Lesson Plans

New Mexico

5th Grade

www.disney.com/planetchallenge

Foreword

Establishing Learning Goals

The Disney Planet Challenge Class Project has two goals:

1. To provide an opportunity for students to identify and focus on one environmental issue in their local area, learn about and investigate ways to address the issue, and develop and take action to improve the environment.

2. To provide an opportunity for students to develop content knowledge and understanding that align with state content standards in English-language arts, mathematics, science, history/social science, and visual and performing arts.

Through the Class Project, teachers identify learning goals for their students based on the content knowledge and understandings that align with state content standards in science, mathematics, English-language Arts, and the visual and performing arts. It is recommended that teachers carefully select the standards that are best taught through project-based learning.

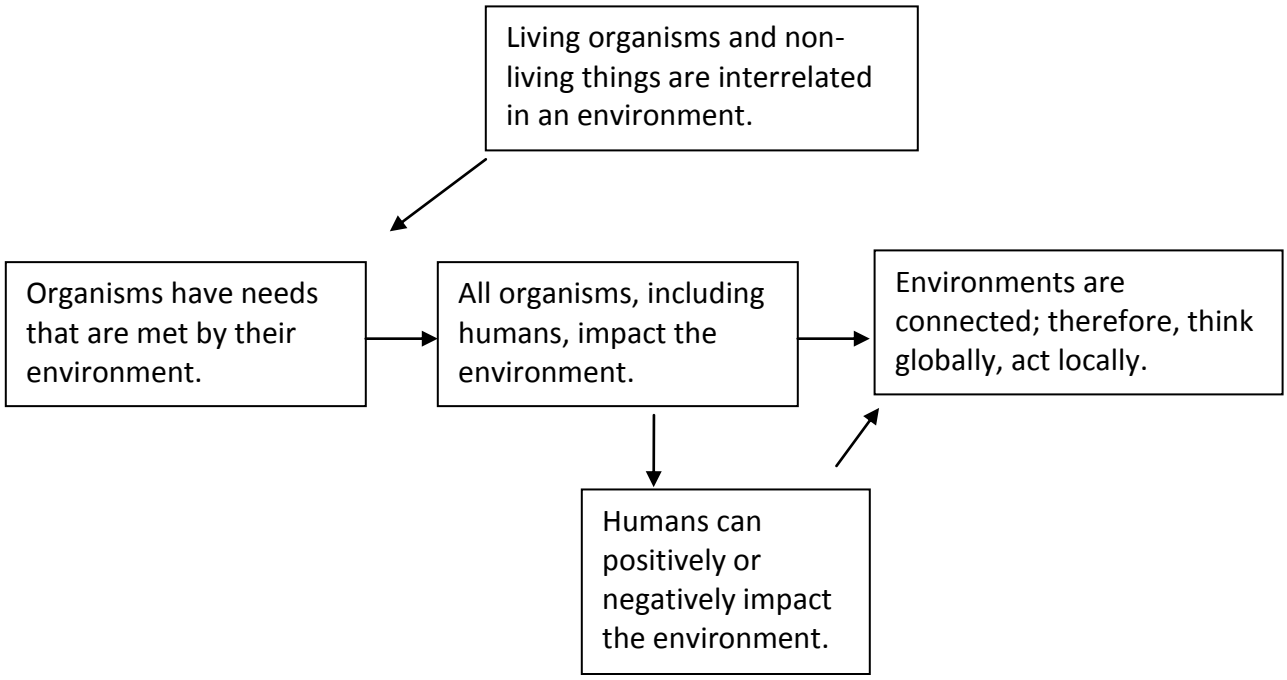
The following state content standards for students in grades 4-6 are strongly suggested as a starting point for identifying student learning goals for the Class Project:

- Science--life, Earth, physical science and environmental science standards as well as inquiry or investigation and experimentation standards;
- Mathematics--mathematical reasoning, graphing standards and statistics, data analysis, and probability standards;
- English-Language Arts--writing, reading, speaking, and listening standards; and
- Visual and Performing Arts--creative expression standards and web-based technology standards.

Developing a Conceptual Flow

Research from *How People Learn* (Bransford, Brown, Cocking, National Research Council, 2000) indicates that expert learners have conceptual frameworks from which to draw for understanding and solving new problems. To help students become experts, teachers should consider the major concepts that the Class Projects will address and create a conceptual flow; i.e., an instructional sequence of those concepts. See Chapter 4 in *Assessment Centered Teaching: A Reflective Process*, (DiRanna, Osmundson, Topps, Barakos, Gearhart, Cerwin, Carnahan, Strang, Corwin, 2008) for detailed instructions on how to construct a conceptual flow.

