

# Gardyn

FOR SCHOOLS



## Growing with Gardyn

Introduction to Hydroponic Gardening in the Classroom

# Meet Your Presenters

**Alicia Kuntz** has been a science educator for 22 years in rural Michigan. Her passion encompasses all living things including her four classroom corn snakes, an axolotl, and numerous plants. She continues to strive to be a lifelong learner by participating in professional development at NASA and having her class participate in the “Growing Beyond Earth” research project. Choosing to integrate Gardyn into her current science curriculum three years ago was an obvious choice and one that enabled her to plant the seeds of curiosity and knowledge in her students.  
[Alicia@charger57.com](mailto:Alicia@charger57.com)



# Meet Your Presenters



With a love of Gardyning and all things science, **Renee Egan** has sought to bring extra-ordinary experience to her students. From “Growing Beyond Earth”, incorporating hydroponics, aquaponics, DWC, and aeroponics, Ms. Egan strives to deliver curriculum in a hands-on, relatable manner that captivates and immerses each learner in her classroom. Working alongside Gardyn to provide teachers across the nation with not only standards based lessons, but also fun and engaging experiences, has been a dream come true and one she is proud to be a part of.

rhe66104@gmail.com

# Gardyn

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## **Our Mission**

**To diversify your approach to NGSS standards while increasing your students' knowledge and interest in plants with Gardyn.**

Feel free to type any questions or comments that you have into the chat during the presentation. We will also have time at the end for discussion.



Stay tuned until the end for a chance to win a microgreens kit.



Welcome to the wonderful  
and exciting world of  
Gardyn! The new and easiest  
way to turn any space into a  
thriving hydroponic indoor  
gardening system. This is  
hydroponics like you've  
never seen before!



Gardyn Home 4.0



# What is Hydroponics?

Hydroponics is growing plants without soil. Hydroponics is a Latin word meaning “working water.” In the absence of soil, water goes to work providing nutrients, hydration, and oxygen to plant life.

Gardyn is a ground-breaking, award-winning, vertical gardening system.

It features 2 breakthroughs:

- Novel Hybriponics
- AI-powered w/ Kelby

Gardyn changing the game for STEM Education:

- Compact design to grow 30 plants in just 2 feet
- Autonomous to keep growing through school breaks
- Adaptable learning for any program



# Hybriponic® technology

## An Innovative Approach to Gardyning

- Gardyn® columns proudly utilize a new and upcoming method of hydroponic gardening called **hybriponic technology**. This is a combination of hydroponics and aeroponics techniques and was developed by Gardyn along with along with researchers at McGill University
- Instead of keeping plants submerged in water all of the time (hydroponics) nor just misting the roots periodically (aeroponics), Gardyn combines the 2 techniques with the proprietary LED based lights to create a overall effective and efficient method of vertical gardening.

This technique is not only effective at providing water and nutrients to each plant in the Gardyn unit, but also requires 95% less energy that outdoor gardening to operate, resulting in minimal cost per month to operate your Gardyn! In fact, following Kelby's recommended light schedule, the Gardyn is estimated to use 26-68kWh per month depending on the device model. Gardyners have reported only paying a few dollars more per month on their usual bill due to minimal usage increases (electricity supply rates vary based on your utility provider).



# Gardyn Devices: Where design meets function



## yPOD®

Plug-in yPods contain the plants and their roots.



## yCUBE®

Seeds are nestled into rockwool and grow within each distinct yCube.



## LED LIGHTS

60 Full spectrum LED lights are set to a schedule for optimal plant growth.



## CAMERAS

Kelby keeps an eye on your plant's health 24/7, even while you're on vacation.



## WATER TANK

A 5 gallon Water tank and recirculation system means less refills.

Gardyn devices integrate technology and function, by combining innovative design with AI technology.

Gardyn utilizes up and coming concepts and design to provide a successful and low maintenance experience!

# Water at Work

Just like us, plants need essential factors in order to not only grow, but thrive.

Gardyn provides these essential factors by equipping units with full spectrum led lights to facilitate photosynthesis. A 5 gallon reservoir with pump holds and cycles water and nutrients to plants.



# Water at Work

Nutrient rich water is pumped up from the reservoir to the top of each column. It then flows down and fills each cup to capacity. Extra water and nutrients continue down the column to the remaining plants. The roots of the plants absorb the water and nutrients. A few hours later, the process repeats.



# Compact Design

Gardyn understands that in most classrooms, space is limited. Organization and utilization of available area is extremely important. With this in mind, Gardyn has developed 2 devices that can fit any classroom, taking up, at most, 2x1 foot of space. To further maximize space, the devices are created vertically to provide space for up to 30 plants.

Gardyn 4.0



30 Plants

Gardyn Studio



16 Plants



# Gardyn Plants

Each Gardyn Home device can grow 30 plants and there are 100+ Gardyn plants to choose from.

