**NAME:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ DATE: 09/25/13 SCORE:**

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wlh

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WARM UP: DEFINE the following terms. Provide an example of each by identifying them in your Oil Spill experiment.

*1. INDEPENDENT VARIABLE:*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*2. DEPENDENT VARIABLE:*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*3. CONTROL GROUP:*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

*4. CONSTANTS:*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_*

**Name:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**Class Period:** \_\_\_\_\_\_ **Date:** September 25, 2013

**LABORATORY INVESTIGATION # 3: BUDS, LEAVES, AND GLOBAL WARMING**

**I SCHOOLYARD STUDY QUESTIONS:**

1. *LONG TERM STUDY:* How long is the growing season in our schoolyard? How might the length of the growing season relate to the climate?
2. *SHORT TERM STUDY:* When does the growing season for trees in our schoolyard end this autumn?

**II HYPOTHESIS:**

CLAIM: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

WARRANT:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**III MATERIALS:**

1. Flagging and/or metal tags

2. Data sheets

3. Clipboards/pencils

4. Tree field ID guides

5. Metric ruler

6. Permanent marker

**III LABORATORY PROTOCOL**

* CHOOSING STUDY TREE:

1. Trees in reach: Each tree in your study must have two or more branches that allow you to reach at least 6 leaves on each branch.
2. Trees that will last the duration: These are the same trees you will study in the autumn and the spring, or probably by younger students in the future years.

* LABELING BRANCHES:

1. Choose, flag, and identify individual trees. At least two branches on each tree will be flagged and labeled.
2. Assign each tree a unique identifying number (integer) to each branch on each tree, and a letter to each branch.

EXAMPLE: a branch may be labeled 1A (where 1 is the number of the tree, and A is the branch you are studying). Another tree will have a branch marked 5B, which shows it is tree 5, branch 5.

**Please note:** Each tree at the park has a unique number; work only on the tree assigned to you.

* MARK THE LEAVES/BUDS: It is best to mark the study leaves/buds in addition to the branches in order to allow for consistency in data collection. To mark the leaves, you can wrap small pieces of flagging or electrical tape at the far end of the last of your 6 study leaves. In other words, locate the terminal bud/leaf of your branch (this is the bud/leaf at the very end/tip of the branch). Don not use this leaf as one of your study leaves. The leaf closest to the terminal leaf is leaf # 1 and label accordingly. The next leaf down the branch is leaf #2, etc. There are many trees/branches that will have side branches close to the leaf tip. In this case, use the terminal leaf on the next side branch as the next leaf in your study.

See diagram below:



ALTERNATE LEAF SPECIES

OPPOSITE LEAF SPECIES



* IF A BRANCH OR TREE IS REMOVED/DESTROYED: Sometimes the inevitable hand of change strikes your study site, and that means you may find a branch or even a tree that has died, been cut down, vandalized, or struck by lightning. In these cases, you need to identify a substitute branch or tree to include in your study.

STEPS IN SUBSTITUTING BRANCHES:

1. Locate a different branch on the same tree and assign it the same number and the next letter. For example if 4A broke off, and you already have branch 4B, label the new branch “4C”.
2. If there is no other branch in reach on that tree, try to find an additional tree of the same species, with a branch in reach of students, and assign it a unique tree number and appropriate letter. For example if you have labeled branches on tree 3 as branches A and B, and then B falls off/is broke, etc, label branch on the new tree, 4A.
3. To substitute trees, try to find a tree of the same species and relative size if possible and assign it a new number.
4. If there are no trees of the same species, choose a new tree of a different species.

**NOTE:** Your teacher will assist you in substituting branches.

* DATA COLLECTION SCHEDULE: Collect data about once a week during study time for a minimum of 4 field visits. It is also possible to begin going out one time a week until it is getting closer to leaf drop, and then twice a week until most leaves have dropped.

**Note** that oak and beech often have leaves that remain on tree all winter, which is why you should consider the study complete when all leaves are brown. 2

* OBSERVE SPECIFIC TREE ASSIGNED:Focus on the 6 leaves closest to the branch tip, not counting those at the terminal bud (the bud at the very tip). These leaves should be labeled prior to data collection (see section E in “Site Preparation” above, including diagram and photograph). It is highly recommended to bring branches cut from other trees of the same species as in study, to practice measuring leaves inside classroom prior to going out.
* **Measure the length of leaf blade (not including leaf stem/petiole) and width** in cm. of each of the 6 leaves, and record on the data sheet. These measurements only need to be done during the first session to see how large the leaves grew during this growing season, and will be useful to estimate leaf development in the spring.