A generic conceptual flow that might guide each Class Project is shown below. This flow would be modified based on the topic the students select for their project as well as the selection of appropriate content standards.



Lesson Sequence Flow

The following eight lessons are suggested as a guide to complete the Disney Planet Challenge Class Project. The actual time for each lesson will vary depending on the topic and the complexity of the question the students are investigating:

- **Lesson 1** **Choosing the project**
  In this lesson, students brainstorm possible topics for the Class Project. Students will refine their project and questions after further content input in Lesson 2 and additional research in Lesson 3.
  Estimated Teaching Time: 1 class period

Lesson 2 **Background Science Lesson(s) based on learning goals**
When students have selected a preliminary topic, the teacher selects appropriate science standards to address as a foundation for students to begin their project. For example, if the project is about water quality, the students should understand the specific grade science content standards that address water quality.
Estimated Teaching Time: 1-3 class periods

Lesson 3 **Select project and refine investigation questions**
In this lesson students use their knowledge from Lesson 2, their ideas from Lesson 1, and further investigation to refine their topic and the Class Project's investigation questions.
Estimated Teaching Time: 2-5 class periods spread over a couple of weeks

Lesson 4 **Determine project goals and action plan**
With a refined topic and questions, students now determine the actual goal(s) of their project and describe their action plan to reach these goals.
Estimated Teaching Time: 1-3 class periods

Lesson 5 **Investigate the project: Research**
During this lesson students use many means of "research" to gather information about their project. This includes reading, internet searches, conducting interviews, having guest speakers, etc. It also includes learning about special components of the project. For example, if students are making community booklets, they would investigate how to design, print, and distribute the booklets.
Estimated Teaching Time: Many class periods spread over several months depending on the complexity of the project

Lesson 6 **Investigate the project: Conduct an experiment**

If the project lends itself to scientific experimentation where students can discover cause-and-effect relationships, Lesson 6 helps students learn the skills to conduct an experiment with controls and variables. Not all projects have a testable question for experimentation. However, projects with an experimental component are desirable.

Estimated Teaching Time: Several to many class periods depending on the complexity of the experiment(s).

Lesson 7 **Synthesize findings: Reflect on process**

Students have been involved in many activities and investigations. Lesson 7 helps students summarize their findings and make conclusions about the effectiveness of their actions. This lesson also allows students to reflect on their efforts.

Estimated Teaching Time: 3-8 class periods spread over several weeks

Lesson 8 **Prepare portfolio**

The Class Project is complete when it is displayed in a portfolio and submitted to the Disney Planet Challenge. This lesson helps students think creatively about the best way to display their question(s), action plan, and findings as well as their hard work.

Estimated Teaching Time: 4-6 class periods spread over several weeks

Disney Planet Challenge Handbook: In addition to these sample lessons, use the Disney Planet Challenge Handbook as a resource for completing the project.

Vignette
An Example of How a Class Project Might Unfold

Ed West, a 6th grade teacher in District USA, decided that he had looked at the Disney Planet Challenge posters long enough. It was time, this year, to encourage his students to DO the Class Project! He was unsure of exactly where to begin.

He knew the Class Project information usually came to his school in the fall and that the project was usually due in March. He decided to get a "jump start" by doing a little investigation of his own. Ed realized that if he knew more about common environmental issues in his community, he would be able to help his students become more aware of local environmental issues. Ed consulted the Disney Planet Challenge web site to get a list of agencies and organizations that address environmental issues. At the same web site, he located his local and state environmental education coordinator and decided to contact a local agency for assistance with the Class Project.

Ed also reviewed the New Mexico state science standards in his Disney's Planet Challenge customized lesson plans to determine what Standards he thought might best be addressed in a project-based learning experience. He knew that this kind of learning would require language arts and mathematical skills as well as scientific inquiry/investigation/experimentation skills. He also knew the topic his students selected should resonate with one of the science content standards.

Ed again consulted the Disney Planet Challenge Handbook and realized that a major portion of this project-based learning was grounded in scientific inquiry, investigation, and experimentation. He decided that the Class Project would emphasize these standards. These standards include:

Strand I: Scientific Thinking and Practice
Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting and validating to think critically.

Benchmark I: Use scientific methods to observe, collect, record, analyze, predict, interpret, and determine reasonableness of data.

