Plant Inquiry

By

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Plant Inquiry

Content Standard:

2.2 - Plants change their forms as part of their life cycles.

The life cycles of flowering plants include seed germination, growth, flowering, pollination and seed dispersal.

Expected Performance(s):

A19  Describe the life cycles of flowering plants as they grow from seeds, proceed through maturation and produce new seeds.
A20  Explore and describe the effects of light and water on seed germination and plant growth

GRADE-LEVEL EXPECTATIONS:

1. Flowering plants progress through a sequenced life cycle. First, seeds sprout (germinate), then seedlings grow into adult plants with leaves and flowers. If the flowers are pollinated, seeds develop that will grow into new plants to continue the life cycle.

2. **Roots, stems, leaves, flowers and seeds are structures that develop during different stages of the plant’s life cycle.**

3. **Seeds contain the beginnings of a new plant (embryo) and the food (energy source) the new plant needs to grow until it is mature enough to produce its own food. Different plant varieties produce seeds of different size, color and shape.**

4. **Environmental conditions, such as temperature, amount of light, amount of water and type of soil, affect seed germination and plant development.**

5. A plant’s seed will grow into a new plant that resembles but is not identical to the parent plant or to other new plants. For example, marigold plants produce marigold seeds that grow into new marigold plants. Individual marigolds, however, vary in height, number of leaves, etc.

6. **Seedlings are young plants that produce the structures that will be needed by the plant to survive in its environment: Roots and leaves begin to grow and take in nutrients, water and air; and the stem starts to grow towards sunlight.**

7. Adult plants form more leaves that help the plant collect sunlight and air to make its food. They produce flowers that are the structures responsible for reproduction.

8. Flowers have structures that produce pollen, attract pollinators and produce seeds that can grow into new plants. Some flowers have structures that develop into fruits, berries or nuts that contain the seeds that can grow into new plants.

9. Some seeds fall to the ground and germinate close to the parent plant; other seeds are carried (dispersed) by wind, animal or water to places far away. The structure of the seed is related to the way it is dispersed.

KEY SCIENCE VOCABULARY:

life cycle, structures (body parts), seed, germinate, reproduce, flower, pollen, pollinator, seed dispersal

Preassessment

3 stations

Station A: Students will sort and sequence plant life cycle cards
Station B: Students will identify the parts of a plant
Station C: “Needs of Seeds” (tweek for plants)- From the Misconception book. This will identify misconceptions, prior and future knowledge

Students will record info in notebook

Teachers will view their notebooks at the end of the day and record responses on checklist.

Teachers will use the info on the checklist to plan question grouping the next day for the inquiry phase one.
**Phase 1: Inquiry Starter**

Students explore seeds and plants at different stages in the plant life cycle.

### Station 1: Students explore dry and soaked bean seeds

**Materials:**
- science notebook
- plates
- dry kidney beans (from grocery store)
- kidney beans soaked overnight
- hand lenses
- tools to break seeds apart

**Procedure:**
- Students work in groups of 3
- Use science notebooks (I Notice/I Wonder) to record exploration of seeds (20 minutes).
- Each group generates 1-2 questions to potentially investigate.

**Potential questions: ("kid speak")**
- Are seeds alive?
- Do big seeds grow big plants and little seeds small plants?
- How does the baby plant (embryo) grow into a plant?
- What does a seed need to sprout?
- Do seeds grow better in the light or the dark?
- Do roots always grow down and do stems always grow up?
- What happens when seeds get overcrowded?

### Station 2: Students explore plants at different stages of the life cycle

**Materials:**
- science notebook
- brassica seeds at different stages of life cycle (seed, seedling, mature plant, flowering plant), also seedlings sprouted in light and dark

**Procedure:**
- Use science notebooks (I Notice/I Wonder) to record exploration of plants (20 minutes). (Use questioning to guide students to think about how plants grow and what they need to grow)
- Each group generates 1-2 questions to potentially investigate.

**Potential questions: ("kid speak")**
- How do plants make new plants? (cycle)
- Do the same kind of seed make the exact same kind of plant?
- What do seeds/plants need to grow?

**Variables**

**Light**
- Light questions (how much, can grow without)
- How do plants get food? How do they eat?
- Can a plant grow without leaves?

