



# Plant Growing Methods Lab Kit

## Workbook



Name: \_\_\_\_\_

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## Seed Germination:

# Introduction

## What is Seed Germination?

Seed germination is the process by which a seed develops into a new plant. It is a critical stage in the life cycle of a plant and requires specific environmental conditions to be successful. During germination, the seed begins to sprout and grow into a seedling.

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## Stages of Germination

1. **Imbibition:** The seed absorbs water, causing it to swell. This triggers the activation of enzymes that start breaking down stored nutrients.
  2. **Activation:** The embryo begins to use the nutrients stored in the seed to grow. Energy is released to power the growth processes.
  3. **Radicle Emergence:** The root (radicle) is the first part to emerge from the seed. It grows downward into the soil to anchor the plant and absorb water and nutrients.
  4. **Shoot Development:** The shoot (stem) grows upward toward light. As it grows, leaves begin to develop, and the seedling starts producing food through photosynthesis.
- 

## Factors That Affect Germination

- **Water:** The seed must absorb water to begin the germination process.
  - **Oxygen:** Seeds need oxygen for cellular respiration, which powers growth.
  - **Temperature:** Each seed has an optimal temperature range for germination.
  - **Light:** Some seeds require light, while others need darkness to germinate.
- 

## Pollinator Plants

Pollinator plants are essential for attracting insects, such as bees and butterflies, that help with pollination. These plants play a crucial role in ecosystems by supporting biodiversity and aiding in food production. Examples of pollinator plants include wildflowers, clover, lavender, and sunflowers.

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## Setting Up Your Germination Experiment

1. Moisten the paper towel and place it inside your **resealable bag**.
2. Sprinkle the **pollinator seed mix** onto the damp paper towel.
3. Seal the bag and use a **permanent marker** to label it with your name and the date.
4. Place your experiment in an area with appropriate light and temperature, following the instructions given by your teacher.

## Seed Germination:

# Introduction

## Observations

- Seed Type: \_\_\_\_\_
  - Date of Setup: \_\_\_\_\_
  - Additional Notes: \_\_\_\_\_
    - \_\_\_\_\_
    - \_\_\_\_\_
    - \_\_\_\_\_
- 

## Next Steps

- Over the next few days, observe your seeds and record the growth stages
  - Watch for the emergence of the roots and shoot
- Keep track of any changes and challenges you notice in your **Seed Germination Data** worksheet

## Seed Germination:

# Setup Instructions

**Purpose:** This guide will help you set up a simple seed germination experiment to observe how seeds sprout and grow under controlled conditions.

## Materials Needed

- Pollinator seed mix
- Gallon resealable bag
- Paper towels
- Water
- Permanent marker

## Instructions

### 1. Prepare the Paper Towel:

- Take one sheet of paper towel and fold it to fit inside the gallon resealable bag.
- Dampen the paper towel with water until it is moist but not soaking wet.

### 2. Add Seeds:

- Sprinkle 5-10 seeds from the pollinator seed mix evenly across the damp paper towel.
- Press the seeds lightly onto the towel to ensure good contact.

### 3. Insert into the Bag:

- Carefully place the paper towel with the seeds into the resealable bag.
- Ensure the paper towel is flat and not bunched up.

### 4. Seal and Label the Bag:

- Seal the bag to retain moisture and create a humid environment.
- Use a permanent marker to label the bag with your name, the date, and the type of seeds.

### 5. Choose a Location:

- Place the bag in a location with the appropriate light and temperature for the seeds.
- Follow specific light requirements mentioned for the seeds in your handout (e.g., sunlight or darkness).

### 6. Monitor Daily:

- Check the bag daily for signs of germination.
- Ensure the paper towel remains moist; if it starts to dry out, add water.

Seed Germination:

# Seed Observation Data

Experiment Overview

- Seed Type(s): \_\_\_\_\_
- Date of Setup: \_\_\_\_\_
- Location of Setup: \_\_\_\_\_
- Temperature of Setup: \_\_\_\_\_

| Date | Days After Setup | Observation/Stage of Germination | Notes/Comments |
|------|------------------|----------------------------------|----------------|
|      |                  |                                  |                |
|      |                  |                                  |                |
|      |                  |                                  |                |
|      |                  |                                  |                |

Additional Notes and Questions

Are the seeds showing any signs of growth (root or shoot)?

How much moisture is in the bag each day? Too dry or too wet?

What changes in temperature or light have you observed, if any?

Analysis (Optional)

What factors do you think are affecting the speed and success of germination?

Are there any noticeable patterns or differences among the seeds?

## Seed Germination:

# Stages of Germination Reference

### Stage 1: Imbibition (Water Uptake)

#### *What Happens:*

- The seed absorbs water, causing it to swell and soften
- Enzymes are activated, initiating the metabolic processes needed for growth

#### *Key Factors:*

- Adequate water supply is essential
- Overwatering can cause rot or fungal growth

#### *Visual Indicator:*

- The seed coat becomes soft and may start to split

### Stage 2: Activation

#### *What Happens:*

- Enzymes break down stored food in the seed (e.g., starches into sugars)
- Energy is produced for the growing embryo

#### *Key Factors:*

- Oxygen is needed for cellular respiration
- Proper temperature ensures enzyme activity

#### *Visual Indicator:*

- Internal processes begin but are not visible externally

### Stage 3: Radicle Emergence

#### *What Happens:*

- The radicle (embryonic root) emerges through the seed coat
- The radicle anchors the plant and begins absorbing water and nutrients

