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| **Standards Key** |
| PS = Physical Science, LS = Life Science, ESS = Earth and Space Science, ETS = Engineering, Technology, and Applications of Science |

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| **Lesson (Grade Level Suggested)** | **Key Topics** | **State of Alaska Standards** | **NGSS Standards** |
| **Growing in Soil** |
| 1. **Reading a Seed Packet**

**(K-12)** | * Reading and Comprehending Scientific Technical Information
* Venn Diagrams
* Plant Life Cycles
* Plant Light and Soil Nutrient Needs
* Horticulture
* Germination
* Propagation
* Recording Scientific Data
* Drawing Conclusions from Experimentation
 | K-LS1-11-LS1-12-LS2-13-LS4-44-LS1-15-LS1-1MS-LS1-5HS-LS1-2 | K-LS1-1K-ESS2-2K-ESS3-11-LS1-12-LS2-13-LS3-14-LS1-15-LS1-1MS-LS2-1HS-LS2-2 |
| 1. **Starting Plants in the Classroom**

**(K-12)** | * Reading and Comprehending Scientific Technical Information
* Horticulture
* Transplanting
* Hydroponics
* Plant Life Cycles
* Array Mathematics and Grids
* Germination
* Plant light and soil nutrient needs
* Standardized Science Measurements
* Science Journaling
* Recording Scientific Data in Tables
* Drawing Conclusions from Experimentation
 | K-LS1-1K-2-ETS1-21-LS1-12-LS2-13-LS4-44-LS1-15-LS1-15-LS2-1MS-LS1-5MS-ETS1-1HS-LS1-2 | K-LS1-1K-ESS2-2K-ESS3-11-LS1-12-LS2-13-LS1-13-LS3-24-LS1-15-PS3-15-LS1-1MS-LS1-5MS-ETS1-1HS-LS2-2HS-ESS2-6 |
| 1. **Salad Container Greenhouse**

**(2-8)** | * Plant light and soil nutrient needs
* Standardized Science
* Standardized Science Measurements
* Horticulture
* Germination
* Engineering – Greenhouse Construction and Function
* Recycling
* Plant Life Cycles
* Careers in Agricultural Science
* Standardized Science Measurements
* Recording Scientific Data in Tables
* Light Wave Physics – Types of Light
* Recording Scientific Data in Tables
* Drawing Conclusions from Experimentation
 | 2-LS2-13-LS4-44-LS1-15-PS3-15-LS1-15-LS2-1MS-LS1-5MS-ESS3-5MS-ETS1-2 | 2-LS2-12-PS1-4K-2-ETS1-13-LS1-13-LS3-24-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS1-6MS-LS2-1MS-LS3-3MS-ETS1-1 |
| **Soil & Nutrition** |
| 1. **Garden Soil Exploration**

**(K-12)** | * Introduction to Soil Composition and Types
* Plant soil nutrient needs
* Hydrology – water cycles
* Geological Creation of Soil
* Agriculture
* Composting
* Field Testing of Soil – Ribbon Test
* Engineering – Constructing Soil Drainage Systems
* Standardized Science Measurements
* Recording Scientific Data in Tables
* Small Scale construction of a Compost System
* Drawing Conclusions from Experimentation
 | K-LS1-1K-2-ETS1-21-LS1-12-LS2-12-PS1-43-LS4-44-ESS2-15-PS3-15-LS1-15-LS2-1MS-LS1-5MS-LS2-1MS-LS2-3HS-LS1-5HS-LS2-3HS-ESS2-2HS-ESS2-7 | K-LS1-1K-ESS2-2K-ESS3-11-LS1-12-LS2-12-PS1-2K-2-ETS1-33-LS3-24-ESS2-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS2-1MS-LS3-3MS-ETS1-1HS-LS2-6HS-ESS2-6HS-ESS2-7HS-ESS3-4HS-ETS1-1 |
| 1. **The Right Diet for Your Plants**