You can even use your own seeds.

- Flowers
- Fruits
- Greens
- Herbs
- Veggies

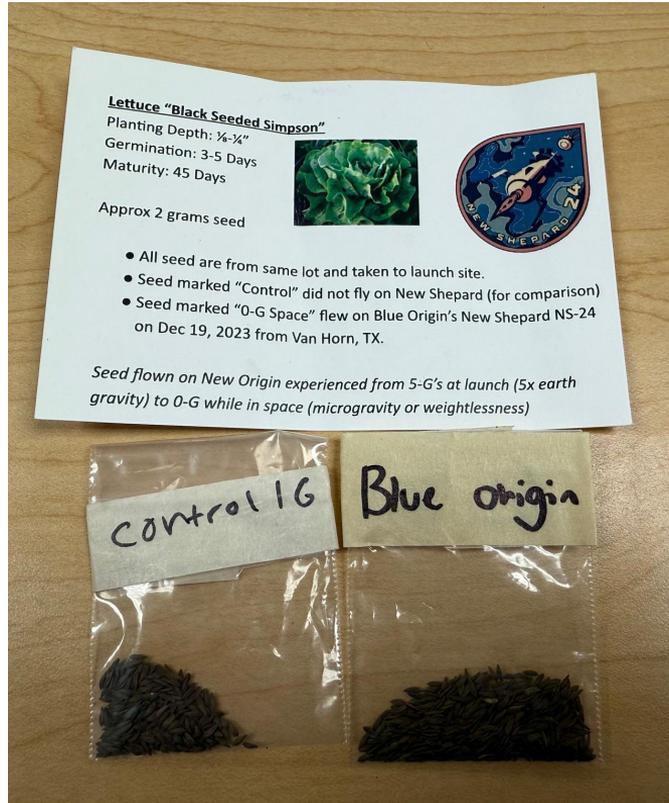


**Students grew seeds from  
The Moon Chili Challenge.**

**These are the same chili  
plants that were grown on  
the International Space  
Station.**



# Comparing Growth of Lettuce Seeds Flown on Blue Origin vs Earth lettuce

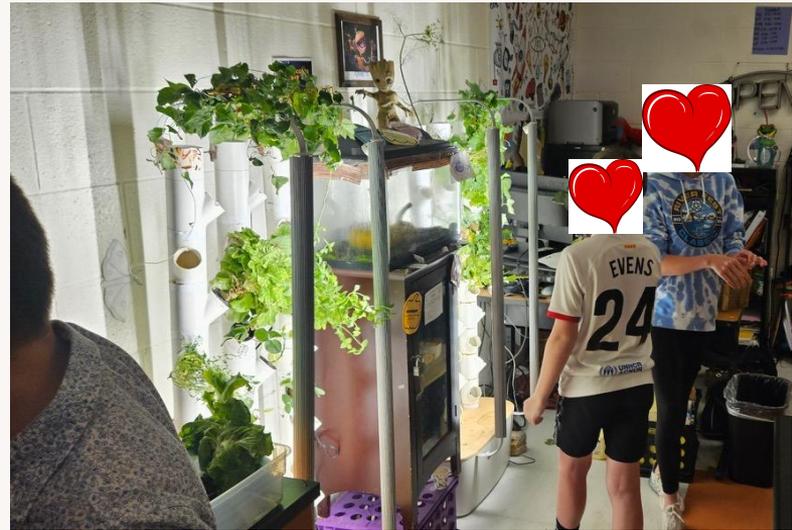


**Provide your students with an opportunity of ownership and caregiving. Anyone can do it and Kelby AI can help!**



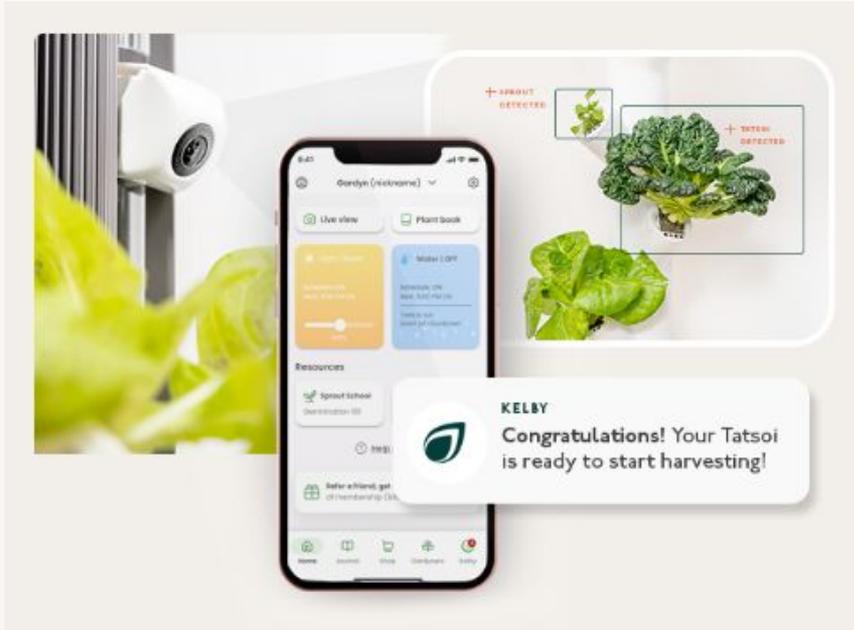
Our students were so proud to share their harvest with the rest of the school.