#### *Key Factors:*

- Soil or substrate must be moist but not waterlogged
- The seed needs a stable environment to support root growth

#### *Visual Indicator:*

- A small root tip is visible outside the seed

### Stage 4: Shoot Development

#### *What Happens:*

- The plumule (embryonic shoot) grows upward, breaking through the soil surface
- Cotyledons (seed leaves) provide energy until true leaves form
- Photosynthesis begins once leaves are exposed to light

#### *Key Factors:*

- Adequate light is critical for photosynthesis
- Temperature and water must remain stable for continuous growth

#### *Visual Indicator:*

- The shoot emerges from the soil, followed by leaf formation

### Key Conditions for Successful Germination

- *Water:* Needed for imbibition and metabolic activation
- *Oxygen:* Essential for cellular respiration
- *Temperature:* Different seeds have specific temperature requirements
- *Light:* Some seeds require light, while others germinate in darkness

Seed Germination:

# Growth Chart for Pollinator Seeds

| Plant Name             | Germination Time | Days to Sprout | Optimal Soil Temperature | Bloom Time            | Special Notes                          |
|------------------------|------------------|----------------|--------------------------|-----------------------|----------------------------------------|
| Black-Eyed Susan       | 7 - 30 days      | 7 - 14 days    | 70 - 75°F                | Summer to fall        | Tolerates poor soil, drought-resistant |
| Sunflower              | 7 - 10 days      | 7 - 10 days    | 70 - 78°F                | Summer                | Requires full sun, great for wildlife  |
| Cornflower (Echinacea) | 10 - 21 days     | 10 - 14 days   | 65 - 70°F                | Mid to late summer    | Attracts bees, butterflies, and birds  |
| Milkweed               | 14 - 28 days     | 10 - 14 days   | 65 - 75°F                | Mid summer to fall    | Essential for monarch butterflies      |
| Zinnia                 | 4 - 7 days       | 4 - 7 days     | 70 - 75°F                | Summer to early fall  | Thrives in well-drained soil           |
| Lavender               | 14 - 21 days     | 14 - 21 days   | 65 - 70°F                | Late spring to summer | Prefers sandy soil and full sun        |

## Seed Germination:

# Analysis Questions

**Instructions:** Answer the following questions based on what you have learned about seed germination. Each question is worth one point unless otherwise noted.

Which stage of germination was most evident in your experiment? Provide evidence from your observations.

How did your results align with the expected conditions for germination?

What challenges did you encounter, and how could you improve your setup in future experiments?

How do your findings relate to real-world applications in agriculture, gardening, or ecosystem restoration?

## Container Gardening:

# Overview

## What Is Container Gardening?

Container gardening is a versatile and practical method of growing plants in containers, such as pots, planters, or recycled materials. This approach allows for gardening in small spaces, urban environments, or areas with poor soil quality.

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## Benefits of Container Gardening

- **Space Efficiency:** Ideal for small areas like balconies, patios, and windowsills
  - **Portability:** Containers can be moved to optimize sunlight or protect plants from harsh weather
  - **Soil Control:** Use high-quality potting soil to create the perfect growing environment
  - **Versatility:** Grow a variety of plants, including vegetables, herbs, flowers, and small shrubs
  - **Accessibility:** Easier for individuals with mobility challenges, as containers can be placed at comfortable heights
- 

## Factors That Affect Germination

- **Water:** The seed must absorb water to begin the germination process.
  - **Oxygen:** Seeds need oxygen for cellular respiration, which powers growth.
  - **Temperature:** Each seed has an optimal temperature range for germination.
  - **Light:** Some seeds require light, while others need darkness to germinate.
- 

## Essential Components of Container Gardening

### 1. Containers

- Choose containers with adequate drainage holes to prevent waterlogging
- Options include terracotta pots, plastic planters, wooden crates, or recycled items, like tin cans

### 2. Soil

- Use potting soil designed for containers, enriched with organic matter for nutrients and aeration

### 3. Plants or Seeds

- Select plants suited to container gardening, such as:
  - Herbs: Basil, mint, parsley
  - Vegetables: Cherry tomatoes, lettuce, peppers
  - Flowers: Marigolds, black-eyed Susans, petunias

### 4. Water

- Ensure consistent moisture but avoid overwatering. Containers dry out faster than ground soil

### 5. Light

- Place containers in locations that meet the light requirements of your chosen plants (e.g., full sun, partial shade)

## Container Gardening:

# Overview

## Steps for Setting Up a Container Garden

### 1. Select a Container

- Ensure it is the right size for your plants and has drainage holes

### 2. Prepare the Soil

- Fill the container with potting soil, leaving space at the top for watering

### 3. Plant Seeds or Seedlings

- Follow recommended spacing and depth guidelines for each plant
- Gently press soil around the seeds or roots to provide support

### 4. Water Thoroughly

- Water the soil until it is evenly moist but not soggy

### 5. Position the Container

- Place it in a location that meets the light requirements of your plants
- 

## Tips for Success

- **Fertilize Regularly:** Use a balanced, water-soluble fertilizer to replenish nutrients in the soil
  - **Monitor Watering:** Check the soil's moisture level daily, especially in hot weather
  - **Prune and Deadhead:** Remove dead leaves and spent flowers to encourage growth
  - **Repot When Necessary:** If plants outgrow their containers, transfer them to larger ones
- 

## Real-World Applications

- **Urban Gardening:** Maximizes green space in cities
- **Food Security:** Grow your own herbs and vegetables at home
- **Community Projects:** Create shared garden spaces to beautify neighborhoods and foster community engagement
- **Careers:** Explore opportunities in horticulture, landscaping, urban agriculture, and environmental science

## Container Garden:

# Setup and Maintenance Guide

## Setting Up Your Container Garden

### *Step 1: Choose the Right Container*

- **Size:** Match the container size to the plant's needs. Larger plants, like tomatoes, require deeper containers, while herbs can thrive in smaller ones.
- **Material:** Options include terracotta, plastic, ceramic, or recycled items (e.g., tin cans, buckets).
- **Drainage:** Ensure the container has drainage holes to prevent waterlogging. If not, create holes using a drill.