**Water**
- How much water does a plant need to grow?
- What happens when a plant gets too much water?
- What happens when a plant gets too little water?
- Can a plant grow with other liquids? (salt water, juice, soda, colored water...other)

**Soil**
- How do plants grow in clay soil?
- How do plants grow in humus?
- How do plants grow in sand soil?
- How do plants grow in loam? (local sample)

**Temperature**
- How do plants grow in the cold? hot? room temp?
Process Skill Goals:
Planning and investigating

Attitude Goals:

Formative Assessment:

“Crowded Seeds”
Question
“How does the number of seeds planted in the same container affect their growth?”

Materials:
- Variety of bean seeds
- Different types of potting soil
- Different size Clear cups
- Measuring tools- measuring cups, centimeter ruler, thermometer

Variables
- Temperature, light, soil, and water

Procedure:
1. “How can we set up an investigation to answer this question.” Share the question.
2. Show materials
3. Discussion for setting this up in our science notebooks. –Use talk and turn, pair share
4. Teacher will write on chart paper (modeling notebook entry). During this discussion focus on drawing a picture of the set-up (one with many seeds and one with few seeds). What needs to be the same? Is this fair? Let students guide you on determining which cups we should use, which soil, etc.
5. Hmmm now we have the set up…I am ready to watch this…what I am looking for…how can I measure it…what tools can I use to measure this…how can I organize it…predict what they will look like as they grow, how will I record these observations…can I measure these observations…
6. Class generates the list of what we are looking at and what we are noticing. They create in the notebook model tables and/or bar graphs together, digital photos. Example: Daily (or every other day) sketch, I notice and wonder, measurements.
7. During investigation: Class graph of …., butcher paper of I wonder and notice, morning work. Both students and teacher could enter in data.

Teacher note: Because there are many content goals for this inquiry Phase 2 is broken into shorter, manageable chunks (variables that impact seed/plant growth). The following Phase 2 parts may be considered based on students’ prior knowledge and questions. Also, based on time available, may want to conduct some of the “subphases” concurrently. Consider simultaneous investigation of variables with mini shareouts (updates) to identify the “Big Ideas” along the way. You could chart this on one big classroom update board. Students will be invested in each group’s learning before the shared understanding part.
While waiting for seeds/plants to grow, plan activities to support content goals not covered in this inquiry..e.g. flowers and pollination, seed dispersal, etc.

<table>
<thead>
<tr>
<th>Phase 2 – Focused Investigation</th>
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<tbody>
<tr>
<td><strong>Phase 2 - For Light, Water, Temp and Soil variables</strong></td>
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<tr>
<td><strong>Materials:</strong></td>
</tr>
<tr>
<td>- variety of seeds for flowering plant</td>
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<tr>
<td>- clear cups</td>
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<tr>
<td>- black paper strips</td>
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<tr>
<td>- cotton</td>
</tr>
<tr>
<td>- paper towel</td>
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<tr>
<td>- zip-loc bags (quart)</td>
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<tr>
<td>- stapler</td>
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<tr>
<td>- water</td>
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<tr>
<td>- soil- clay, humus, sand, loam</td>
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<tr>
<td>- tray of marigolds</td>
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<td>- plant light (24 hours of light)</td>
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<tr>
<td>- measuring tools</td>
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<tr>
<td>- measuring tools (graduated cylinders, measuring cups, spoons)</td>
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<tr>
<td>- variety of liquids (salt water, colored water, soda, juice, soap)</td>
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<td>- thermometer</td>
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<tr>
<td><strong>Procedure:</strong></td>
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<tr>
<td>Select question to investigate (groups of 2 or 3)</td>
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<tr>
<td>Plan a fair investigation</td>
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<td>Predict outcomes</td>
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<tr>
<td>Set-up investigation</td>
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<tr>
<td>Monitor growth daily</td>
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<tr>
<td>draw/photo</td>
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<tr>
<td>I notice, I wonder, I think</td>
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<td>measure and graph (cm)</td>
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<tr>
<th>Content Goals (GLE)</th>
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<tr>
<td>See Phase 1</td>
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<tbody>
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<td>• Planning</td>
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<tr>
<td>• Observing</td>
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<tr>
<td>• Interpreting and Drawing Conclusions</td>
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<td>• Communicating</td>
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<th>Attitude Goals:</th>
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<tr>
<td>Phases 2-3</td>
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<tr>
<th>Formative Assessment:</th>
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<tbody>
<tr>
<td>Student notebook</td>
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<tr>
<td>Use of process skill indicator checklist</td>
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<td>Self assessments</td>
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<th>Phase 3 - Shared Understanding</th>
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<tr>
<td><strong>Share out</strong></td>
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**Summative Assessment – Performance Task**

- **Goal:**
  - Your task is:
  - The goal to:
  - The challenge/problem is:
  - The obstacles to overcome are:

  Your goal is to design a plant care book that you will give to the PTC before their Spring planting. The goal is for the PTC to be able to grow a healthy plant for our school gardens from seed. The challenge is to make it a user friendly “How To” book.

