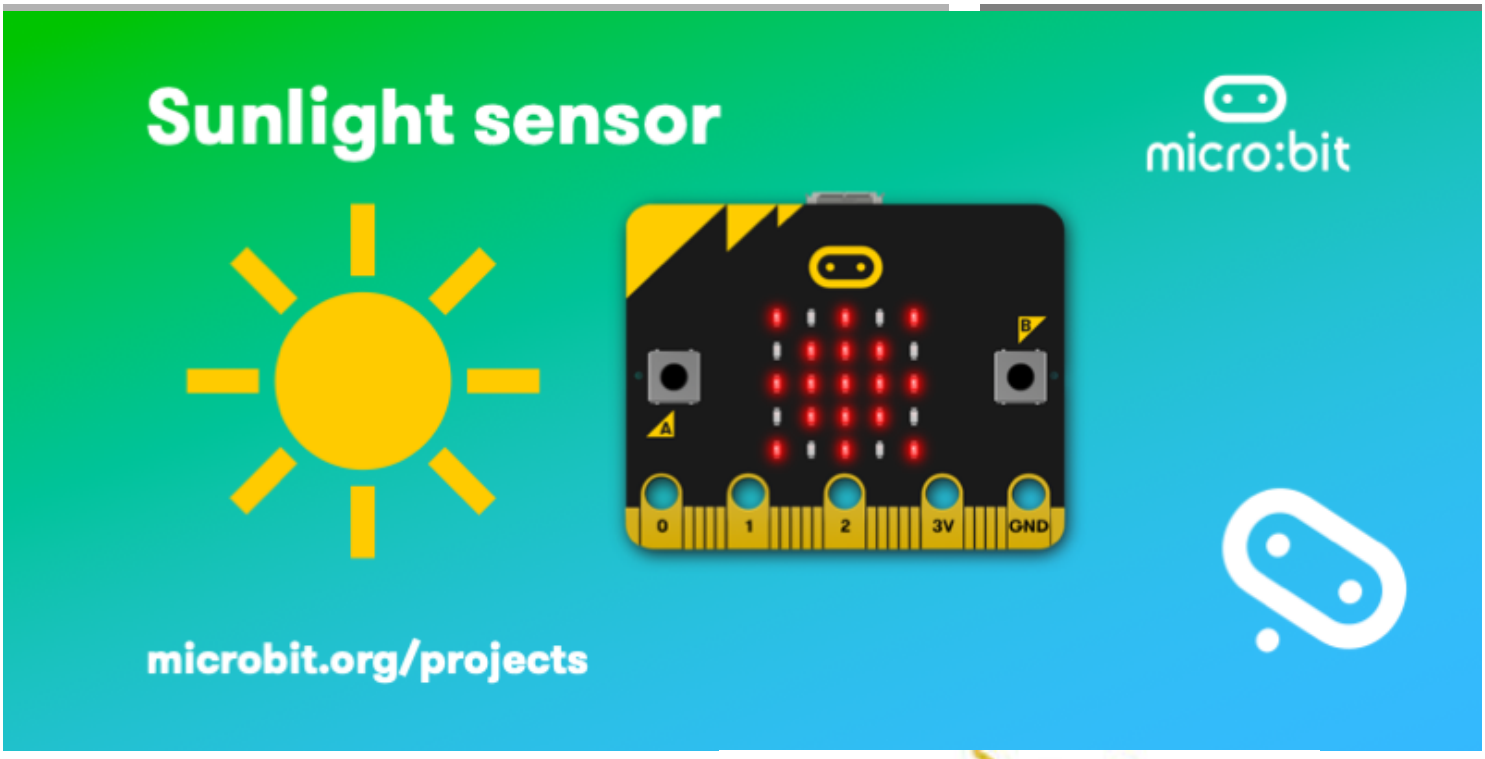
Using Microbits to measure the light level of sunlight for optimal plant growth.