**(6-8)** | * Soil Composition and Types
* Plant soil nutrient needs
* Fertilizers
* Human nutrient needs
* Plant nutrient needs
* Plant Life Cycles
* Soil Improvement
* Reading labels for fertilizers
* Reading advertisements
* Agricultural Economics – Products Promotion, Designing Advertisements for Soil Supplements
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation
 | MS-LS1-5MS-LS2-1MS-LS1-7  | MS-LS1-5MS-LS2-1 |
| 1. **Plant Nutrient Deficiencies**

**(6-8)** | * Plant Nutrient Needs
* Nutrient Balance in Agricultural Soils
* Fertilizers
* Nutrient Deficiencies in Plants
* Nutrient Deficiencies in Humans
* Plant Nutrient Toxicities
* Macronutrients and Micronutrients
* Nitrogen Fixation
* Organic vs. Commercial Fertilizers
* Humanity Against Hunger – Social Concerns
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation
 | MS-LS1-5MS-LS2-4 MS-ESS3-2 | MS-LS1-5MS-LS2-4MS-LS4-5MS-ETS1-1 |
| **Plant Growth** |
| 1. **Do You Know the Parts of Plants?**

**(K-3)** | * Introduction to Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Photosynthesis
* Singing to Remember
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | K-LS1-11-LS1-12-LS4-13-LS4-4 | K-LS1-1K-ESS2-2K-ESS3-11-LS1-12-LS2-13-LS1-1 |
| 1. **Plant Parts: Roots**

**(2-6)** | * Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | 2-LS4-13-LS4-44-LS1-15-LS1-15-LS2-1MS-LS1-1MS-LS1-2MS-LS1-4 | 2-LS2-12-PS1-13-LS1-14-LS1-15-LS1-1MS-LS1-1MS-LS1-2 |
| 1. **Plant Parts: Stems**

**(2-6)** | * Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Evapotranspiration and Transpiration
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | 2-LS4-13-LS4-44-LS1-15-LS1-15-LS2-1MS-LS1-1MS-LS1-2MS-LS1-4 | 2-LS2-12-PS1-13-LS1-14-LS1-15-LS1-1MS-LS1-1MS-LS1-2 |
| 1. **Plant Parts: Seeds**

**(3-6)** | * Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Germination
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | 3-LS4-44-LS1-15-LS1-15-LS2-1MS-LS1-1MS-LS1-2MS-LS1-4 | 3-LS1-14-LS1-15-LS1-1MS-LS1-1MS-LS1-2 |
| 1. **Leaf Factory**

**(3-6)** | * Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Photosynthesis
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | 3-LS4-44-LS1-15-LS1-15-LS2-1MS-LS1-1MS-LS1-2MS-LS1-4MS-LS1-6 | 3-LS1-14-LS1-15-LS1-1MS-LS1-1MS-LS1-2MS-LS1-6 |
| 1. **Hydroponic Plant Growth Lesson**

**(3-12)** | * Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Hydroponics
* pH Testing
* Photosynthesis
* Pollination
* Nutrient Uptake
* Lighting Systems
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | 3-LS4-44-LS1-15-PS3-15-LS1-15-LS2-1MS-LS1-5MS-LS1-6MS-ETS1-1HS-LS1-2HS-LS1-5HS-LS2-3HS-LS2-5HS-ESS3-4 | 3-LS1-13-LS4-34-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS1-6MS-LS2-1MS-LS3-3MS-ESS3-3HS-LS1-5HS-LS2-7HS-ESS2-6HS-ESS2-7HS-ESS3-4HS-ETS1-1 |
| 1. **Harvesting Plants: Leaves**

**(2-8)** | * Plant Anatomy
* Plant Life Cycles
* Plant Dynamics (circulation and nutrient uptake)
* Agriculture – Harvesting
* Photosynthesis – Chemistry
* Recording Scientific Data
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, drawing, and note-taking)
 | 2-LS4-13-LS4-44-LS1-15-LS1-15-LS2-1MS-LS1-1MS-LS1-2 | 2-LS2-12-PS1-13-LS1-14-LS3-15-LS1-1MS-LS1-1MS-LS1-2MS-LS1-6 |
| **Hydroponics** |
| 1. **Introduction to Hydroponic Systems**