### *Step 2: Prepare the Soil*

- Use high-quality potting soil designed for containers. Avoid using garden soil, which may compact and hinder root growth.
- Mix in compost or organic matter to enrich the soil and improve aeration.

### *Step 3: Select Your Plants*

- **Herbs:** Basil, parsley, mint
- **Vegetables:** Cherry tomatoes, lettuce, peppers
- **Flowers:** Marigolds, petunias, black-eyed Susans
- Consider light requirements and choose plants that match the available sunlight (full sun, partial shade, or shade)

### *Step 4: Planting*

1. **Add Soil:** Fill the container with soil, leaving about one to two inches of space from the top.
2. **Plant Seeds or Seedlings:**
  - For seeds: Follow the depth and spacing instructions on the seed packet.
  - For seedlings: Gently loosen the roots and place them in the soil. Cover with soil and press lightly to secure.
- **Water Thoroughly:** Water the soil until it is evenly moist but not soggy.

### *Step 5: Position the Container*

- Place the container in a location that meets the light requirements of the plants.
- Rotate the container periodically to ensure even sunlight exposure.

## Maintaining Your Container Garden

### *Watering*

- Check the soil daily. If the top inch feels dry, it is time to water.
- Water slowly until it drains out of the bottom holes to ensure roots are thoroughly hydrated.
- During hot weather, containers may require watering twice a day.

### *Fertilizing*

- Use a balanced, water-soluble fertilizer every two to four weeks.
- Follow the fertilizer's instructions to avoid overfeeding, which can damage plants.

## Container Garden:

# Setup and Maintenance Guide

### *Pruning and Deadheading*

- Remove dead leaves, stems, and flowers to promote new growth.
- For flowering plants, deadhead spent blooms to encourage continuous flowering.

### *Repotting*

- If a plant outgrows its container, transfer it to a larger one:
  1. Gently remove the plant from its current container.
  2. Loosen the roots and place it in a new container with fresh soil.
  3. Water thoroughly after repotting.

### *Pest Management*

- Inspect plants regularly for pests, like aphids or spider mites.
- Use natural pest control methods, such as neem oil or soapy water sprays.
- Encourage beneficial insects, like ladybugs, to control pests naturally.

### *Seasonal Care*

- **Spring/Summer:** Plant heat-tolerant crops and ensure adequate watering.
- **Fall/Winter:** Bring sensitive plants indoors or use insulating materials to protect them from frost.

## Common Challenges and Solutions

| Challenge                         | Solution                                                                                                                   |
|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| Containers drying out too quickly | <ul style="list-style-type: none"><li>• Use self-watering pots or add mulch to retain moisture</li></ul>                   |
| Poor drainage causing root rot    | <ul style="list-style-type: none"><li>• Ensure containers have drainage holes and use well-draining soil</li></ul>         |
| Overcrowding                      | <ul style="list-style-type: none"><li>• Follow recommended spacing guidelines and thin out overcrowded plants</li></ul>    |
| Pest infestations                 | <ul style="list-style-type: none"><li>• Apply natural pest control methods and maintain healthy plant conditions</li></ul> |

## Tips for Success

- **Group Plants Efficiently:** Place plants with similar light and watering needs together
- **Monitor Growth:** Keep track of plant health and adjust care as needed
- **Experiment:** Try growing different plants to see what works best in your environment

Container Gardening:

# Observation and Data

Basic Information

- Student Name: \_\_\_\_\_
  - Date Planted: \_\_\_\_\_
  - Plant Name(s): \_\_\_\_\_
  - Container Type: \_\_\_\_\_
  - Light Requirements (e.g., full sun, partial shade): \_\_\_\_\_
- 

Initial Setup Details

- Soil Type: \_\_\_\_\_
  - Seed/Seedling Depth (in inches): \_\_\_\_\_
  - Spacing Between Plants: \_\_\_\_\_
  - Initial Watering Amount: \_\_\_\_\_
- 

Daily/Weekly Observations

| Date | Soil Moisture Level (dry, moist, wet) | Plant Height (inches) | Leaf Count | Flowers/Buds Visible (yes/no) | Notes/Changes Observed |
|------|---------------------------------------|-----------------------|------------|-------------------------------|------------------------|
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |

## Container Gardening:

# Observation and Data

### Growth Summary

1. Average Plant Height (in inches): \_\_\_\_\_
2. Total Leaf Count (at end of observation period): \_\_\_\_\_
3. Number of Flowers/Buds Observed: \_\_\_\_\_
4. Challenges Encountered: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Reflection Questions

1. How did the container type and size affect plant growth?  
\_\_\_\_\_  
\_\_\_\_\_
2. What changes did you notice in the plant over time?  
\_\_\_\_\_  
\_\_\_\_\_
3. What adjustments, if any, would you make for future container gardening projects?  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### Additional Notes

Use this sheet to monitor and document your container garden's progress. Detailed records will help you evaluate your gardening techniques and improve outcomes for future projects.