Life Science

Middle School

2020 fall semester



https://www.earthrangers.com/climate-change-2/the-power-of-the-sun/

Standards:

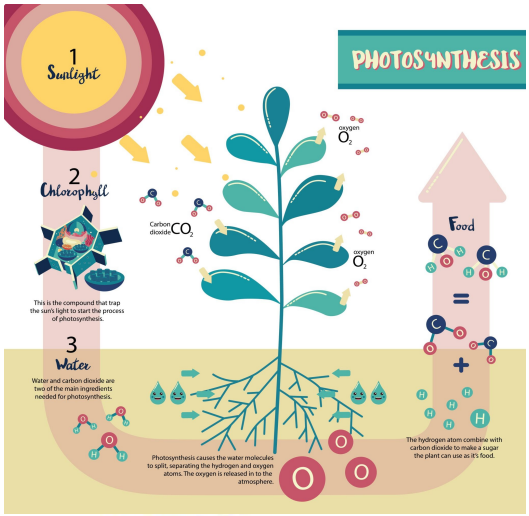
WYCSTA Standards: CS.T, DA.CVT, DA.IM, and AP.A
WYScience Standards MS-LS1-5, MS-ETLS1-1, MS-ETLS1-2
WYELA Standard WHST.6-8.2
WY Mathematics Standard 6.SP.A.2
WY Career and Vo Ed CV8.3.1
ISTE 5a, 5b, 5c.
NGSS MS-LS2-4, LS2-A, ETS1-B.

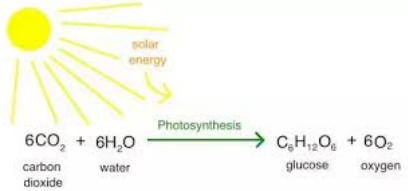
Learning Targets:

- Microbit can measure the amount of sunlight a plant receives. Is there a limit to how much sunlight a plant should receive?
- The process of photosynthesis.
- Explain how a plant grows and parts of a plant.

Criteria for Success/SWBAT:

- Observe how different amounts of sunlight affect the growth of a plant.





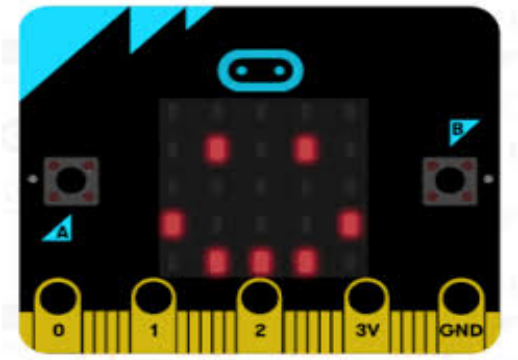
- Draw their own conclusion from their experiment.
- Gather evidence of inputs and outputs by finding the amount of sunlight a plant can absorb.

Materials

Groups can be as small as one or as large as four students. Below is material for each group.

- 1 Microbit
- Computer, i-Pad or Chromebook
- MakeCode (internet program)
- Battery Pack for Microbit
- Light Sensor for Microbit
- Seeds (beans recommended)
- Soil
- Containers for plants
- Sunlight

Catch:



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Pretest Questions:

1) How do you know a plant is growing?
2) Choose a plant and make a diagram showing what this plant needs in order to grow. Label all parts of the plant that you know and explain each function.
3) Explain if a microprocessor, such as Microbit, can improve the growth rate of a plant.

Objectives:

Students will investigate and design an experiment that explores the natural world using microprocessors. They will study the phenomenon of photosynthesis, "which is the process used by plants, algae and certain bacteria to harness energy from sunlight and turn it into chemical energy." [1](livescience.com) Students will create an experiment that uses Microbit light sensors to determine the optimal amount of sunlight needed to grow the fastest growing bean plant, from seed to germination.
They will program a Microbit to accurately measure the amount of sunlight a plant receives.

Evaluation:

Students will be given a pre-assessment to see if they have any misconceptions about plants and sunlight.
They will learn how to use a Microbit for determining the amount of sunlight.
Then, students will create an experiment to determine if there is a correlation between the amount of sunlight and the growth of a plant.
Finally, students will be given a post-assessment to see if their misconceptions have been addressed.