**Note:** Be careful not to remove leaf from tree accidentally.

 If the leaf is compound (multiple leaflets are attached to a main leaf stem/petiole), measure from the tip of the entire leaf down to the base of the lowest leaflets where they meet the leaf stem for the leaf length.

|  |  |
| --- | --- |
| **Factors Influencing Autumn Leaf Color**  http://harvardforest.fas.harvard.edu/leaves/science | |
| ANNOTATION | QUESTION, NEW LEARNING, SOMETHING THAT SURPRISED YOU, ETC. |
| Although always impressive, autumn leaf colors vary from year to year, and seem to be more intense in some regions. For instance, aging leaves in tropical forests generally do not change color. People in New England would argue that the autumn colors in their forests are the most colorful, although people in the southern Appalachians would argue otherwise. Predicting color intensity and timing may be economically interesting because the colors are a huge tourist draw, worth hundreds of millions of dollars in revenues every year. The following factors appear to be important in the color displays. |  |
| **What Trees are Present**  Few broadleaf trees, and lots of conifers, mean a primarily green display in autumn. In the northeast more pines and hemlocks reduce the color intensity, although the presence of some conifers provides a nice contrast to the bright colors. European forests seem to lack many species that produce good color, especially the reds. Some trees produce their colors earlier than others, and the mix of species may affect the peak color production. |  |
| **Summer Weather**  Summer drought conditions stress trees. They may thus lose their leaves prematurely or start color production prematurely. The result is a reduction of color during the peak of the season. Adequate summer rains promote good tree health, leaf retention and, therefore, color production during the autumn. |  |
| **Autumn Weather**  The right weather during the autumn can promote more intense color production. The reds (anthocyanins), which require sunlight for production, are enhanced by cold and sunny days. Rainy and windy weather during the autumn can knock leaves down prematurely thereby shortening the |  |
| The timing of many individual species' autumn coloration and leaf drop is being [documented at the Harvard Forest](http://harvardforest.fas.harvard.edu/data/p00/hf003/hf003.html). These changes along with the timing of a plant's flowering and leaf development in the spring are part of what is called its phenology, a term that includes all relationships between periodic biological activity and climate, including migrations, dormancy, etc. |  |
| **SUMMARY:** (Summarize what you have learned from the text above.)  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |

**THREE TYPES OF PIGMENTS PRESENT IN LEAVES:**

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| --- | --- | --- |
| **PIGMENT** | **COLOR** | |
| 1. Chlorophyll | green | |
| 1. Carotenoid | bright yellow-orange colors | |
| 1. Anthocyanin | pink-red colors | |
| **Autumn Foliage Color: Past, Present, and Future**  http://harvardforest.fas.harvard.edu/leaves/science | | | | |
| Autumn colors were different a century ago in southern New England, and they will likely continue to change during this century. These changes are largely due to human activity, including land-use changes, introduced pests and diseases, forest management, and climate change from fossil fuel emissions. At present, the [timing of color production](http://harvardforest.fas.harvard.edu/data/p00/hf003/hf003.html) is quite consistent from year to year, although very unusual weather conditions can retard or advance the timing. | | |  | |
| **White Pine**  At the start of the twentieth century, much of this [landscape was covered by white pine forests](http://harvardforest.fas.harvard.edu/dioramas) that had naturally established on fields and pastures when they were abandoned in the late nineteenth century. As these white pines were harvested, they have typically been replaced (succeeded) by a mixture of broadleaf species (including maples, oaks, birches, ash and others), significantly increasing the autumn color in the landscape. | | |  | |
| **Chestnut**  The American Chestnut, which produces a nice yellow color during autumn, was a very common broadleaf tree in these forests a century ago. All large mature trees were destroyed by the Chestnut Blight, an introduced fungal disease, and only small sprouts linger on in our forests. Our forests would have produced more yellows and fewer reds with these trees in the mix. | | |  | |
| **Hemlock**  This beautiful native conifer, particularly common in valleys, on steep slopes, and along streams, is being removed from our forests by an introduced insect pest, the hemlock woolly adelgid. The insect is presently infesting trees at the Harvard Forest, and trees may begin to die in several years. It is not clear how far north this insect pest will move. As these hemlocks die, they will likely be replaced by black birch, which will replace the dark green with yellow foliage during the autumn. | | |  | |
| **Sugar Maple**  This is one of our most spectacularly colorful trees during the autumn. It is near the southern end of its natural range in Massachusetts, although it can be grown as a landscape tree further south. Its abundance in eastern Massachusetts and coastal southern New England is a result of extensive planting along roadsides during the eighteenth and nineteenth centuries to provide a source of sap for maple sugar. It is likely that its natural distribution will move towards the north over the next century, with the anticipated increase in temperatures due to the accumulation of greenhouse gases. Over time, the autumn colors of our forests may diminish as conditions become less favorable for this tree. | | |  | |
| **Climate Change**  Temperature increases brought on by accumulation of greenhouse gases may affect other trees. Diseases, such as those of ash, dogwood and other species, may reduce the abundances of these colorful trees, and these diseases may be promoted by climate change. Climate change is yet another stress that may increase susceptibility to existing diseases, rather than killing trees outright. USDA has a [climate change tree atlas](http://www.fs.fed.us/ne/delaware/atlas/) for the Eastern USA | | |  | |
| **SUMMARY:** (Summarize what you have learned from the text above.)  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | | |





**“Pride Inside”**

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| **Teachers:** | Willy L. Herrera | | | | |
| **Date:** | September 25, 2013 | | | | |
| **Content:** | **ENVIRONMENTAL SCIENCE** | | | | |
| **Unit:** | Skills and Processes | | | | |
| **Topic:** | Experimental Design | | | | |
| **Core Learning Goal(s)**  **or VSC Standard(s)** | | ***Skills and Processes:***  **1.2.1** The student will identify meaningful, answerable scientific questions.  **1.2.3** The student will formulate a working hypothesis.  **1.2.4** The student will test a working hypothesis  **1.2.5** The student will select appropriate instruments and materials to conduct an investigation.  **1.4.1** The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title).  **1.3.3** The student will demonstrate safe handling of the chemicals and materials of science  **1.5.4** The student will use tables, graphs, and displays to support arguments and claims in both written and oral communication.  ***Common Core State Standards:***  ***RST 9-10.1*** *Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.*  ***RST.9-10.10*** *By the end of grade 10, read and comprehend Science/technical texts in the grades 9-10 text complexity band independently and proficiently.*  **RST.9-10.7** Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or a chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.  ***ENVIRONMENTAL SCIENCE STANDARDS:***   * **6.4.2** Design and conduct the research.   Methods of data collection may include field or laboratory questionnaire/opinionnaire   * **6.4.3** Interpret the findings to draw conclusions and make recommendations to help resolve the issue. | | | |
| **Objective:** | | At the end of the lesson students will be able to learn how to do a field research by conducting a field study answering the question “When will the growing season for trees in our school yeard end this autumn?” | | | |
| ***Assessment Focus:***  ***(Key Idea)*** | | **BIG IDEAS:**   * There is more than one way to do science. * Science is a problem solving process as well as a body of knowledge.   **MAIN IDEAS:**   * Experiments are often repeated and/or modified by scientists in order to find the answer to a scientific question. * Hypotheses are statements based on observations and research that provide possible answers to scientific questions. * We use carefully designed experiments to test hypotheses. * A hypothesis must be measurable. * An experiment can be designed to test a measurable hypothesis. | | | |
| **Materials Needed:** | | Students:   1. Writing instruments 2. Binder | Teacher:   1. Hand Outs 2. Document camera 3. Flagging and/or metal tags 4. Data sheets 5. Clipboards/pencils 6. Tree field ID guides 7. Metric ruler 8. Permanent marker | | |
| **Handouts:** | | 1. Warm Up sheet 2. Lab Protocol | | | |
| **Background:** | | Understanding science concepts requires a lot of skills and processes such as observing, investigating, and critical thinking. These skills are vital in problem solving. In science, problem solving requires inquisitive minds and extra skills in conducting investigations.  One of the major lessons taught in science classes is the concept of scientific method; the method itself is not fixed to certain steps as it varies depending on the situation and needs.  In today’s lesson, students will demonstrate and would be able to recognize the value of scientific investigation in problem solving. Although the lesson is designed to teach students how to conduct a field research, this will teach students the main steps they will use in scientific investigations. | | | |
| **Essential Question:** | | *When does the growing season for trees in our schoolyard end this autumn?* | | | |
| **Accommodations and Modifications:** | | |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **STUDENT INITIAL** | **ACCOMODATIONS/MODIFICATIONS** | | | | | | **Presentation Accommodations** | **Response Accommodations** | **Timing and Scheduling Accommodations** | **Setting Accommodations** | **Supplementary Aids** | | 1. C.N.