## Container Gardening:

# Reflection

**Instructions:** Reflect on your container gardening experience by answering the following questions. Be specific in your responses, drawing from your observations and data. Use complete sentences.

### 1. Observations and Outcomes

1. What trends did you notice in your plant's growth (e.g., height, number of leaves, flowering)?
2. How did the type of container you selected impact the growth of your plant?
3. How did the location (e.g., amount of sunlight, exposure to weather) influence your plant's growth?

### 2. Challenges and Solutions

4. What challenges did you face during the container gardening process (e.g., watering, pests, growth issues)?
5. How did you address these challenges, and were your solutions effective?

## Container Gardening:

# Reflection

### 3. Learning and Future Improvements

6. What did you learn about the importance of proper container selection, soil, and plant care?

7. If you were to start another container gardening project, what changes or improvements would you make?

### 4. Real-World Applications

8. How might container gardening be useful in urban environments or areas with limited space?

9. What role do you think container gardening can play in promoting food security or biodiversity?

### 5. Reflection Summary

10. In one sentence, summarize what you learned about container gardening and how you might apply it in your own life.

## Vertical Gardening:

# Overview

### What Is Vertical Gardening?

Vertical gardening is a method of growing plants upward instead of outward using structures such as trellises, wall-mounted containers, hanging planters, and hydroponic towers. This technique maximizes space and allows for efficient gardening in both indoor and outdoor settings.

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### Benefits of Vertical Gardening

- **Maximizes Space:** Ideal for small areas, like balconies, patios, and urban settings
  - **Improves Air Quality:** Plants help filter pollutants and produce oxygen
  - **Enhances Aesthetic Appeal:** Creates beautiful living walls and decorative displays
  - **Reduces Soil-Borne Diseases:** Keeping plants off the ground minimizes exposure to pests and fungi
  - **Eases Maintenance:** Less bending and kneeling compared to traditional gardening
  - **Supports Sustainable Living:** Encourages homegrown food production and eco-friendly gardening practices
- 

### Common Vertical Gardening Structures

1. **Trellises and Arbors:** Support climbing plants, like tomatoes, cucumbers, and beans
  2. **Hanging Baskets:** Great for trailing flowers and compact herbs
  3. **Wall-Mounted Planters:** Used for herbs, ferns, and succulents
  4. **Hydroponic Towers:** Soil-free vertical systems for leafy greens
  5. **Pallet Gardens:** Repurposed wooden pallets for growing various plants
  6. **Stacked Planters:** Multi-tiered containers for maximizing growth in a small footprint
- 

### Best Plants for Vertical Gardening

- **Vegetables:** Cherry tomatoes, cucumbers, peppers, lettuce
- **Herbs:** Basil, thyme, parsley, mint
- **Flowers:** Petunias, nasturtiums, black-eyed Susans
- **Vines and Climbers:** Ivy, jasmine, morning glories

## Vertical Gardening:

# Overview

### Essential Care Tips

- **Sunlight:** Position your vertical garden where plants receive adequate light
  - **Watering:** Monitor moisture levels; vertical gardens may dry out faster
  - **Fertilizing:** Use balanced fertilizers to maintain nutrient levels
  - **Pruning and Maintenance:** Regularly trim overgrown plants for healthy growth
- 

### Real-World Applications

- **Urban Agriculture:** Maximizing food production in limited spaces
- **Eco-Friendly Landscaping:** Beautifying cities and homes sustainably
- **Community Gardens:** Encouraging collective gardening efforts
- **Indoor Green Spaces:** Improving indoor air quality and aesthetics in offices and home

## Vertical Gardening:

# Setup and Maintenance Guide

### Step 1: Choose Your Stacked Vertical Planter

Select a stacked planter that fits your space and gardening needs:

- **Tiered Planters:** Pre-made stackable containers designed for multiple plant levels
- **DIY Stacked Pots:** Stack different-sized pots to create a vertical growing system
- **Tower Planters:** Vertical grow towers with individual planting pockets
- **Recycled Materials:** Repurpose crates, buckets, or storage bins for a budget-friendly options

### Step 2: Select the Right Plants

Choose plants that thrive in stacked planters:

- **Vegetables:** Lettuce, cherry tomatoes, peppers, radishes
- **Herbs:** Basil, parsley, thyme, mint
- **Flowers:** Petunias, nasturtiums, marigolds, black-eyed Susans
- **Fruits:** Strawberries and other small fruits

### Step 3: Prepare Your Planter and Soil

- **Ensure Stability:** Place the stacked planter on a level surface to prevent tipping
- **Create Drainage:** Ensure each tier has drainage holes to prevent root rot
- **Use Quality Soil:** Fill each tier with well-draining potting mix and mix in compost for nutrients
- **Layer Efficiently:** Place tall plants in the top tiers, medium plants in the middle, and trailing or compact plants in the lower tiers

### Step 4: Assemble and Plant Your Stacked Planter

1. Stack the planter tiers securely, ensuring proper balance.
2. Fill each level with soil, leaving space for plant roots.
3. Plant seedlings or seeds, following recommended spacing:
  - Top tier: Plants needing more sun and airflow (e.g., tomatoes, peppers)
  - Middle tier: Medium-sized plants (e.g., herbs, flowers)
  - Bottom tier: Trailing or shade-tolerant plants (e.g., strawberries, nasturtiums)
4. Water thoroughly after planting to help plants establish roots.