[1] (htt) (htt1)

Lesson Schedule with Review Strategies embedded in green:

Pre-test Questions (5-10 minutes):

1) How do you know a plant is growing?
2) Choose a plant and make a diagram showing what this plant needs in order to grow.
3) Explain if a microprocessor (processing part of the computer), such as Microbit, can improve the growth rate of a plant.

Identify any misconceptions in pre-test questions or conversations with students. Such as:

Needs of Plants (https://beyondpenguins.ehe.osu.edu/issue/polar-plants/common-misconceptions-about-plants
More misconceptions can be found at the above website)
Students also tend to give plants human characteristics, especially when it comes to considering what plants need to grow. They may describe plants as eating, drinking, or breathing, or believe that plants need things that are provided by people. This may be an unintended consequence of having students grow and care for plants. (Fries-Gaither, 2009)

The role of light and nutrients in plant growth seems to be especially difficult for elementary students. For example, students may view sunlight as useful but not essential for plant growth.

STUDENTS MAY THINK…	*INSTEAD OF THINKING…*
Sunlight is helpful but not critical.	Sunlight is essential for plant survival.
Sunlight helps plants grow by keeping them warm.	Chloroplasts in the plant absorb the sun's energy for use in photosynthesis.
Soil provides a support structure and food for plants.	Some plants grow in soil-free environments. Plants take up water and minerals from soil, but not "food."
Plants need things provided by people (water, nutrients, light)	While people often care for plants (especially those indoors), plants as a whole are not dependent on people for their n

Pre-Assessment (10 minutes): All students will be given a pre-assessment (examples of assessment questions are listed at the bottom of this lesson). and will be required to submit a lab journal during this investigation.
Identify any misconceptions in pre-assessment questions.

Introduction (10 minutes): Briefly review how a plant grows, edpuzzles - https://edpuzzle.com/media/5f0dc67ba0436a3f0c429cc5
and photosynthesis https://read.activelylearn.com/#teacher/reader/authoring/preview/518302/notes. Students can work on assignments at home or in class.
Use an entrance ticket to check for understanding and misconceptions.

Microbit (20 minutes) Students make a working Microbit that measures the amount of sunlight. Each group or student will need a light sensor, Microbit and a Chromebook. They will use the following link to build a working light sensor so they can measure the light intensity of the sun, https://microbit.org/projects/make-it-code-it/sunlight-sensor/.
Monitor students' progress and ask questions.

Create write up for experiment (30 minutes). Students will develop an idea for an experiment, discuss their idea with the teacher and then if the teacher approves the idea for the experiment, the student will write-up the design for the experiment. Ideas for design experimental rubric can be found at www.rcampus.com. Students may need to be guided/reminded to record amount of sunlight plant receives, height and germination. It would be best if students grow minimum of 5 plants and place them in different areas that receive different amounts of sunlight.
Next two to three weeks. Students will record their plants information each day and at the end of the week have a group discussion of how their plants are growing. Observe which plants are going the fastest and determine why.
Have students graph the classes information and have a class discuss explaining what works for optimal pant grow using the data.