(P4/6) | **(1-P)** Notes, Outlines,  (1-F) Human reader or audio recording for verbatim reading of the entire test | **(2-J)** Calculation Devices  (2-L) Visual Organizers **(2-M)** Graphic Organizers  (2-A) Scribe | **(3-A)** Extended time  **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students  (4-B) Reduce distraction to other students | **(4H) Preferential seating (1Q) Repetition of directions (1P) Provide student with copy of student/teacher notes**  **(2C) Chunking of texts**  **(5C) Classroom instruction consult(1F) Have students repeat and/or paraphrase information(1H) Monitor independent work (3H) Frequent eye contact/proximity control**  **(3R) Strategies to initiate and sustain attention** | | 1. A.J (P4/6) | **(1-G)**Human Reader for verbatim reading of selected sections of the test  **(1-P)** Notes, Outlines, | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students  (4-B) Reduce distractions to other students | **(1E) Frequent and/or immediate feedback**  **(1H) Monitor independent work (1Q) Repetition of direction (5C) Classroom instruction consult** | | 1. J.R (P 4/6) | **(1-G)**Human Reader for verbatim reading of selected sections of the test  **(1-P)** Notes, Outlines, | **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students  (4-B) Reduce distractions to other students |  | | 1. S.M. (P4/6) |  | **(2-J)** Calculation Devices | **(3-A)** Extended time  **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students | **(1Q) Repetition of directions (1E) Frequent and/or immediate feedback (5K) Psychologist consult (1H) Monitor independent work (2B) Break down assignments into smaller units (3R) Strategies to initiate and sustain attention (5C) Classroom instruction consult** | | 1. K.H. (P8) | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(2A) Classroom instruction consult**  **(5C) Classroom instruction consult** | | 1. A.J. (P8) | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students  (4-B) Reduce distractions to other students | **(1A) Allow use of highlighters during instructions and assignments**  **(1Q) Repetition of directions**  **(1D) Check for understanding (5C) Classroom instruction consult** | | 1. T.R. (P 8) | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students |  | | 1. K.R. (P8) | **(1-P)** Notes, Outlines,  (1-F) Human reader or audio recording for verbatim reading of the entire test | **2-J)** Calculation Devices **(2-M)** Graphic Organizers (2-L) Visual Organizer | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(3J) Home-school communication system**  **(3G) Encourage/reinforce appropriate behavior in academic and non-academic settings (!D) Check for understanding**  **(1O) Provide proofreading checklist**  **(1J) Peer tutoring/paired work arrangement**  **93R) Strategies to initiate and sustain attention**  **(2A) Altered/modified assignments**  **(5C) Classroom instruction consult** |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **STUDENT INITIAL** | **ACCOMODATIONS/MODIFICATIONS** | | | | | | **Presentation Accommodations** | **Response Accommodations** | **Timing and Scheduling Accommodations** | **Setting Accommodations** | **Supplementary Aids** | | 1. C.N.(P4/6) | **(1-P)** Notes, Outlines,  (1-F) Human reader or audio recording for verbatim reading of the entire test | **(2-J)** Calculation Devices  (2-L) Visual Organizers **(2-M)** Graphic Organizers  (2-A) Scribe | **(3-A)** Extended time  **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students  (4-B) Reduce distraction to other students | **(4H) Preferential seating (1Q) Repetition of directions (1P) Provide student with copy of student/teacher notes**  **(2C) Chunking of texts**  **(5C) Classroom instruction consult(1F) Have students repeat and/or paraphrase information(1H) Monitor independent work (3H) Frequent eye contact/proximity control**  **(3R) Strategies to initiate and sustain attention** | | 1. A.J (P4/6) | **(1-G)**Human Reader for verbatim reading of selected sections of the test  **(1-P)** Notes, Outlines, | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students  (4-B) Reduce distractions to other students | **(1E) Frequent and/or immediate feedback**  **(1H) Monitor independent work (1Q) Repetition of direction (5C) Classroom instruction consult** | | 1. J.R (P 4/6) | **(1-G)**Human Reader for verbatim reading of selected sections of the test  **(1-P)** Notes, Outlines, | **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students  (4-B) Reduce distractions to other students |  | | 1. S.M. (P4/6) |  | **(2-J)** Calculation Devices | **(3-A)** Extended time  **(3-B)** Multiple or frequent breaks | **(4-A)** Reduce distractions to the students | **(1Q) Repetition of directions (1E) Frequent and/or immediate feedback (5K) Psychologist consult (1H) Monitor independent