### Step 5: Watering and Maintenance

- **Water Regularly:** Top tiers may dry out faster than lower tiers; check moisture levels daily
- **Use a Drip System:** If possible, install a small drip irrigation system for consistent watering
- **Rotate the Planter (if possible):** Ensures all sides receive even sunlight exposure
- **Prune and Harvest Frequently:** Trim dead leaves and harvest herbs/vegetables to promote continuous growth
- **Fertilize Every 2-4 Weeks:** Use a balanced, organic fertilizer to replenish nutrients
- **Monitor for Pests:** Check for insects, like aphids and spider mites, and use natural remedies if needed

## Vertical Gardening:

# Setup and Maintenance Guide

### Step 6: Troubleshooting Common Issues

| Issue                       | Solution                                                 |
|-----------------------------|----------------------------------------------------------|
| Dry soil in upper tiers     | Water from the top and allow moisture to filter downward |
| Water pooling at the bottom | Ensure drainage holes are open and avoid overwatering    |
| Plants growing unevenly     | Rotate the planter to balance sunlight exposure          |
| Weak or leggy plants        | Prune regularly and provide support if needed            |

### Step 7: Long-Term Care and Seasonal Adjustments

- **Spring/Summer:** Increase watering frequency and fertilization
- **Fall/Winter:** Move portable planters indoors or insulate outdoor planters to protect roots
- **Replant as Needed:** Refresh soil and replace plants seasonally to maintain a productive garden

Vertical Gardening:

# Stacked Vertical Planter Observation and Data

Basic Information

- Student Name: \_\_\_\_\_
- Date Planted: \_\_\_\_\_
- Plant Type(s): \_\_\_\_\_
- Planter Material: \_\_\_\_\_
- Location (indoor/outdoor): \_\_\_\_\_
- Sunlight Exposure (full/partial/shade): \_\_\_\_\_

Initial Setup Details

- Soil Type Used: \_\_\_\_\_
- Planting Depth (in inches): \_\_\_\_\_
- Spacing Between Plants: \_\_\_\_\_
- Initial Watering Amount: \_\_\_\_\_

Growth Observations

| Date | Soil Moisture Level (dry, moist, wet) | Plant Height (inches) | Leaf Count | Flowers/Buds Visible (yes/no) | Notes/Changes Observed |
|------|---------------------------------------|-----------------------|------------|-------------------------------|------------------------|
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |

## Vertical Gardening:

# Stacked Vertical Planter Observation and Data

## Maintenance & Care Log

- Watering Frequency: \_\_\_\_\_
- Fertilization Schedule and Type Used: \_\_\_\_\_
- Pruning/Trimming Notes: \_\_\_\_\_
- Pest/Disease Issues and Solutions Applied: \_\_\_\_\_

## Final Growth Summary

- Average Plant Height (in inches): \_\_\_\_\_
- Total Leaf Count (at end of observation period): \_\_\_\_\_
- Number of Flowers/Buds Observed: \_\_\_\_\_
- Overall Health Assessment (excellent/good/fair/poor): \_\_\_\_\_

## Observations and Outcomes

1. How did the stacked vertical planter affect plant growth compared to traditional planting?
2. What adjustments did you make during the growing process to improve plant health?
3. What challenges did you encounter, and how did you address them?
4. If you were to redesign your stacked vertical planter, what changes would you make?

## **Vertical Gardening:**

# **Reflection Questions**

**Instructions:** Reflect on your vertical gardening experience by answering the following questions. Be specific in your responses, drawing from your observations and data. Use complete sentences.

### **Observations and Growth Assessment**

1. What trends did you notice in your plant's growth (e.g., height, number of leaves, flowering)?
2. How did the stacked vertical planter affect the growth of your plants compared to traditional planting methods?
3. How did sunlight exposure impact the health and growth of your plants?

### **Challenges and Problem Solving**

4. What challenges did you face while maintaining your vertical garden (e.g., watering, pests, plant spacing)?
5. How did you adjust your care routine to overcome these challenges?
6. Were there any unexpected issues that arose? If so, how did you handle them?

## Vertical Gardening:

# Reflection Questions

### Learning and Future Improvements

7. What did you learn about the importance of plant selection, container choice, and maintenance in vertical gardening?
8. If you were to start another vertical gardening project, what changes or improvements would you make?
9. What advice would you give to someone setting up a vertical garden for the first time?

### Real-World Applications

10. How do you think vertical gardening can benefit urban areas or spaces with limited ground space?
11. What role do you think vertical gardening can play in promoting sustainability and food security?
12. How can the skills you learned from this project be applied to other areas of gardening, agriculture, or environmental science?

### Real-World Applications

13. In one sentence, summarize what you learned about vertical gardening and how you might apply it in the future.

## Raised Bed Gardening:

# Overview

### What Is Raised Bed Gardening?

Raised bed gardening involves growing plants in soil that is elevated above ground level, typically within a constructed frame. This gardening method offers better control over soil conditions, improves drainage, and makes gardening more accessible for all ages and abilities.

