**Course: Plant & Soil Science**

**Unit:** Plant Reproduction

**Unit Objectives:**

**Sexual Reproduction of Plants**

1. List & describe common methods of sexual plant propagation
2. Describe the process and environmental conditions of seed germination
3. Diagram the process of plant fertilization
4. Explain the importance of seed viability and vigor.
5. Explain pollination, cross-pollination, and self-pollination of flowering plants.

**Asexual Reproduction of Plants**

1. List & describe methods of asexual plant reproduction
2. Describe optimal conditions for asexual propagation.
3. Demonstrate techniques used to propagate plants by cuttings, division, separation, and layering.
4. Describe grafting techniques.

Materials Needed (Equipment):

* Computer & Projector
* Printed guided notes
* Lab supplies as indicated on job sheets

Facilities:

* Classroom
* Greenhouse (if available)

Interest Approach:

Objective A: List & describe common methods of sexual plant propagation

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
| * Use powerpoint slides 2-18 for curriculum

When & Why do you need to reproduce or “propagate” plants?**Plant Propagation=** * + Reproduction of plants
* **Sexual Plant Propagation**
	+ Reproduction of plants by seed or spore by the uniting of 2 gametes
	+ Offspring plants are genetically different than parent plants

Sexual Reproduction in Plants:* Flower Produces **Seeds**
* Seeds are pollinated (fertilized) by **insects/wind**
* Seed is harvested & planted to produce **new** plant
* Offspring plant has ½ of it’s genes from 1 plant & ½ from another
* Offspring plant is genetically DIFFERENT than both parent plants

What is the most common method of reproducing plants?**Seed:*** + Seeds are harvested from flowers and planted
	+ Most common method of plant reproduction

**Where do seeds come from?*** + Seeds develop in **ovary** of flower & are harvested
	+ Seeds are kept to grow another season
		- Collected at home OR
		- Commercially

How are seeds harvested?1-Flower blooms & dies2-Petals fall off and seed pod dries3-Seeds are collected from pod**Parts of a Seed*** + **Seed Coat**
		- Hard surface that protects interior of plant
	+ **Embryo**
		- The new plant that develops as result of fertilization

**Types of commercial seed*** + Raw
	+ Pelleted
		- coated to make seed bigger and easier to handle

If a plant does not have a flower, can it reproduce sexually?What type of plants don’t have flowers?**Spores:*** + Primarily with ferns
		- Ferns do not have **flowers**
	+ Usually found on back of fern
	+ They drop to ground and grow into a new plant
 | * Follow prompts in the “Notes” section beneath the powerpoint slides
* Pass out guided notes to students
 |

**Activity:**

1. **-Seed Dissection Lab**

**” you will proceed to the front**

Objective B: Describe the process and environmental conditions of seed germination

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
| **Germination:*** Development of a seed from a resting stage to a stage of growth.

**Environmental Requirements:*** + **Oxygen**
	+ **Sun**
	+ **Temperature**
	+ **Water**
 | * Use slides 19-20 of the powerpoint
* Continue using guided notes
* Include learning activities listed below.
 |

**Activity:**

1. **-Environmental Factors of Seed Germination Experiment**
2. **-Seed Planting Job Sheet (for use if you have a school greenhouse)**

Objective C: Diagram the process of plant fertilization

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
| **Plant Fertilization:*** + The meeting of the male gamete with the female gamete
	+ Takes places in ovary of flower

**Steps:**1- Pollen from anther transferred to stigma2- Pollen moves to ovary3- Haploid cells (pollen & seed embryo) unite  | * Use powerpoint slides 21-22
* Continue guided notes
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**Activity:**

Objective D: Explain the importance of seed viability and vigor.

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
|   **The most viable seed is:*** + Collected from strong, healthy parent plants
	+ Pollinated properly prior to seed harvest
	+ Kept at moisture/temperature level to keep seed in dormancy

\*Remember, a seed is living, it’s just in dormancy til proper environmental conditions take it out of dormancy  | * Use slide 23 of the powerpoint
* Continue Guided Notes
* Use information from the seed germination lab to discuss why not every seed germinates, even in optimal conditions.
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**Activity:**

Objective E: Explain pollination, cross pollination, and self-pollination of flower plants

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
|   **Pollination:*** + Transfer of pollen from an anther to a stigma of a flower of the same species

**Self Pollination:*** + Pollen from a plant pollinates a flower on the **SAME** plant

**Cross Pollination:*** + Pollen from a plant pollinates a flower on a **DIFFERENT** plant

**Methods of Pollination:*** + **Insects**
		- Bees
		- Butterflies
		- Moths
	+ **Wind**
 | * Use powerpoint slides 24-26
* Continue guided notes
 |

**Activity:**

**-Video: Silence of the Bees** <http://www.pbs.org/wnet/nature/episodes/silence-of-the-bees/full-episode/251/>

The movie is from PBS and talks about the declining population of honey bees and the possible ramifications of losing honey bees. The DVD can be purchased, or it may be available for viewing online.