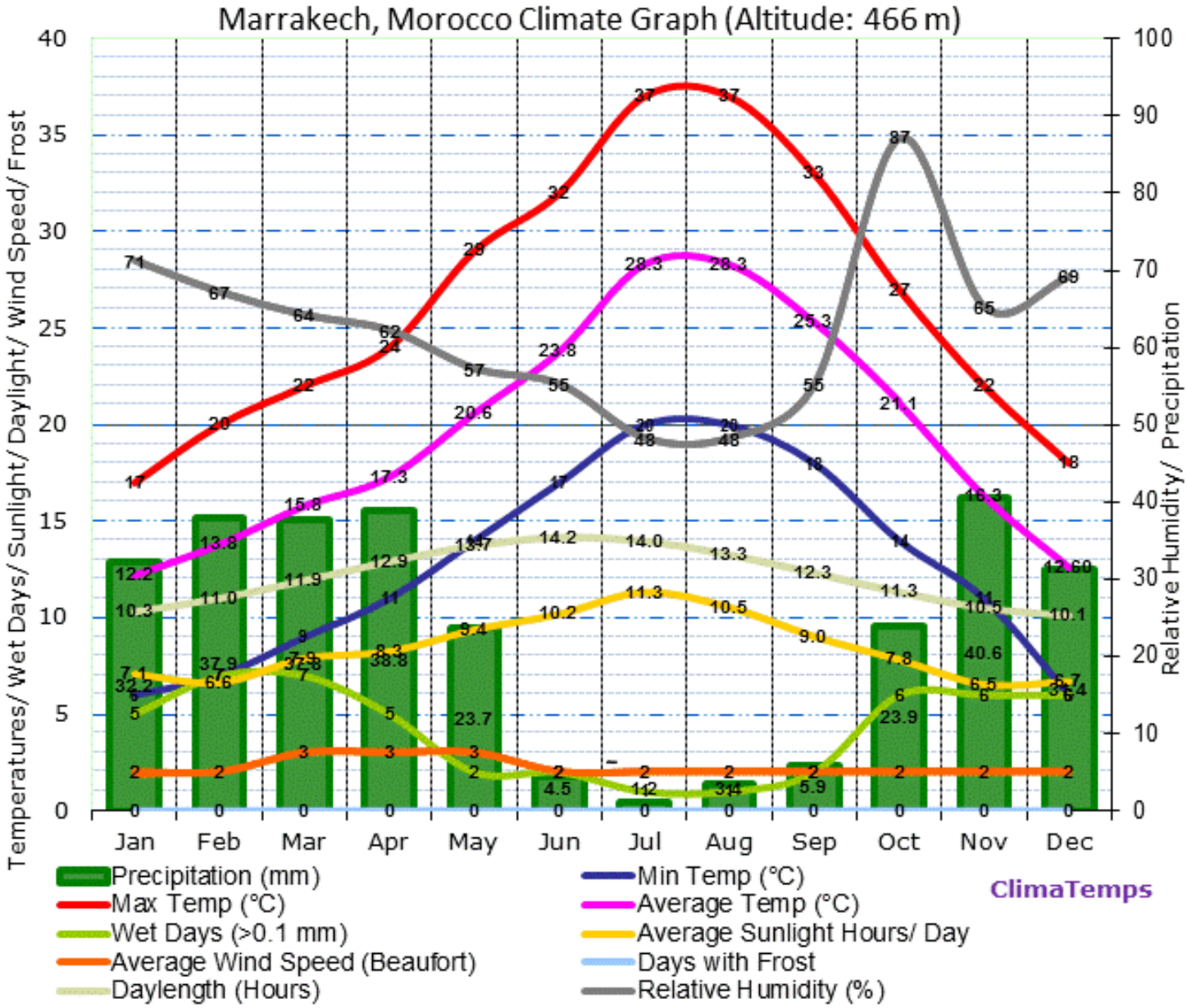
Lab write up (50 minutes). Give students time to write up their lab experiment and have students proof read each other's report. Ideas for lab rubric can be found at www.rcampus.com.

Post-test questions (15 minutes): Every student will be given a post-test questions, post-assessment (assessment and test questions can be combined to one form), lab journals and lab write ups will be collected.

1) How did you know your plant was growing?
2) Using the bean seed, make a diagram showing what this plant needs in order to grow. Label all parts of the plant that you know and explain each function.
3) Explain if the Microbit helped you determine the best location for sunlight to grow a bean plant.

Pre and Post Assessment Questions:

1) Explain if plants are living or non-living. How do you know?
2) Explain if the amount of sunlight affects the growth of a plant? For example, will a plant grow in the dark? Will a plant grow better with 18 hours of sunlight?
3) Explain if a microprocess, such as a Microbit, can help a plant regulate the amount of sunlight it receives?
4) What data/information do you need to determine the optimal (best) growing benefits for a plant?
5). Using the graph below, explain when is the best time to grow plants outside in Marrakech, Morocco. Remember 0 °C is freezing.



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