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### Benefits of Raised Bed Gardening

- **Improved Soil Quality:** Control soil type and composition, enhancing nutrient availability
  - **Better Drainage:** Prevents waterlogging and reduces the risk of root rot
  - **Accessibility:** Easier to manage for individuals with mobility challenges
  - **Extended Growing Season:** Raised beds warm up faster in the spring
  - **Pest and Weed Control:** Reduces competition from weeds and limits exposure to soil-borne pests
  - **Aesthetic Appeal:** Can be designed to enhance the beauty of a garden space
- 

### Common Materials for Raised Bed Construction

1. **Wood:** Cedar, redwood, and treated lumber
  2. **Stone or Brick:** Durable and offers a natural look
  3. **Metal:** Corrugated steel or galvanized beds for modern designs
  4. **Recycled Materials:** Upcycled containers or composite boards
  5. **Concrete Blocks:** Provides structure and durability
- 

### Steps to Create a Raised Bed Garden

1. **Select a Location:** Choose a site with adequate sunlight and access to water
  2. **Build the Frame:** Assemble the raised bed using chosen materials
  3. **Prepare the Soil Mix:** Combine topsoil, compost, and organic matter for nutrient-rich soil
  4. **Planting:** Arrange seeds or seedlings according to their spacing needs
  5. **Maintenance:** Regular watering, weeding, and adding mulch to retain moisture
- 

### Best Plants for Raised Bed Gardening

- **Vegetables:** Lettuce, carrots, tomatoes, peppers, and radishes
- **Herbs:** Basil, rosemary, parsley, and mint
- **Flowers:** Marigolds, nasturtiums, and zinnias
- **Small Fruits:** Strawberries and blueberries

## Raised Bed Gardening:

# Overview

### Tips for Success

- **Use Quality Soil:** Ensure a balanced mix of topsoil, compost, and organic material
  - **Plan for Proper Drainage:** Avoid water pooling by ensuring beds are not overly compacted
  - **Rotate Crops:** Prevent soil depletion by changing plant types each season
  - **Mulch Regularly:** Helps retain moisture and reduce weed growth
  - **Water Efficiently:** Water at the base of plants to reduce evaporation
- 

### Real-World Applications of Raised Bed Gardening

- **Urban Gardens:** Maximizes productivity in small spaces
- **Community Projects:** Encourages local food production and beautifies public spaces
- **Educational Programs:** Hands-on learning opportunities in schools and community centers

## **Raised Bed Gardening:**

# **Setup Guide**

### **Step 1: Choose the Right Pre-Made Raised Bed Container**

- **Materials:** Select durable, non-toxic materials such as:
  - **Wood:** Cedar and redwood are naturally rot resistant
  - **Metal:** Galvanized steel or aluminum options for a modern look
  - **Plastic or Composite:** Lightweight, often with built-in drainage systems
- **Size and Depth:**
  - **For vegetables:** Minimum 12-18 inches deep
  - **For herbs and flowers:** At least 6-12 inches deep
  - Ensure the container provides adequate width for plant spacing

### **Step 2: Prepare the Site**

- **Location:** Choose a site with at least six to eight hours of sunlight daily
- **Surface Preparation:**
  - If placing on soil, remove weeds and level the ground
  - On hard surfaces, ensure good drainage by slightly elevating the container
- **Optional:** Lay landscape fabric under the bed to prevent weed growth

### **Step 3: Assemble and Position the Raised Bed Container**

1. **Follow Manufacturer Instructions:** Assemble the pre-made container securely.
2. **Check for Drainage:** Ensure there are drainage holes at the bottom.
3. **Stabilize the Container:** Place the bed in the designated area, checking for stability and level ground.

### **Step 4: Fill the Raised Bed with Soil**

- **Soil Mix:** Use a high-quality mix for raised beds
  - 50% Topsoil
  - 30% Compost
  - 20% Organic matter (e.g., peat moss, coconut coir)
- **Filling Technique:**
  - Add soil in layers, lightly compacting each layer to reduce settling
  - Leave about one to two inches from the top of the container to prevent overflow when watering

### **Step 5: Planting Your Garden**

1. **Plan the Layout:** Arrange plants according to their sunlight, water, and space needs.
2. **Plant Seeds or Seedlings:**
  - Follow spacing and depth recommendations on seed packets or plant tags
  - For vegetables, plant taller plants, like tomatoes, at the back and shorter ones, like lettuce, at the front
3. **Water Thoroughly:** Ensure the soil is evenly moist, avoiding water pooling.

Raised Bed Gardening:

# Setup Guide

Step 6: Maintenance Tips

- Watering:
  - Water at the base of plants to avoid wetting the foliage
  - Raised beds may require more frequent watering, especially in warm weather
- Fertilizing:
  - Apply a balanced, water-soluble fertilizer every four to six weeks
  - Consider adding slow-release fertilizer at the beginning of the planting season
- Weeding:
  - Check weekly and remove weeds by hand to avoid disturbing plant roots
- Mulching:
  - Apply a one- to two-inch layer of mulch to retain moisture and suppress weeds

Step 7: Troubleshooting Common Issues

| Issue                       | Solution                                                  |
|-----------------------------|-----------------------------------------------------------|
| Soil dries out quickly      | Add mulch and water more frequently                       |
| Waterlogged soil            | Improve drainage or reduce watering frequency             |
| Pests (e.g., aphids, slugs) | Use natural remedies, like neem oil or diatomaceous earth |
| Uneven plant growth         | Rotate container or adjust plant placement                |