- **Role**
  - You are:
  - You have been asked to:
Your job is:

You are our school community expert gardener. You have been asked to create write a “How To” book. Your job is to explain the steps which will enable our community to grow a school garden beginning with the seed.

- **Audience**
  - Your client(s) is (are):
  - The target audience is:
  - You need to convince:

Your audience are the PTC parents. You need to excite and guide them in this gardening adventure.

- **Situation:**
  - The context you find yourself in:
  - The challenge involves: writing a that people can.

- **Product/Performance/and Purpose:**
  - Your How To Book should contain:
    - A cover
    - A dedication page
    - A table of contents
  - Chapter 1: How to Plant a Seed
    - Materials List
    - Numbers for each step
    - Captioned pictures that teach what to do

  Be sure to include…
  - What do seeds need to grow?
  - What will help them sprout?
  - What’s happening underground?
  - How to prepare the soil?

  Chapter 2: How to Care for Your Plant
  - Materials List
  - Captioned pictures that teach what to do

  Be sure to include information about….
  - Light
  - Water
  - Soil
  - Temperature
  - Human Factors

  Chapter 3: What to Look for Over Time
  Sequence of plant growth/ life cycle
  Glossary
  Author's Page

- **Standards and Criteria for Success:**
  - Your performance needs to:
  - Your work will be evaluated by:
  - Your product must meet the following (attach rubric) standards:
Predicting Checklist K-2
1. I think __________ will happen based on what I think I know.
2. I think __________ will happen because of my experience and what I noticed __________ (evidence).
3. I think __________ will happen because my investigation showed me ___________, ___________ and ___________ (you can keep adding evidence blanks).
4. I think __________ will happen because the evidence helps me understand that ___________.
5. I think __________ because I noticed __________ pattern.
6. I use the “big science idea” __________ to explain what will happen.

Observing Checklist K-2
1. I notice how the objects are the same or different using color, shape, and size.
2. I use my senses to explore objects (see, touch, smell, feel, taste).
3. I use my senses to notice the differences between objects.
4. I can find details that are the same between objects that seem very different.
5. I can use tools to notice more details about an object.
6. I notice important details that can help answer my questions.

Planning and Investigation K-2
1. I use pictures or words to describe how I can answer my question.
2. I can identify the variable that has to be changed.
3. I know the variables that need to stay the same to keep my investigation fair. If its fair it can compare (with movement...cha cha).
4. I know what needs to be measured and compared before I start.
5. I have a plan for collecting, recording and organizing my data.
6. I took steps to make sure that my results are as accurate as possible by correctly using the proper measurement tool and multiple trials.

Indicators of Ideas

<table>
<thead>
<tr>
<th>Generic Indicators</th>
<th>Specific Indicators</th>
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<tbody>
<tr>
<td>1. Do no more than describe the situation, rather than</td>
<td>Describe what happens with variables.</td>
</tr>
<tr>
<td>explaining it?</td>
<td></td>
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<tr>
<td>2. Use their own preconceived ideas, rather than</td>
<td>Use preconceived ideas about plants and ______ to</td>
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<tr>
<td>Scientific ones?</td>
<td>Explain what happens.</td>
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<tr>
<td>3. Refer to relevant ideas without showing how they apply?</td>
<td>Mention relevant ideas/evidence about _______ but doesn’t understand/ explain why.</td>
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<tr>
<td>4. Apply the relevant ideas only in situations similar to those already encountered?</td>
<td>Apply evidence to explain their variable to a similar situation?</td>
</tr>
<tr>
<td>5. Apply the relevant ideas only in situations different to those already encountered?</td>
<td>Apply the idea of variable differently from those given</td>
</tr>
<tr>
<td>6. Bring several relevant ideas together to give a reasoned explanation or prediction.</td>
<td>Make a connection between all the variables and can explain how they impact on plant growth</td>
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