**(4-12)** | * Introduction to Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Drawing Conclusions from Lecture and Examples
 | 4-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-4 MS-LS2-5MS-ESS3-3HS-LS1-2HS-LS2-5 | 4-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS2-1MS-LS3-3MS-ESS3-3HS-LS2-7HS-ESS2-6HS-ESS3-4HS-ETS1-1 |
| 1. **Passive Hydroponic System**

**(3-8)** | * Introduction to Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Small Scale construction of a Hydroponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 3-LS4-34-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-4 MS-LS2-5MS-ESS3-3MS-ETS1-1 | 3-LS1-13-LS4-34-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS2-1MS-LS3-3MS-ESS3-3MS-ETS1-1 |
| 1. **Hydroponic Growing Media**

**(3-12)** | * Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* Growing Media (soil, water, other)
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 3-5-ETS1-24-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-4 MS-LS2-5MS-ESS3-3MS-ETS1-2HS-ESS3-4 | 3-LS1-13-LS4-44-LS1-15-LS1-13-5-ETS1-2MS-LS1-5MS-LS3-3MS-ESS3-3MS-ETS1-1HS-LS1-3HS-LS2-6HS-ESS2-6HS-ESS3-4HS-ETS1-3 |
| 1. **Setting Up the Floating Platform Hydroponic System**

**(4-12)** | * Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* Plant Life Cycle
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Medium Scale construction of a Hydroponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 4-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-4MS-LS2-5MS-ESS3-3MS-ETS1-4HS-LS1-2HS-LS2-5HS-ESS3-4 | 4-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS2-1MS-ESS3-3MS-ETS1-4HS-LS1-3HS-LS2-7HS-ESS2-6HS-ESS2-7HS-ESS3-4HS-ETS1-3 |
| 1. **Setting Up the Nutrient Film Technique (NFT) System**

**(4-12)** | * Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Large Scale construction of a Hydroponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 4-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-4MS-LS2-5MS-ESS3-3MS-ETS1-4HS-LS1-2HS-LS2-5HS-ESS3-4 | 4-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS2-1MS-ESS3-3MS-ETS1-4HS-LS1-3HS-LS2-7HS-ESS2-6HS-ESS2-7HS-ESS3-4HS-ETS1-3 |
| 1. **What? No Soil?**

**(6-8)** | * Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Small Scale construction of a Hydroponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | MS-LS2-1MS-LS2-3MS-LS2-4MS-LS2-5MS-ESS3-3MS-ETS1-1 | 4-LS1-15-PS3-15-LS1-13-5-ETS1-1MS-LS1-5MS-LS2-1MS-ESS3-3MS-ETS1-1 |
| 1. **Chena Hot Springs Growing Tower System**

**(4-12)** | * Hydroponic Systems
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Standardized Science Measurements
* Large Scale construction of a Hydroponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 4-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-3MS-LS2-5MS-ESS3-3MS-ETS1-4HS-ESS3-4 | 4-LS1-15-LS1-15-ESS3-13-5-ETS1-1MS-LS2-1MS-LS3-3MS-ETS1-4HS-LS1-3HS-LS2-7HS-ESS2-6HS-ESS3-4HS-ETS1-3 |
| **Aquaponics** |
| 1. **Setting Up the Aquaponic System**

**(4-12)** | * Introduction to Aquaponics (fish farming + hydroponics)
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Medium Scale construction of an Aquaponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 4-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-2MS-LS2-4 MS-ESS3-3MS-ETS1-4HS-LS1-2HS-LS2-5HS-LS2-6HS-ESS3-4 | 4-LS1-15-PS3-15-LS1-15-LS2-13-5-ETS1-1MS-LS1-5MS-LS2-2MS-LS3-3MS-ESS3-3MS-ETS1-4HS-LS1-3HS-LS2-7HS-LS4-5HS-ESS2-6HS-ESS2-7HS-ESS3-4HS-ETS1-3 |
| 1. **Aquaponic Fish Care**