1. Use instruments to perform investigations (e.g., timers, balances) and communicate findings.
2. Differentiate observation from interpretation and understand that a scientific explanation come in part from what is observed and in part from how observation is interpreted.
3. Conduct multiple trials to test a prediction, draw logical conclusions, and construct and interpret graphs from measurements.
4. Collect data in an investigation using multiple techniques, including control groups, and analyze those data to determine what other investigations could be conducted to validate findings.

Benchmark II: Use scientific thinking and knowledge and communicate findings.

1. Communicate ideas and present findings about scientific investigations that are open to critique from others.
2. Describe how scientific investigations may differ from one another (e.g., observations of nature, measurements of things changing over time).
3. Understand how data are used to explain how simple system functions (e.g., a thermometer to measure heat loss as water cools).

Benchmark III: Use mathematical skills and vocabulary to analyze data, understand patterns and relationships, and communicate findings.

1. Conduct multiple trial using simple mathematical techniques to make and test predictions.
2. Use mathematical equations to formulate and justify predictions based on cause-and-effect relationships.
3. Identify simple mathematical relationships in a scientific investigation (e.g., the relationship of the density of materials that will or will not float in water to the density of water).

When Ed considered his state math standards, he found a close match to the suggestions in the Disney Planet Challenge Handbook where students gather data, chart and graph the data, and then interpret the graphs. Likewise, Ed knew that he could consult the History Social Science Standards to see what might be included once his students selected the topic.

Ed recognized that the Class Project would require that he integrate language arts skills with science learning in an authentic way. His students would need to write coherent paragraphs and essays, do persuasive and expository writing and create research reports. Of course, all of this would require edits and revisions. And finally, students would need to make presentations, both oral and written, about their project. Ed reviewed the Visual and Performing Arts Standards to help prepare his students for their presentation.

Ed's "jump start" was starting to evolve into a plan for a Class Project that would make standards-based learning come alive for his students and could make a difference in the community. Ed quickly realized that his decision to research his state standards was going to become the best way to integrate the core content areas with project-based learning.

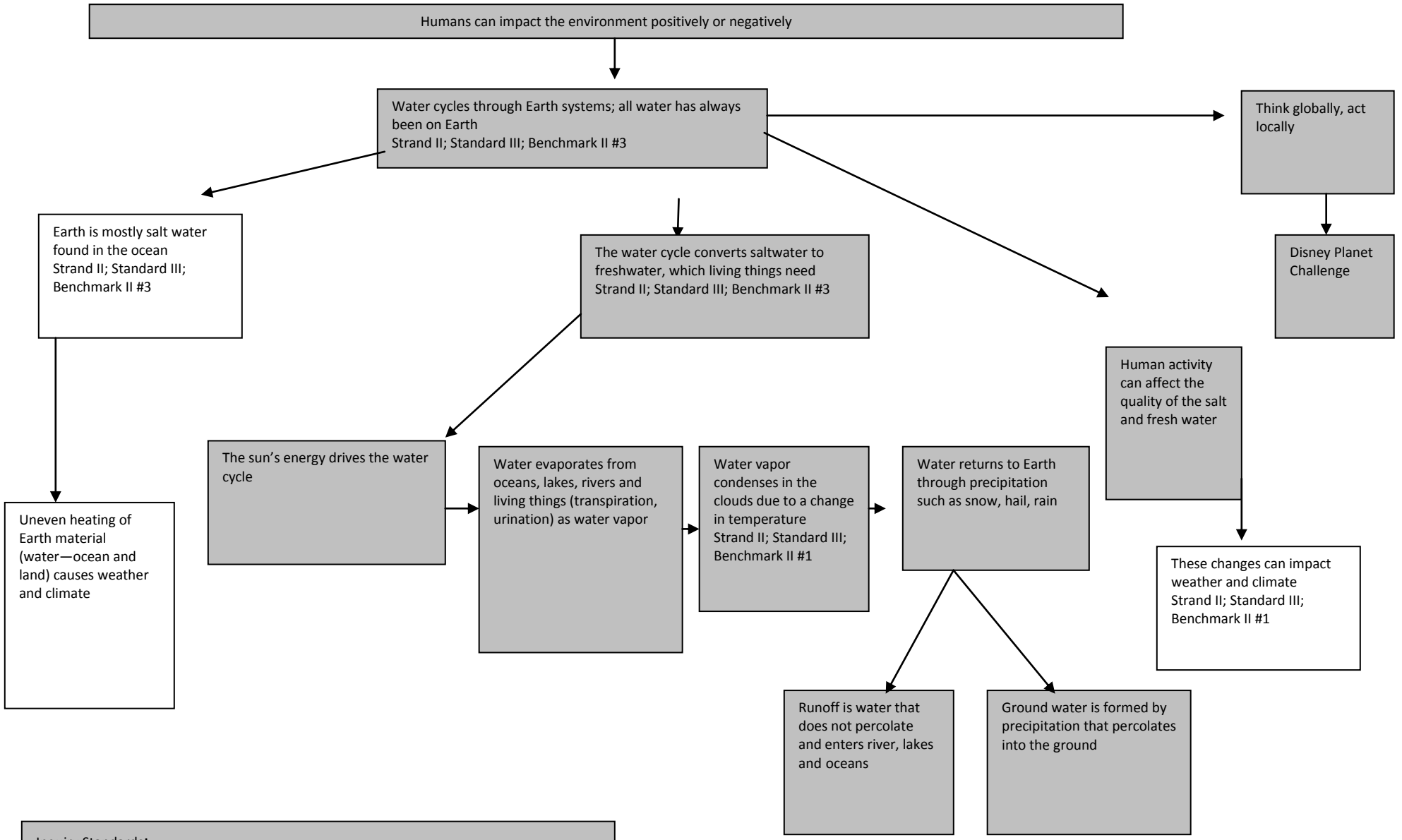
Ed was now ready to prepare for teaching and facilitating the students' thinking and selection of a topic for their project. He used Lesson 1 to help students brainstorm possible topics. The students selected the broad topic of the water cycle. PLEASE SEE Burrowing Owl portfolio page 2.

