photosynthesis.

Improve: Perform rate-limiting ~~factor~~ experiments (e.g. counting no. of O_2 bubbles)

- The results are determined by ~~colour~~ change and this is subjective.

Improve: Use a colourimeter

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13. Challenge questions! (Choose any one!)

- During the experiment, you observed that the leaf appeared brittle after being submerged in alcohol. Why did this happen?
- What are some strengths of this starch test experiment?
- What are some limitations of this starch test experiment? Suggest improvements/alternative experiments that may be performed.

Choice of question: C

Answer:

1. It can only determine the presence or absence of ~~starch~~ starch, but it does not tell you the amount of starch present.

2. It does not tell you the rate of photosynthesis

Improvement: Perform rate limiting experiments

Sources of error: The results are determined by colour change and is subjective

Improvement: Use a colourimeter

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