# Introducing Kelby! The best friend you never knew you had!



- With Kelby, your Gardyn is always growing. Through a network of sensors, it monitors all stages of growth for every plant as well as monitoring the overall health of the system. If it identifies a problem, it offers specific instructions on how to fix it.
- Gardyn's multiple sensors are controlled and monitored by Kelby, which tracks indoor temperature, humidity, water usage, and growth rates of every plant. It's always analyzing and adjusting itself to optimize health and maximize growth at every stage.
- Through the help of AI technology integrated into the Gardyn design, Kelby puts your green thumb on full display with time lapse videos of your growing garden.
- Kelby keeps you updated on progress, status, and offers suggestions on how to optimize growth.
- Wherever you are, your plants are taken care of. With Vacation Mode, your plant growth is slowed, the freshness is maintained, and they're ready to thrive when you get home. All while saving 3-4x energy and 2-3x water.

# Example messages for users



Pepper flower count > 1 with confidence over 80%

🌶️ Your Pepper has flowers - time to pollinate! 🌸 Gently shake the plant by hand to replicate the effects of wind or gently disturb the inside of blossoms with your finger or a small brush. Repeat daily until fruit begins to appear.



Coverage exceeds 80% -Camera not obscured

Your Gardyn is bursting with growth! 🌿 While beautiful, it's better for plants' health to leave room between them for airflow. ✂️ I recommend harvesting your plants regularly to keep them from overlapping too much.





# Computer Vision Techniques



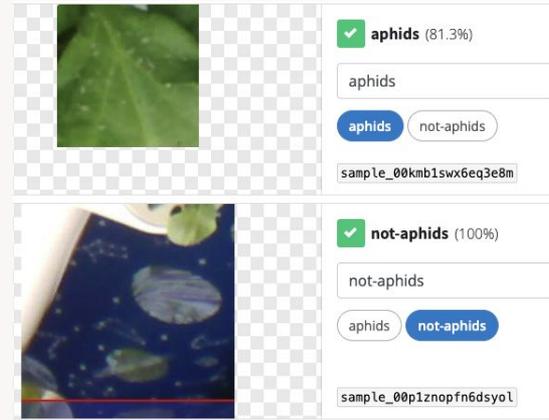
## “Segmentation” models

Identify detailed area in images where features are present (identification of leaves and plants)



## “Detection” models

Identify the location of specific objects in images (sprouts, cardboard, flowers etc)

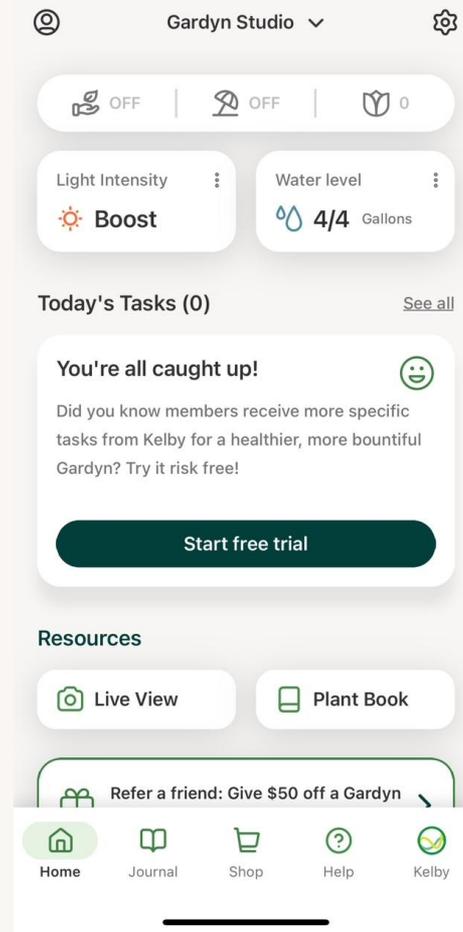


## “Classification” models

High-accuracy decision to confirm a detection in critical cases (flower identification, pollen etc)