With the students' topic as a foundation, Ed identified the appropriate Science Content Standards for the topic. These standards include:

Strand II: Content of Science
Standard III (Earth and Space Science): Understand the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of Earth's systems
5-8 Benchmark II: Describe the structure of Earth and its atmosphere and explain how energy, matter, and forces shape Earth's systems.

1. Understand that water and air relate to Earth's processes, including:
    - How the water cycle relates to weather
    - How clouds are made of tiny droplets of water, like fog or steam.
2. Know that air is a substance that surrounds Earth (atmosphere), takes up space, and moves, and that temperature fluctuations and other factors produce wind currents.
3. Know that most of Earth's surface is covered by water, that most of that water is salt water in oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers.

He used these standards to develop a conceptual flow shown below. The grey-shaded boxes represent the science content embedded in the students' topic. The language arts, math, and science processes will be addressed throughout the project.



Inquiry Standards:
Strand 1; Standard 1
Benchmark I 1-4
Benchmark II 1-3
Benchmark III 1-3

Knowing what science concepts have to be reviewed or explored, Ed is ready for Lesson 2 (which may be many lessons, depending on the science concepts necessary to build student understanding). Understanding water pollution is addressed as an outcome of the entire Class Project. In the sample lessons that follow this vignette, Lesson 2 addresses "Water evaporates from oceans, lakes, rivers and living things (transpiration, urination) as water vapor" from Ed's conceptual flow.

Ed continues to facilitate his class as they use their language arts skills and understanding to research and refine their questions in Lesson 3. Ed's class found out that improper disposal of certain products can seep into the ground water and contaminate not only the local ground water but it can also have far-reaching effects. They refined their questions to include: What is the current state of our natural waterways? Is there any danger of it impacting the wildlife? Which plants are most impacted by water pollution? Which animals? Are there other factors impacting the health of this ecosystem?

In Lesson 4, Ed's class determines their project goals and action plan. PLEASE SEE Battery Recycling portfolio page 1. The class wants to inform the community of the impact of the pollution on the ecosystem and build awareness for stopping the pollution.

In Lesson 5 and 6 students combine their science process, math, and language skills as they investigate their selected project through research and experimentation. Ed's class used the library, Internet and local environmental agencies to determine the impact. Students worked with the local water agency to collect data on water quality. The students charted and graphed the data, comparing it with other data released by the agency. PLEASE SEE Battery Recycling portfolio page 15.

The class invited a naturalist to share their work in trying to restore the plants and animals in the wetlands. They even had a councilman explain how the city council was trying to clean up the local waterways. PLEASE SEE Our Starfish portfolio page 6.