**(4-12)** | * Introduction to Aquaponics
* Introduction to Fisheries (biology and care)
* Water Quality and Monitoring
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data in Tables
* Standardized Science Measurements
* Small Scale construction of an Aquaponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 4-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1MS-LS2-1MS-LS2-2MS-LS2-4 MS-ESS3-3MS-ETS1-4HS-LS1-2 HS-LS2-3HS-LS2-5HS-LS2-6HS-ESS3-4 | 4-LS1-15-PS3-15-LS1-15-LS2-13-5-ETS1-1MS-LS1-5MS-LS2-2MS-LS3-3MS-ESS3-3MS-ETS1-4HS-LS1-3HS-LS2-6HS-LS2-7HS-LS4-5HS-ESS2-6HS-ESS2-7HS-ESS3-4HS-ETS1-3 |
| 1. **Exploring Aquaponics**

**(K-2)** | * Introduction to Aquaponics
* Introduction to Fisheries (anatomy, biology, and care)
* Water Quality and Monitoring
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data
* Standardized Science Measurements
* Small Scale construction of an Aquaponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | K-LS1-1K-ESS3-1K-2-ETS1-21-LS1-12-PS1-4 | K-LS1-1K-ESS2-2K-ESS3-11-LS1-11-LS1-21-ESS1-22-PS1-22-LS2-12-LS4-12-ESS2-2K-2-ETS1-2 |
| 1. **Exploring Aquaponics**

**(3-5)** | * Introduction to Aquaponics
* Introduction to Fisheries (anatomy, biology, and care)
* Water Quality and Monitoring
* Plant Dynamics (circulation and nutrient uptake)
* pH, Acidity, and Alkalinity Testing
* Recording Scientific Data
* Standardized Science Measurements
* Small Scale construction of an Aquaponic System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 3-LS3-23-5-ETS1-34-LS1-14-PS3-45-PS3-15-LS1-15-LS2-1 | 3-LS1-13-LS3-23-LS4-33-LS4-44-LS1-15-PS3-15-LS1-15-LS2-13-5-ETS1-1 |
| **Composting** |
| 1. **Composting Worms**

**(K-8)** | * Introduction to Composting
* Life Cycle and Anatomy of Worms
* Decomposition of Vegetation
* Composition of Compost (Macro and Micro Organisms, Oxygen and Aeration, Temperature)
* Recording Scientific Data
* Standardized Science Measurements
* Medium Scale construction of a Compost System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | K-LS1-1K-ESS3-1K-2-ETS1-21-LS1-12-LS4-13-LS4-33-5-ETS1-14-LS1-25-PS3-15-LS2-1MS-LS1-3MS-LS1-8MS-LS2-1MS-LS2-2MS-LS2-5MS-ESS3-3MS-ETS1-1 | K-LS1-1K-ESS2-2K-ESS3-11-LS1-11-LS1-22-LS4-1K-2-ETS1-13-LS1-13-LS3-23-LS4-33-LS4-44-LS1-14-LS1-25-PS3-15-LS2-13-5-ETS1-1MS-LS1-1MS-LS1-5MS-LS1-7MS-LS2-4MS-LS3-3MS-ESS3-3MS-ETS1-1 |
| 1. **The Rotten Truth**

**(3-5)** | * Introduction to Composting
* Life Cycle and Anatomy of Worms
* Decomposition of Vegetation
* Biodegradation
* Composition of Compost (Macro and Micro Organisms, Oxygen and Aeration, Temperature)
* Recording Scientific Data
* Standardized Science Measurements
* Small Scale construction of a Compost System
* Drawing Conclusions from Experimentation (hands-on, observation, and note-taking)
 | 3-LS4-33-5-ETS1-34-LS1-15-PS3-15-LS2-1 | 3-LS1-13-LS3-23-LS4-33-LS4-44-LS1-14-LS1-25-PS3-15-LS2-13-5-ETS1-1 |