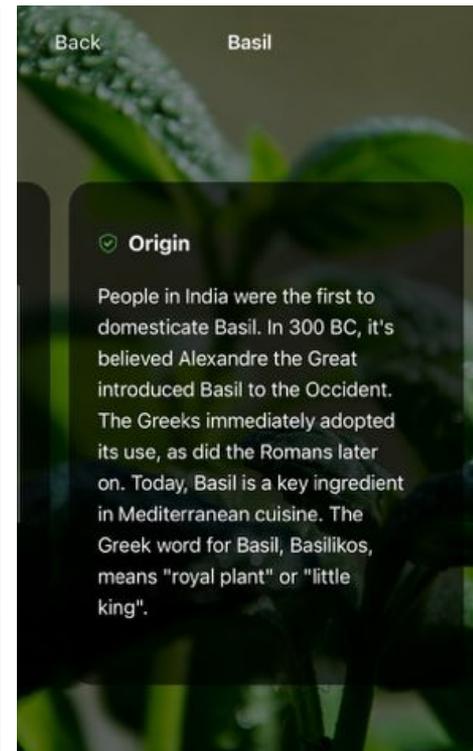
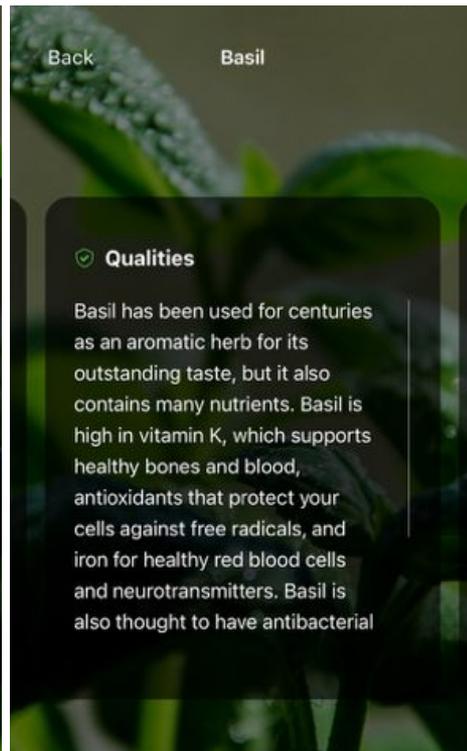
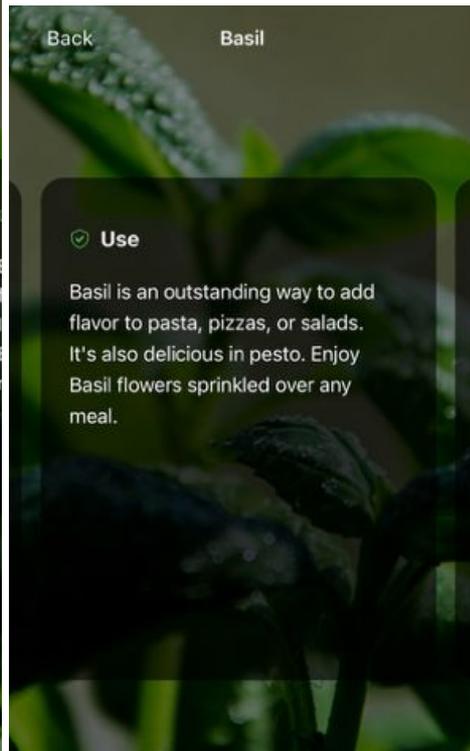
# Gardyn App

- Provides live data
- Controls light and watering cycles (automatically run on a schedule)
- Prompts with tasks when needed
- Help center with hundreds of resources
- Troubleshooting self-service hub