In Lesson 7 and 8 the students synthesize their learning and think about ways in which to communicate what they have learned. Ed's class prepared their findings, backed with evidence from their research and experimentation, and made a portfolio to submit as their Disney Planet Challenge Class Project. They practiced their presentation, and shared their learning with other classes and at a PTA meeting. Ed made sure that they also sent a copy of their findings to the city council. And, lastly, they celebrated their hard work!

SAMPLE LESSONS

Use in conjunction with

the

Disney Planet Challenge Handbook

Lesson 1: Choosing the Project
Brainstorming Issues/Topics

Purpose: To brainstorm local environmental issues as possible topics to research for the Disney Planet Challenge Class Project.

Outcome: Students will select a topic to research for the Disney Planet Challenge Class Project.

Reference: Please see Burrowing Owl portfolio page 2.

Time: 40-60 minutes

Materials: Chart paper
Marking pens
Disney Planet Challenge Handbook:
Page 4, Teacher Page--Brainstorming Issues/Topics,
Page 5, Student Page--Carousel Brainstorming Issues/Topics

Standards: Language Arts Standards that help students clarify and support spoken ideas with evidence and examples.

Advanced Preparation:

1. Review the newspaper for articles that might suggest local environmental issues.
2. Contact one of the state and/or federal agencies about a project they might be conducting in your area.
3. Call local environmental agencies for ideas for local environmental issues.
4. Review Disney Planet Challenge website for ideas from previously completed projects.
5. Have students check with their parents regarding any local environmental issues.

Procedure:

1. Explain to students that the Disney Planet Challenge is an opportunity for 4th - 6th grade students from throughout the country to make a difference in their community by researching and developing a project based on a local environmental issue.

2. Have students think about their answer to the following prompt: "What do we mean by an environmental issue?" Have students share their response with a partner. Have partner groups share their responses with the entire class. Chart student responses. Facilitate a discussion to help students decide which environmental issues are local or global. Allow 10 minutes.

Teacher Note: Possible student responses may include: habitat destruction, soil contamination, invasive species, E-waste, reduce human impact, efficient energy use, over fishing, landfill, smog, water pollution, endangered species, recycling, toxins in the food chain.

3. Prior to the brainstorm of a specific issue/topic, "seed" the brainstorm by completing the following:
   - Have students do a think-pair-share of possible environmental problems in their community.
   - Ask students to do a quick-write on an environmental topic of their choice. Ask students to include a rationale for their choice.
   - Have students interview a parent, school official, and/or community members to get ideas.
   - Contact one of the state and/or federal agencies, provided on the Disney Planet Challenge Resource Center, about a project they may be conducting in the area.

4. Refer to the **Disney Planet Challenge Handbook**, **page 4, Teacher Page--Brainstorming Issues/Topics**. Jot notes on this page as you facilitate the brainstorm process with your students.

5. Divide the class into small working groups. Have students refer to the **Disney Planet Challenge Handbook, page 5, Student Page--Carousel Brainstorming Issues/Topics.** Have students use page 5 for their group carousel brainstorm. Ask students to think about possible local environmental issues. Have each student in the small group add their idea to page 5. After the first student has added his/her issue, he/she passes the paper to the next student to add another idea. Have students continue to pass the paper and record ideas until the groups have exhausted their ideas. Remind students that in a brainstorm all ideas are important.

6. Ask the small groups to review their list and star their top two choices. Ask groups to share their top two choices with the whole class. Tally student choices.

7. Have the class vote for their top choice from the list of topics.

Teacher Note: If the votes are close, choose the top 3 or 4 ideas and have students vote again.

8. Once a topic is chosen, have students discuss in table groups how the class might gather more information about the topic: Who can be called to come and give a talk? What local

agencies should be contacted? Who might be an expert in this area? What books might be helpful?

9. Make a class list of the suggestions.

10. For homework, direct students to share the topic with their parents and get suggestions from them regarding a possible project, information needed, and possible contacts. Add these suggestions to the class list.

Teacher Note: Retain the list of suggestions to use in Lesson 3.

Lesson 2: Background Science Lesson(s) Based on Learning Goals

Teacher Note: This is a sample lesson that a teacher might use to build science background for students before they get too far into the project. The actual lesson(s) will be dependent on the topic the students select, science standards the teacher has selected, and the amount of science background students will need to refine their project and questions in Lesson 3.

We provide one example of a background science lesson; however, it may be necessary to provide additional background science lessons to help students to fully understand the science learning to be gained through the Class Project.

