S.1 STEM project

Investigating effect of different colored light on rate of photosynthesis

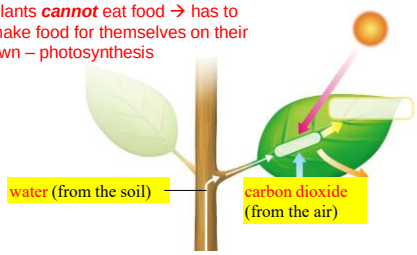
Lesson 1

Preview

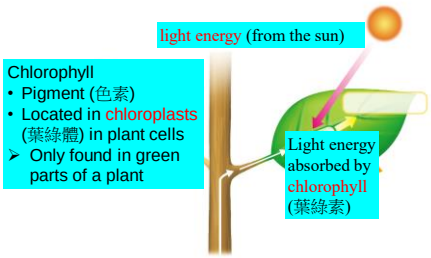
- Introduction of photosynthesis
- Introduction of the project

What is photosynthesis?

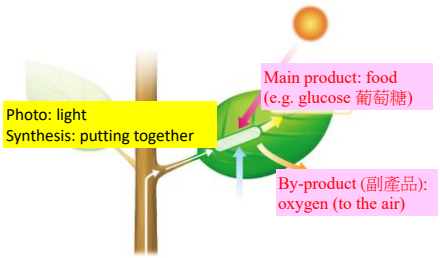
- Plants ***cannot*** eat food → has to make food for themselves on their own – photosynthesis



Conditions to trigger (觸發) photosynthesis



Products of photosynthesis



Light energy absorbed by chlorophyll

carbon dioxide + water → glucose + oxygen

- Some are consumed by the cells immediately
- Some are stored as *starch (澱粉)* for later use

Introduction of the upcoming project 3 students/ group

Topic: Investigating effect of **different colored light** on **rate of photosynthesis**

- Red
- Green
- Blue

How do we know if a plant carries out photosynthesis **fast or slow**?

Light energy absorbed by chlorophyll

carbon dioxide + water → glucose + oxygen

- Measure the amount of oxygen released during a period of time
- Compare the results of different colored lights

Variables of the investigation (WS p.3)

Controlled variables (at least ***two***)	The amount of water supplied, the amount of carbon dioxide supplied, the type of plant, etc.
Independent variable (the thing you change)	The colors of light supplied
Dependent variable (the thing you observe/measure)	The amount of oxygen released

Experimental setup (WS p.3)

- Hints:
  - How can you provide different colors of light to the hydrilla (水草)?
  - How can you collect the oxygen produced by the plant for measurement during the investigation?

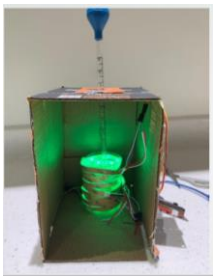
Bring USB drive starting from the next lesson!

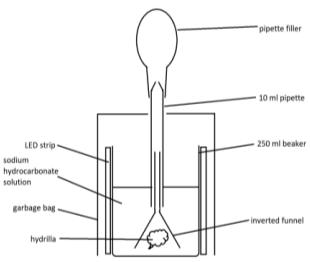
Lesson 2

Preview

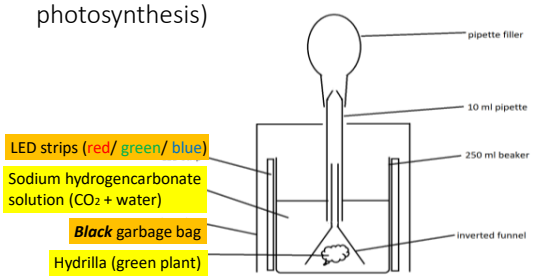
- Explanation on the experimental setup
- Coding: Control the colored light provided by the LED strip

Experimental setup (WS p. 5)

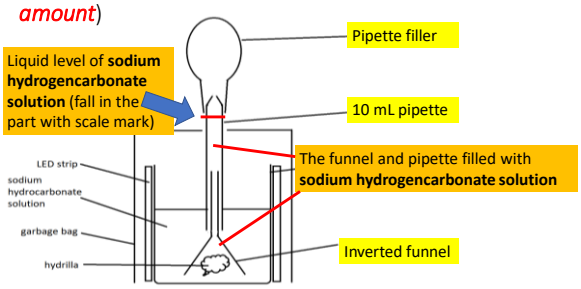




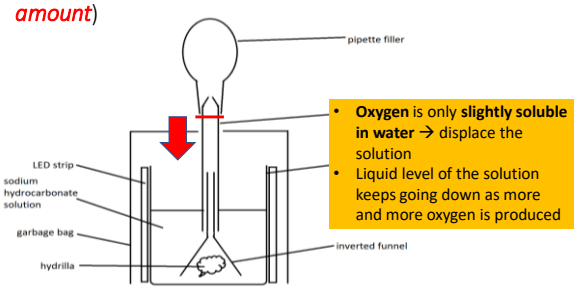
Experimental setup (To provide *inputs* of photosynthesis)