Long-Term Care and Seasonal Tips

- Spring/Summer:
  - Plant warm season crops and water regularly
  - Add compost to replenish soil nutrients
- Fall/Winter:
  - Cover beds with a frost blanket, if needed
  - Consider planting cool season crops, like lettuce and spinach

Additional Tips for Success

- Rotate Crops Annually: Helps maintain soil health and reduce pest risks
- Monitor Plant Health: Check regularly for signs of stress or disease
- Experiment with Plant Varieties: Use your raised bed to test new plants or create a themed garden (e.g., herb garden, pollinator garden)

Raised Bed Gardening:

# Observation and Data

Basic Information

- Student Name: \_\_\_\_\_
- Date Planted: \_\_\_\_\_
- Plant Type(s): \_\_\_\_\_
- Container Material: \_\_\_\_\_
- Location (indoor/outdoor): \_\_\_\_\_
- Sunlight Exposure (full/partial/shade): \_\_\_\_\_

Initial Setup Details

- Soil Type Used: \_\_\_\_\_
- Planting Depth (in inches): \_\_\_\_\_
- Spacing Between Plants: \_\_\_\_\_
- Initial Watering Amount: \_\_\_\_\_

Growth Observations

| Date | Soil Moisture Level (dry, moist, wet) | Plant Height (inches) | Leaf Count | Flowers/Buds Visible (yes/no) | Notes/Changes Observed |
|------|---------------------------------------|-----------------------|------------|-------------------------------|------------------------|
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |
|      |                                       |                       |            |                               |                        |

## Raised Bed Gardening:

# Observation and Data

## Maintenance & Care Log

- Watering Frequency: \_\_\_\_\_
- Fertilization Schedule and Type Used: \_\_\_\_\_
- Pruning/Trimming Notes: \_\_\_\_\_
- Pest/Disease Issues and Solutions Applied: \_\_\_\_\_

## Final Growth Summary

- Average Plant Height (in inches): \_\_\_\_\_
- Total Leaf Count (at end of observation period): \_\_\_\_\_
- Number of Flowers/Buds Observed: \_\_\_\_\_
- Overall Health Assessment (excellent/good/fair/poor): \_\_\_\_\_

## Observations and Outcomes

1. How did the raised bed container affect plant growth compared to traditional gardening?
2. What adjustments did you make during the growing process to improve plant health?
3. What challenges did you encounter, and how did you address them?
4. If you were to redesign your raised bed garden, what changes would you make?

## **Raised Bed Gardening:**

# **Reflection Questions**

**Instructions:** Reflect on your raised bed gardening experience by answering the following questions. Be specific in your responses, drawing from your observations and data. Use complete sentences.

### **Observations and Growth Assessment**

1. What trends did you notice in your plant's growth (e.g., height, number of leaves, flowering)?
2. How did the raised bed container affect the growth of your plants compared to traditional growing methods?
3. How did sunlight exposure impact the health and growth of your plants?

### **Challenges and Problem Solving**

4. What challenges did you face while maintaining your raised bed garden (e.g., watering, pests, plant spacing)?
5. How did you adjust your care routine to overcome these challenges?
6. Were there any unexpected issues that arose? If so, how did you handle them?

## **Raised Bed Gardening:**

# **Reflection Questions**

### **Learning and Future Improvements**

7. What did you learn about the importance of plant selection, container choice, and maintenance in raised bed gardening?
8. If you were to start another raised bed gardening project, what changes or improvements would you make?
9. What advice would you give to someone setting up a raised bed garden for the first time?

### **Real-World Applications**

10. How do you think raised bed gardening can benefit urban areas or spaces with limited ground space?
11. What role do you think raised bed gardening can play in promoting sustainability and food security?
12. How can the skills you learned from this project be applied to other areas of gardening, agriculture, or environmental science?

### **Real-World Applications**

13. In one sentence, summarize what you learned about raised bed gardening and how you might apply it in the future.

## Horticulture:

# Career Exploration

## What Is Horticulture?

Horticulture is the science and art of growing and maintaining plants for food, medicine, decoration, and environmental improvement. Careers in horticulture span multiple industries, including agriculture, research, landscape design, and environmental sustainability.

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## Why Choose a Career in Horticulture?

- **Diverse Career Paths:** From urban farming to botanical research, horticulture offers a variety of careers
  - **Growing Job Market:** Increased focus on sustainability, food production, and green spaces means high demand for skilled horticulturists
  - **Environmental Impact:** Many careers support conservation, climate change solutions, and urban green infrastructure
  - **Opportunities for Innovation:** Careers in hydroponics, vertical farming, and biotechnology continue to evolve
  - **Hands-On and Scientific Opportunities:** Jobs range from fieldwork and design to lab-based plant research
- 

## Major Career Categories in Horticulture

### 1. Landscape and Garden Design

- *Landscape Architect:* Designs outdoor spaces, parks, and gardens
- *Garden Designer:* Plans and arranges aesthetic plant layouts for homes and businesses
- *Arborist:* Specializes in tree care, pruning, and maintenance

### 2. Agriculture and Crop Science

- *Greenhouse Manager:* Oversees plant production in controlled environments
- *Hydroponics Specialist:* Focuses on soil-free plant growth systems
- *Agronomist:* Works with farmers to improve crop yields and soil health

### 3. Research and Education

- *Botanist:* Studies plant biology, genetics, and ecology
- *Horticulture Educator:* Teaches plant science in schools, colleges, and community programs
- *Plant Breeder:* Develops new plant varieties with improved traits