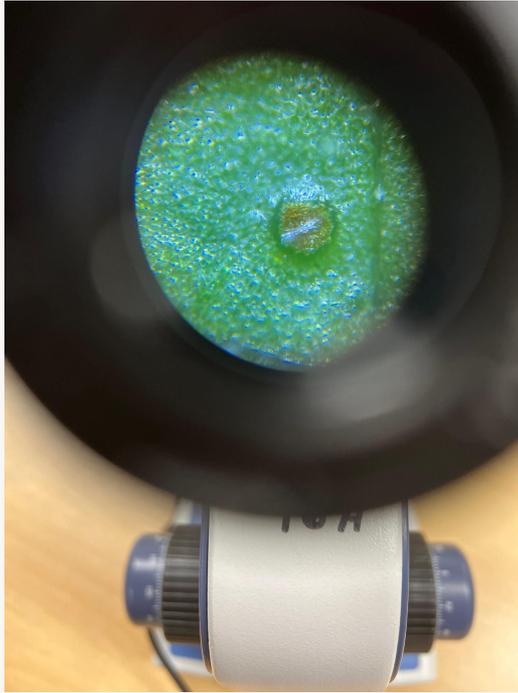




# Plant Book - In App

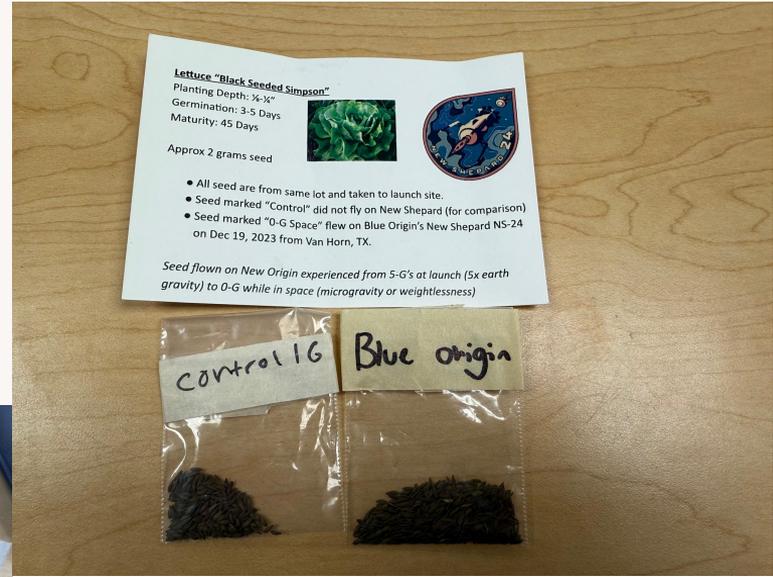


**Integrate Gardyn into your current science curriculum.**





# Chromatography and Photosynthesis



# Comparing growth of space lettuce vs Earth lettuce



Feed for  
incubated  
ducklings

Traditional  
gardening vs  
hydroponics



Gardyn just released Kindergarten  
through High School NGSS aligned  
lessons!

*Lesson are written and tested by veteran  
science teachers still in the classroom.  
Includes lesson plans, student worksheets,  
and answer keys.*

# Pre-school / Pre-K Sprouting Gardyner

- Integrate STEAM into their learning process and understand the importance of nutrition through microgreens.
- 5 lessons; flexibility range 1-2 weeks



# K-5th Elementary STEAM

- Explore hydroponic systems, data collection, and art techniques to visualize plant growth
- Hands-on learning through plant and life science, principles of art, and interactive studies aligned to NGSS
- 9 lessons at 50 minutes each; flexibility range of 9-14 weeks of study



# 6th-8th Middle School STEM

- Hands-on learning aligned to NGSS in plant and life science, earth science, and engineering
- 27 lesson plans at 50-250 minutes each; flexibility range of 9-35 weeks of study (roughly 37 hours of learning)
- Enhances critical thinking skills and provides project-based learning opportunities



# 27 Middle School Lessons Aligned to 26 NGSS Standards

- \*Getting to Know Your Gardyn
- \*MyGardyn Website Scavenger Hunt
- \*Hydroponics pH, EC and Plant Research
- \*Plant Selection and Placement
- \*Competing Plants
- \*Exploring Environmental Factors with Gardyn
- \*Exploring Genetics with Gardyn
- \*Seed Germination
- \*Materials Selection
- \*Waves with Gardyn
- \*Herb Uses
- \*The History of Hydroponics
- \*Types of Hydroponics
- \*Gravity's Effect on Plant Roots



- \*International Space Station: Plant Research
- \*Design a Hydroponic Unit for Space
- \*Plants and the Water Cycle
- \*Nutrients and Their Roles in Plant Growth
- \*Plant Cells and Specialized Structures
- \*Exploring Plant Cell Parts and Structures with Gardyn
- \*Modeling Photosynthesis: Carbon Dioxide and Water to Glucose
- \*How Plant Structures Support Reproduction
- \*Flower Anatomy and Dissection
- \*Exploring DNA Extraction with Gardyn
- \*Genetics with Gardyn: The Taste of Cilantro
- \*Sense Receptor and The Brain
- \*Light and Algae Growth

# 9th-12th High School STEM

- Hands-on learning aligned to NGSS advanced plant & life science, photosynthesis/cellular respiration, and biodiversity.
- 27 lessons targeted for 50 minute sessions; flexibility range of 9-35 weeks (roughly 45 hours of learning)