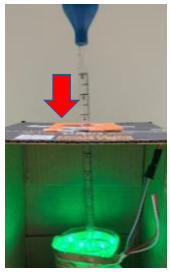
Experimental setup (To *collect oxygen* and *measure its amount*)



Experimental setup (To *collect oxygen* and *measure its amount*)



Experimental setup (To *collect oxygen* and *measure its amount*)



Keep track on the change of liquid level in 24 hours → know the amount of oxygen produced (in mL)

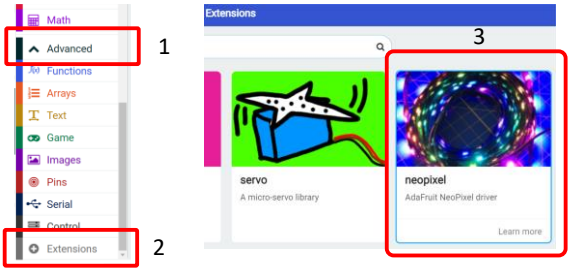
Coding: Control the colored light provided by the LED strip

When button **'A' and 'B'** are pressed:

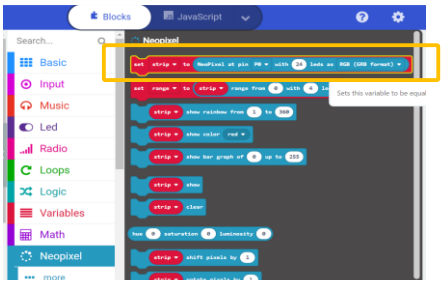
When button **'A'** is pressed:

When button **'B'** is pressed:

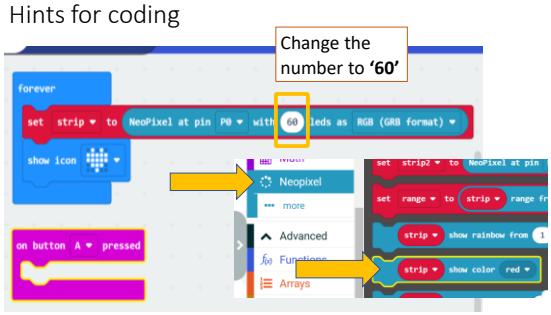
Coding: Add the 'neopixel' package to micro:bit interface



Put this block into '**forever**'

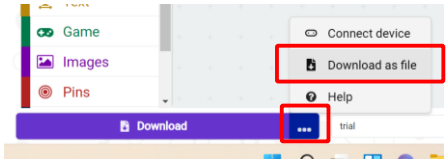


Hints for coding



When you finished coding…

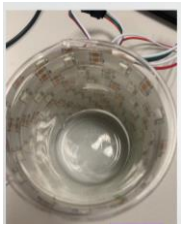
- Download the program to your micro:bit
- Download the program to your USB drive as a back up