work (2B) Break down assignments into smaller units (3R) Strategies to initiate and sustain attention (5C) Classroom instruction consult** | | 1. K.H. (P8) | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(2A) Classroom instruction consult**  **(5C) Classroom instruction consult** | | 1. A.J. (P8) | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students  (4-B) Reduce distractions to other students | **(1A) Allow use of highlighters during instructions and assignments**  **(1Q) Repetition of directions**  **(1D) Check for understanding (5C) Classroom instruction consult** | | 1. T.R. (P 8) | **(1-G)**Human Reader for verbatim reading of selected sections of the test | **(2-J)** Calculation Devices **(2-M)** Graphic Organizers | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students |  | | 1. K.R. (P8) | **(1-P)** Notes, Outlines,  (1-F) Human reader or audio recording for verbatim reading of the entire test | **2-J)** Calculation Devices **(2-M)** Graphic Organizers (2-L) Visual Organizer | **(3-A)** Extended time | **(4-A)** Reduce distractions to the students | **(3J) Home-school communication system**  **(3G) Encourage/reinforce appropriate behavior in academic and non-academic settings (!D) Check for understanding**  **(1O) Provide proofreading checklist**  **(1J) Peer tutoring/paired work arrangement**  **93R) Strategies to initiate and sustain attention**  **(2A) Altered/modified assignments**  **(5C) Classroom instruction consult** | | | | |
| **Warm-Up** | | * Students will identify the variables and constants in their bean and onion investigations. | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Engagement** | | * Students will be asked to read, annotate and summarize the text “Factors Affecting Autumn Leaf Color.” * Students will be familiarized with the lab protocol for the field investigation. | |  | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Exploration** | | * Students will work in pairs in conducting a field investigation. * Students will perform the first part of their field investigation by:   1. Flagging the trees   2. Measuring the width and length of the leaves assigned to them.   3. Make field notes of the weather and plants/animals spotted in the research site. * Students will formulate their hypothesis.   **Di** | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Explanation** | | * Students will be asked to state their hypothesis in a form of argumentation where they have to state a claim and provide warrants to their claim. Students can use their prior experience of the season and the text they have read as warrants. | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Extension** | | Students will be asked to read, annotate, and summarize the text “ Autumn Foliage Color: Past, Present, and Future” | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Evaluation** | | * Student-completed laboratory report will serve as the evaluation of the lesson, where students will present their investigation from the statement of the problem to the formulation of the conclusion. | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Homework** | | * Students will be asked to observe the color of the trees around their community. * Students will be asked to take pictures of the trees in their community to be emailed to willylherrera75@yahoo.com. | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **Summary** | | * Students will be asked to answer the following questions:   + 1. What are the basic steps of scientific investigation?     2. Differentiate dependent, independent, and control variables.     3. How are hypothesis and conclusion similar? How are they different? | | Level(s) of Bloom’s taxonomy: | I Knowledge  II Comprehension  III Application  IV Analysis  V Synthesis  VI Evaluation |
| **References/Credits:** | | 1. Kathy Schrock’s Guide for Educators 2. [www.havefunteaching.com/science-songs/scientific-method-song](http://www.havefunteaching.com/science-songs/scientific-method-song) 3. <http://www.biologycorner.com/> 4. <http://qldscienceteachers.tripod.com/worksheets/junior/biology/> 5. <http://www.tes.co.uk/TaxonomySearchResults.aspx?parametrics=44354,44478&event=23&mode=browse> 6. <http://www1.dcsdk12.org/secondary/dchs/index.php?pagenum=624601> | | | |
| **Reflections:** | | * What went well and why? * What didn’t go well and why? | | | |
| ***Areas for Improvement:*** | |  | | | |
| ***NOTES:*** | |  | | | |