# 27 High School Lessons Aligned to 29 NGSS

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>*Hydroponic Systems</li><li>*Hydroponic vs Traditional Farming</li><li>*Designing a Hydroponic Exhibit</li><li>*Energy Conversion - Greenhouses</li><li>*Reducing Environmental Impact with Marigolds</li><li>*Photosynthesis and Energy Conversion</li><li>*Modeling Photosynthesis and Glucose Utilization</li><li>*Observing Aerobic and Anaerobic Respiration</li><li>*CO<sub>2</sub> Sensors, Photosynthesis, and Cellular Respiration</li><li>*Chromatography and Photosynthesis</li><li>*Energy Changes in Chemical Reactions of Plants</li><li>*Preparing and Observing Plant Cells Undergoing Meiosis</li><li>*Role of Mitosis and Differentiation in Plant Roots</li></ul> | <ul style="list-style-type: none"><li>*Exploring Meiosis in Plants: Genetic Variation</li><li>*Plant Genetics</li><li>*Genetics and Cilantro</li><li>*Plant Fitness</li><li>*Plant Biodiversity</li><li>*Anthocyanin and Basil</li><li>*Carbon Cycle</li><li>*Cycling Matter</li><li>*Factors Affecting Carrying Capacity in Plant Ecosystems</li><li>*Homeostasis</li><li>*Plant Cell Organelles and Functions</li><li>*Group Behavior and Plant Reproduction</li><li>*Plants and Evolutionary Relationships</li><li>*Evidence of Common Ancestry and Biological Evolution in Plants</li></ul> |
|--|---|

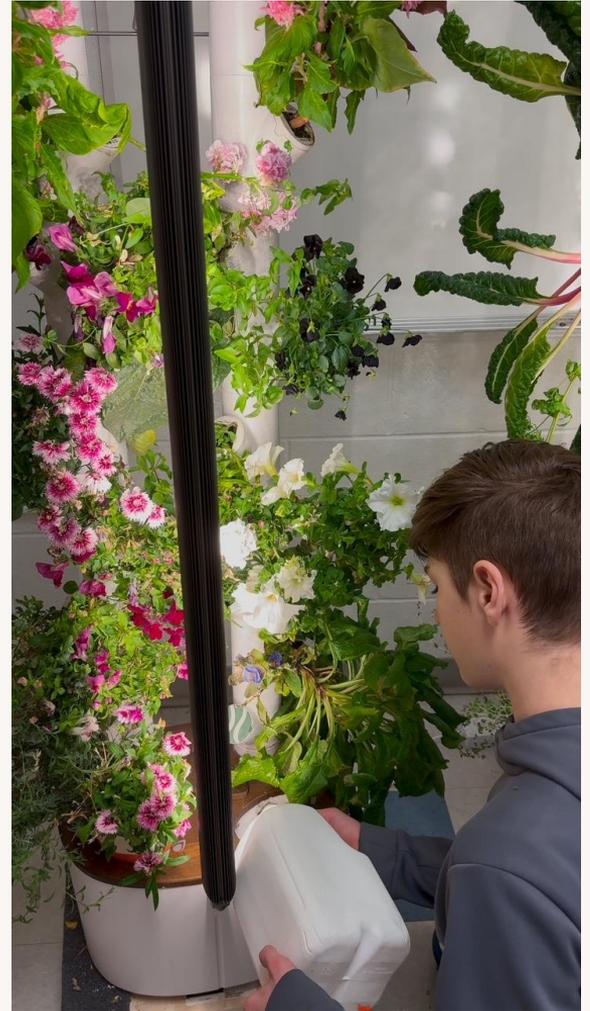


**Gardyn**   
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**Coming Soon**

**STEM Discovery  
Highschool & Early  
College Education**

Gardyn also  
offers  
Mindfulness  
Curriculum for TK  
- 8th Grade



# TK-2nd Gardyn Mindfulness Lab

- Integrates STEM and SEL with a focus on the whole child
- 16 lessons of each:
  - 60 minutes Hydroponics STEM
  - 45 minutes Mindfulness
- Provides flexibility range of 16-32 weeks of study
- Complete lesson plans for both Mindfulness and Hydroponics aligned with NGSS standards

# 3rd-5th Gardyn Mindfulness Lab

- Integrates STEM and SEL with a focus on the whole child
- 16 lessons of each:
  - 60 minutes Hydroponics STEM
  - 45 minutes Mindfulness
- Provides flexibility range of 16-32 weeks of study
- Complete lesson plans for both Mindfulness and Hydroponics aligned with NGSS standards

# 6th - 8th Gardyn Mindfulness Lab

- Integrates STEM and SEL with a focus on the whole child
- 16 lessons of each:
  - 60 minutes Hydroponics STEM
  - 45 minutes Mindfulness
- Provides flexibility range of 16-32 weeks of study
- Complete lesson plans for both Mindfulness and Hydroponics aligned with NGSS standards



Filter: No Fil



Gardyn Mindfulness  
Lab - Grade 3rd-5th



High School STEM



K-5th STEAM



Middle School STEM



Sprouting Gardyner  
- A Lesson with...



This curricula focuses on plant and life science, earth science, and engineering, with studies aimed for grades 6th-8th.