Objective F: List & describe methods of sexual plant propagation

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
|   **Asexual Propagation:*** + Reproduction of plant **without** the use of reproductive organs (flower pistil & stamen)
	+ Also called **“vegetative”** propagation
	+ Use of **stems**, **leaves**, or **roots** to grow a new plant
	+ Produces genetically **identical** plants (clones)

**Benefits:*** + Can be quicker
	+ Assures characteristics to be passed to offspring
	+ Less expensive

**Drawbacks:*** + Can’t be used with all plants
	+ No genetic diversity

**1-Separation/Division:*** + Separating or dividing one plant into several smaller plants

**2-Layering:*** + Reproduce a new plant while offspring plant is still connected to parent.
		- Advantage: No water stress

**3-Cuttings:*** + Using a section of stem and/or leaf to produce a new plant
 | * Use powerpoint slides 27-32
* Continue guided notes
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**Activity:**

Objective G: Describe optimal conditions for asexual propagation

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
|  **Do asexual propagation methods need special environmental conditions to succeed??** * **Humidity/Moisture**
	+ Remember, they don’t have roots anymore
* **Good draining soil**
 | * Use powerpoint slides 33-34
* Continue guided notes
 |

**Activity:**

**-Experiment:** to illustrate this objective, when you do the cuttings lab for the next objective, place cuttings in different mediums (soil and straight vermiculite) and compare rooting speed, conditions, etc.

Objective H: Demonstrate techniques used to propagate plants by cuttings, division, separation, and layering.

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
| **How to take Cuttings:** 1. Cut a section of stem* + - Be sure there are at least 2 nodes

2. Strip leaves from bottom nodes3. Dip in rooting hormone4.Plant in soil less media & Water**Tips for Cuttings:*** Rooting Hormone isn’t always necessary, but may increase speed of root formation
* Remove ALL flowers
* Remove excessive leaves

**How to separate plants:**1-Dig up plant with as many roots as possible2. Wash off excess soil and split roots at the natural separation3. Replant, water well, and keep in shade til completely re-rooted**How to layer:****Ground Layering:*** + Often done with vine plants
	+ Take section of vine & place under soil
	+ In time, new roots form

**Air Layering:** 1 & 2: With sharp knife, cut away outer layer3. Cover in wet sphagnum peat moss4. Cover tightly with plastic* + Will take at least 1 month or more

**Air Layering:*** + Successful with woody stemmed plants
	+ Decreases plant stress because it’s connected to mother plant until rooted
 | * Use powerpoint slides 35-48
* Students take guided notes on the cuttings lab sheet
* Use powerpoint slides 49-54
* Students take guided notes on the separation/division lab sheet prior to lab
* Use powerpoint slides 55-59
* Students take guided notes on Layering lab sheet prior to lab
 |

**Activity:**

**-Cuttings Lab**

**-Division/Separation Lab**

Objective I: Describe grafting techniques

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| **Curriculum (Content)****(What to teach)** | **Instruction (Methodology)****(How to teach)** |
|   **Grafting:*** + Connecting 2 pieces of living plant material together to form a single plant
	+ Scion= New plant material
	+ Rootstock= old plant material

  **Benefits of Grafting:*** + Increase the strength and disease resistance of roots
		- Peach trees have stronger roots that are more resistant to root rot than almond tree roots
	+ Several Varieties grown on one tree/bush
		- Apple trees with 2-3 varieties of apple
		- Rose bushes with multiple colors of roses

**Types of Grafts:*** + Wedge Graft
	+ Saw Kerf Graft
	+ Whip & Tongue Graft

**Budding:*** + Grafting technique where only a single bud is transferred
 | * Begin lesson by teaching students about almond trees. Explain how they are completely dependent on bees to pollinate. (refer back to objective E) Also explain that most almond, citrus, and some fruit trees actually have a trunk from a different tree.
* Use powerpoint slides 60-67
* Students fill in guided notes on Plant Reproduction Notes sheet.
 |

**Activity:**

Have students practice grafting or budding using tree twigs.

Evaluation:

See Plant Reproduction test

References:

* [www.theseedbasket.com](http://www.theseedbasket.com)

**Meets USOE Standards and Objectives:**