### 4. Urban and Environmental Planning

- *Urban Farmer:* Grows crops in cities using innovative farming techniques
- *Sustainability Consultant:* Helps businesses develop eco-friendly landscaping
- *Environmental Restoration Specialist:* Works on habitat restoration and conservation projects

### 5. Therapeutic Horticulture and Public Services

- *Horticulture Therapist:* Uses gardening to support mental and physical health
- *Community Garden Coordinator:* Manages public garden spaces and programs
- *Parks and Recreation Manager:* Oversees green spaces and outdoor recreation areas

## Horticulture:

# Career Exploration

### Education and Training Requirements

- **High School Diploma:** Entry-level jobs in nurseries, landscaping, and greenhouse work
  - **Associate Degree:** Technician roles in plant production, landscape design, and sustainable agriculture
  - **Bachelor's Degree:** Required for careers in agronomy, research, and horticultural business management
  - **Certifications:** Industry credentials like Certified Horticulturist (CH), ISA Certified Arborist, and Master Gardener programs enhance employability
  - **Graduate Degrees:** Needed for specialized research, botany, and teaching roles at the college level
- 

### Skills and Qualities for a Successful Career in Horticulture

- » Knowledge of plant biology and soil science
  - » Strong problem-solving and analytical skills
  - » Creativity in design and planning
  - » Hands-on practical experience
  - » Environmental awareness and sustainability focus
  - » Communication and teamwork skills
- 

### Career Outlook and Industry Trends

- The demand for *urban agriculture* and sustainable food production is increasing
  - *Vertical farming* and *hydroponics* are rapidly expanding industries
  - *Green infrastructure* and *landscaping* careers are growing due to environmental concerns
  - There is a rise in *therapeutic horticulture* as a tool for mental and physical wellbeing
  - Technology advancements in *precision agriculture* and *plant genetics* are shaping the future of horticulture careers
- 

### Exploring Your Future in Horticulture

1. Research a horticulture career that interests you. What education and skills are needed?
  2. Identify companies or organizations in your area that employ horticulturists.
  3. Consider what aspects of horticulture align with your personal interests and career goals.
  4. Look for internship or volunteer opportunities in greenhouses, community gardens, or research institutions.
- 

### For additional resources, visit:s

- American Society for Horticultural Science ([www.ashs.org](http://www.ashs.org))
- U.S. Department of Agriculture ([www.usda.gov](http://www.usda.gov))
- Bureau of Labor Statistics – Horticulture Careers ([www.bls.gov](http://www.bls.gov))

## Horticulture:

# Career Pathways

### Step 1: Choose a Horticulture Career

Select a career from the list below or choose one based on your research:

- Landscape architect
- Greenhouse manager
- Hydroponics specialist
- Arborist
- Horticulture therapist
- Urban farmer
- Plant breeder
- Sustainability consultant
- Agricultural scientist
- Nursery manager
- Botanic garden curator

**Chosen Career:** \_\_\_\_\_

### Step 2: Career Overview

1. Job Description: Briefly describe what this career involves.
2. Work Environment: Where does someone in this career typically work? (e.g., greenhouse, farm, urban setting, research lab, office, education center)
3. Skills Required: What are the key skills needed for success in this career?

### Step 3: Education & Training

1. Minimum Education Required: (Circle one)
  - ☐ High School Diploma
  - ☐ Associate's Degree
  - ☐ Bachelor's Degree
  - ☐ Master's Degree
  - ☐ Doctorate (Ph.D.)
2. Plan of Study: What major or coursework is needed for this career?

## Horticulture:

# Career Pathways

3. Certifications and Licenses: Are there any specific certifications required?

## Step 4: Salary & Job Outlook

1. Average Salary Range: What is the estimated salary for this career?
2. Job Demand: Is this career in high demand? Why or why not?
3. Future Growth Trends: What are some advancements or emerging trends in this field?

## Step 5: Personal Reflection

1. Why does this career interest you?
2. What skills or experiences do you already have that align with this career?
3. What steps can you take now to prepare for this career?

## Step 6: Research & Sources

List at least two credible sources you used to research this career (websites, books, interviews, etc.):

1. \_\_\_\_\_  
\_\_\_\_\_
2. \_\_\_\_\_  
\_\_\_\_\_

## **Horticulture:**

# **Career Reflection Questions**

### **Step 1: Personal Interests & Career Alignment**

1. Which horticulture career did you research, and why did you choose it?
2. What aspects of this career appeal to you the most?
3. Does this career align with your personal skills, interests, and strengths? Why or why not?

### **Step 2: Career Preparation & Education**

4. What level of education and training is required for this career?
5. What additional skills or certifications would be beneficial for someone entering this career?
6. Are there local schools, colleges, or programs that offer relevant training for this career?  
If so, list them.

## **Horticulture:**

# **Career Reflection Questions**

### **Step 3: Job Market & Career Growth**

7. What is the average salary range for this career?
  
  
  
  
  
  
  
  
  
8. Is this career in high demand? Why or why not?
  
  
  
  
  
  
  
  
  
9. What are some potential challenges someone in this career might face?

### **Step 4: Real-World Application & Future Planning**

10. How does this career contribute to sustainability, agriculture, or environmental conservation?
  
  
  
  
  
  
  
  
  
11. What steps can you take now to explore or prepare for this career?
  
  
  
  
  
  
  
  
  
12. Would you consider pursuing this career in the future? Why or why not?

**Notes:**

# Notes:



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