Reference &  
Planning Documents

Student Worksheets  
Only

Teacher Lesson Plans



 ... / High School STEM / Teacher Planning Do...

### High School Gardyn Curriculum

Lesson	NGSS Alignment
Factors Affecting Carrying Capacity in Plant Ecosystems	HS-LSJ-1
Hydroponic vs Traditional Farming	HS-LSM-4
Hydroponic Systems	HS-ESS3-4
Designing a Hydroponic System	HS-ETS1.3, HS-ESS3-4
Plant Growth	HS-LSJ-3
Photosynthesis and Energy Conversion	HS-LSJ-4
Modeling Photosynthesis and Glucose Utilization	HS-LSJ-4, HS-LSJ-7
Opening Stomata and Anion/Cation Regulation in Plants	HS-LSJ-7
CO2 Sensors, Photosynthesis, and Cellular Respiration	HS-LSJ-9, HS-LSJ-7
Chromatography and Photosynthesis	HS-LSJ-9, HS-LSJ-7
Energy Changes in Chemical Reactions of Plants	HS-PSJ-4
Hormones	HS-LSJ-3
Plant Cell Organelles and Functions	HS-LSJ-2
Carbon Cycle	HS-LSJ-5
Genetics and Clones	HS-LSJ-3
Plant Fitness	HS-LSJ-2
Plant Biodiversity	HS-LSJ-2
Cycling Matter	HS-LSJ-4, HS-LSJ-6
Anthropocene and Soil	HS-LSJ-1, HS-LSJ-1
Reducing Environmental Impact with Hydroponics	HS-LSJ-7
Group Behavior and Plant Reproduction	HS-LSJ-8
Preparing and Growing Plant Cells	HS-LSJ-2
Role of Mycorrhizae and Diffusion in Plant Roots	HS-LSJ-4
Exploring Mitosis in Plants: Genetic Variation	HS-LSJ-2
Plants and Evolutionary Relationships	HS-LSA-2, HS-LSA-4, HS-LSA-5
Evolution of Common Ancestry and Biological Evolution in Plants	HS-LSA-1, HS-LSA-2, HS-LSA-3
Energy Conversion - Greenhouses	HS-PSJ-1, HS-ETS1-2

### High School Standards Addressed

Created: 10/31/2024

### Quick Glance Planning - High School

Lesson	Plants Needed	Lesson Time	Materials	Advance Prep
Factors Affecting Carrying Capacity in Plant Ecosystems	Gardyn vCubes of various plants (up to 30 depending on how many plants you would like to use for this lesson)	Lesson: 60 minutes Observations: 45 minutes Classroom: 10 minutes	<ul style="list-style-type: none"> <li>Computers/tablets with internet access</li> <li>Spreadsheet software (e.g., Microsoft Excel, Google Sheets)</li> <li>Access to a simulation tool or online ecological model (e.g., P&amp;T)</li> <li>Sample data set</li> <li>Whiteboard/News board</li> </ul>	Could be a first lesson to set up the Gardyn for other lessons. Preview the Quick Glance Guide (and/or lessons to see what plants you will need for other lessons.
Hydroponic vs Traditional Farming	<ul style="list-style-type: none"> <li>30 vCubes (unless leaving)</li> </ul>	Lesson: 50 minutes	<ul style="list-style-type: none"> <li>Gardyn</li> <li>Planting soil</li> </ul>	This lesson will require an empty Gardyn when starting and a space to

### Quick Glance Planning Doc

Created: 10/29/2024





**Chromatography and Photosynthesis**

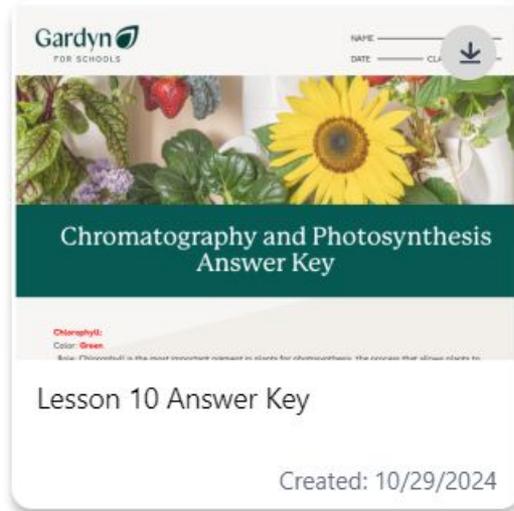
**GRADE LEVEL** High School (9th - 12th)