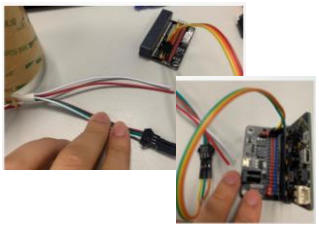
Lesson 3

Preview

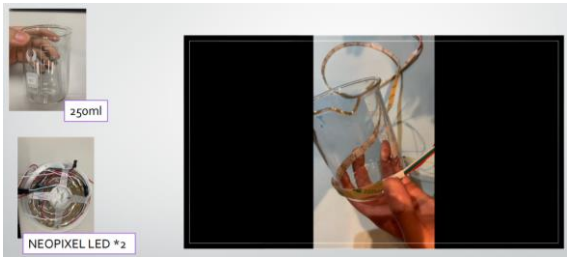
- Affix the LED strips onto the beaker

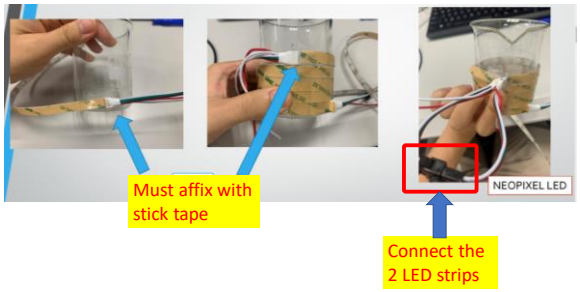


- Connect the LED strips to the micro:bit

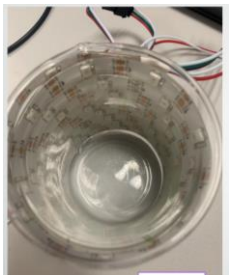


Affix the LED strips onto the beaker

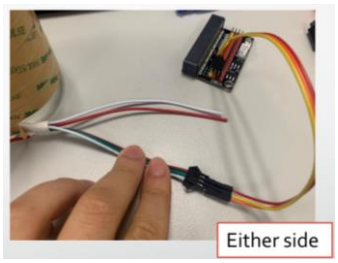




Double check the beaker is fully covered with the 2 LED strips ☺

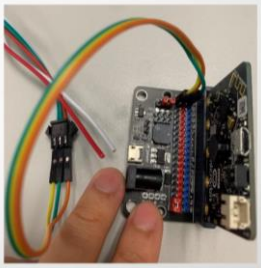


Connect the LED strips to the micro:bit



LED strip	Micro:bit extension board
Red	3V
Green	Pin 0
White	GND

Connect the micro:bit to the extension board ☺



Ask your teacher to come and mark your work! 

Expected outcome

When button **'A' and 'B'** are pressed:

When button **'A'** is pressed:

When button **'B'** is pressed:

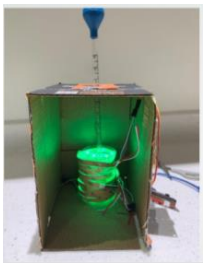
Bring these to the next lesson!

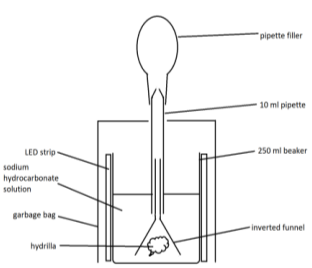
Two pieces of AA dry cells

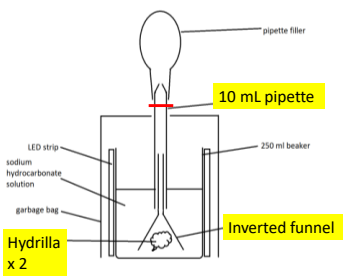
A black garbage bag

Lesson 4

Preview – Assemble the experimental setup







Reminders:

1. ***Root*** of the hydrilla should be pointed up in the stem of the funnel.
2. Squeeze the pipette filler to suck the solution into the pipette. (***Avoid gas bubbles get into the pipette***)

3. Connect the battery case (with dry cells) to the micro:bit.

4. Switch to the specific color according to the following assignment:

Group number	color
1-4	Red
5-8	Green
9-11	Blue

5. Wrap the set up with the black garbage bag.

6. ***Take the initial reading of the liquid level*** ***and*** ***mark the starting time on your worksheet p.5.***

Example:

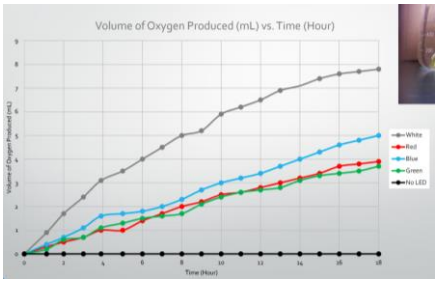
Time	Liquid level (mL)	Volume of gas collected (mL)
08:30	8.8	0
10:00	8.4	8.8-8.4 = 0.4
11:30	8.1	8.8-8.1 = 0.7

7. Stick a piece of memo onto the pipette filler. (***Write your names, class, group number and starting time!***)

Your teachers will take photos from time to time to keep track of the change in the liquid level.

Lesson 5

Preview – result and data treatment



Based on the photos, complete the result table of Q7 on your worksheet p.5.

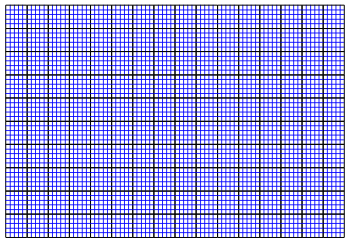
Example:

Time	Liquid level (mL)	Volume of gas collected (mL)
08:30	8.8	0
10:00	8.4	8.8-8.4 = 0.4
11:30	8.1	8.8-8.1 = 0.7

Worksheet p.6 Q8:

Plot a graph of ***volume of gas collected*** against ***time***

Volume of oxygen produced (mL)



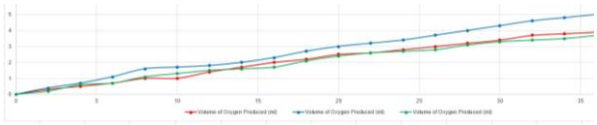
Time (hours)

Worksheet p.6 Q9:

Determine the ***average rate of gas formation*** in the first 24 hours

Total volume of gas collected in 24 hours: _____

Average rate of gas formation (cm^3/hr) =



Worksheet p.6 Q10:

Collect the results from other groups working with ***different colored light***

Color of light used	Average rate of gas formation (cm^3/hr)
Red	
Green	
Blue	

Conclusion

_____ light is most efficient for green plants to carry out photosynthesis.

Hand in the completed worksheets next lesson!