**DURATION** Lesson: 2 Classes of 50 minutes

**NGSS PERFORMANCE EXPECTATIONS**    **OBJECTIVES: STUDENTS WILL**

Lesson 10 - Chromatography and Photosynthesis

Created: 10/29/2024



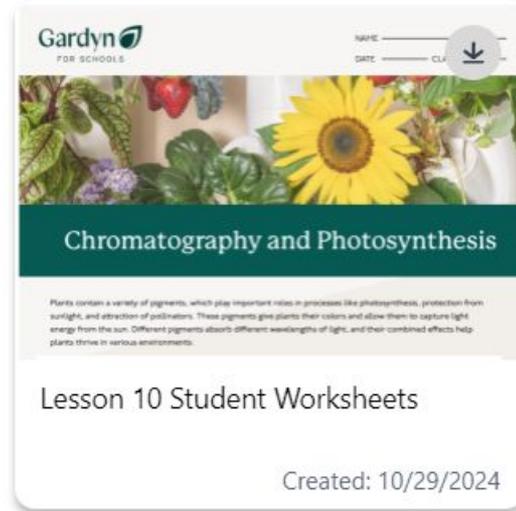
**Chromatography and Photosynthesis Answer Key**

**Chlorophyll:**  
**Color:** Green

Note: Chlorophyll is the most important pigment in plants for photosynthesis. The process that allows plants to...

Lesson 10 Answer Key

Created: 10/29/2024



**Chromatography and Photosynthesis**

Plants contain a variety of pigments, which play important roles in processes like photosynthesis, protection from sunlight, and attraction of pollinators. These pigments give plants their colors and allow them to capture light energy from the sun. Different pigments absorb different wavelengths of light, and their combined effects help plants thrive in various environments.

Lesson 10 Student Worksheets

Created: 10/29/2024



Download or print  
PDFs of lesson  
plans, student  
sheets, and  
answer keys.



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## Chromatography and Photosynthesis

### GRADE LEVEL

High School (9th - 12th)

### DURATION

Lesson: 2 Classes of 50 minutes

### NGSS PERFORMANCE EXPECTATIONS

- HS-LSI-5: Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
- HS-LSI-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

### OBJECTIVES: STUDENTS WILL

- use paper chromatography to separate and identify different pigments in plant leaves
- explore how pigments contribute to photosynthesis and plant coloration.

### MATERIALS

- Fresh leaves from your Gardyn (green and purple/red if possible)
- Isopropyl alcohol (rubbing alcohol - 70%)
- Chromatography paper or coffee filters



## Chromatography and Photosynthesis

Plants contain a variety of pigments, which play important roles in processes like photosynthesis, protection from sunlight, and attraction of pollinators. These pigments give plants their colors and allow them to capture light energy from the sun. Different pigments absorb different wavelengths of light, and their combined effects help plants thrive in various environments.

\_\_\_\_\_

Color: \_\_\_\_\_

Role: Chlorophyll is the most important pigment in plants for photosynthesis, the process that allows plants to convert sunlight into energy. There are two types, chlorophyll a and chlorophyll b, both of which absorb light, mostly in the \_\_\_\_\_ and \_\_\_\_\_ parts of the spectrum, and reflect \_\_\_\_\_ light.

\_\_\_\_\_

Color: \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_

Role: Carotenoids protect plants from the damaging effects of excess light and absorb \_\_\_\_\_ of light that chlorophyll cannot. They help capture more \_\_\_\_\_ for photosynthesis and prevent oxidative damage.

\_\_\_\_\_

Color: \_\_\_\_\_, \_\_\_\_\_, or \_\_\_\_\_

Role: Unlike chlorophyll and carotenoids, anthocyanins do not play a direct role in photosynthesis. Instead, they help protect plants from \_\_\_\_\_, act as antioxidants, and sometimes give plants a competitive advantage by attracting \_\_\_\_\_ or deterring herbivores.

PHOTO: GETTY IMAGES/ALAMY



## Chromatography and Photosynthesis Answer Key

### Chlorophyll:

Color: **Green.**

Role: Chlorophyll is the most important pigment in plants for photosynthesis, the process that allows plants to convert sunlight into energy. There are two types, chlorophyll a and chlorophyll b, both of which absorb light, mostly in the **blue** and **red** parts of the spectrum, and reflect **green** light.

### Carotenoids:

Color: **Yellow, orange, or red.**

Role: Carotenoids protect plants from the damaging effects of excess light and absorb **wavelengths** of light that chlorophyll cannot. They help capture more **sunlight** for photosynthesis and prevent oxidative damage.

### Anthocyanins:

Color: **Red, purple, or blue.**

Role: Unlike chlorophyll and carotenoids, anthocyanins do not play a direct role in photosynthesis. Instead, they help protect plants from **UV light**, act as antioxidants, and sometimes give plants a competitive advantage by attracting **pollinators** or deterring herbivores.

PHOTO: GETTY IMAGES/ALAMY



# NSTA

**Come visit us at NSTA Philadelphia**

**March 26th - 29th**

**Exposition Hall - Booth #536**



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Gardyn for Education



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# Questions?