This example is based on Ed West's vignette. Ed's students selected water pollution. Ed then selected science standards that addressed the importance of protecting water quality to support a healthy environment.

Purpose: To connect students' prior knowledge of the water cycle

Outcome: Students will gain a better understanding of where water moves by learning about the water cycle in order to comprehend the impact of water pollution.

Time: 1-2 class periods

Materials: 9 boxes, about 6 inches (15 cm) on a side to use for the die. Gift boxes used for coffee mugs are a good size or inquire at your local mailing outlet. There will be one die (or box) per station of the water cycle (to increase the pace of the game, use more boxes at each station, especially at the clouds and ocean stations).
The labels for the sides of the die are located in the Water Cycle Table (**R1**). These labels represent the options for pathways that water can follow. Explanations for the labels are provided.
One pipe cleaner for each student
50-60 colored beads in nine different colors

Resources: **R1:** Water cycle table

Keeley, P., Eberle, and L. Farrin. 2005. *Uncovering student ideas in science: 25 formative assessment probes. Vol. 1* Washington, DC: National Science Teachers Association.

The Watercourse, Council for Environmental Education. 1995. *Project WET Water Education for Teachers.*
Bozeman, MT: The Watercourse and Council for Environmental Education.

Standards: **Strand II: Content of Science**
Standard III (Earth and Space Science): Understand the structure of Earth, the solar system,

and the universe, the interconnections among them, and the processes and interactions of Earth's systems

5-8 Benchmark II: Describe the structure of Earth and its atmosphere and explain how energy, matter, and forces shape Earth's systems.

3. Understand that water and air relate to Earth's processes, including:
    - How the water cycle relates to weather
    - How clouds are made of tiny droplets of water, like fog or steam.
4. Know that air is a substance that surrounds Earth (atmosphere), takes up space, and moves, and that temperature fluctuations and other factors produce wind currents.
3. Know that most of Earth's surface is covered by water, that most of that water is salt water in oceans, and that fresh water is found in rivers, lakes, underground sources, and glaciers.

Advanced Preparation:

1. *Activity Adapted from Project WET "The Incredible Journey".* Set up nine stations in the classroom. Label the stations as follows: soil, clouds, animals, lake, groundwater, rivers, oceans, plants and glaciers.

2. Create nine die (one for each station) with the labels on each side (See **R1**-Water Cycle Table).

3. The day before you begin the lesson, use the formative assessment probe "Wet Jeans" from *Uncovering Student Ideas in Science: 25 Formative Assessment Probes* (Keeley, Eberle, and Farrin 2005):

   Sam washed his favorite pair of jeans. He hung the jeans on a clothesline outside. An hour later the jeans were dry. Circle the answer that best describes what happened to the water that was in the wet jeans *an hour later*.

   a. It soaked into the ground.
   b. It disappeared and no longer exists.
   c. It is in the air in an invisible form.
   d. It moved up to the clouds.
   e. It chemically changed into a new substance.
   f. It went up to the Sun.
   g. It broke down into atoms of hydrogen and oxygen.

   Describe your thinking. Provide an explanation for your answer.

   Review answers prior to lesson to uncover some of the misconceptions your students may have.

Procedure:

1. Have students think/pair/share the following questions: Where does the water go when it evaporates? Chart responses.

2. Tell students that they will be exploring where water goes by pretending to be a water molecule as it travels through the water cycle.

3. Have students create a data table with the following three columns: Place, State(s) of matter, Process.

4. Pass out a pipe cleaner to each student and tell students that they will be using the pipe cleaner to collect beads at each station they arrive at.

5. Break students into nine even numbered groups and assign them a starting station.

6. Explain that when they get to their station, they are to get in a line and roll the dice one at a time.

7. Tell students that once they have rolled the die, they write down the location displayed on the dice, the state of matter that the water is in at that station and the process (melting, evaporation, etc) the water is experiencing in order to move to that station. After recording the data, the students then move to that station. Inform the students that they will not end up staying together as a group. Each individual student will move to whichever station they rolled.

8. Tell students that when they get to their next station they are to grab a bead from that station and place it on their pipe cleaner, and then stand in line and wait for their turn. Once it is their turn, they are to roll the dice again, copy down the information on the die and then proceed to the station indicated on the dice.

9. Tell students that they will repeat this process until they are instructed to stop.

10. Have students go to stations and begin the activity. Give the students 10 minutes to move from station to station.

Instructor note: By no means should a student be given enough time to move to all of the stations. It is important for students to realize that there are certain places were water can spend a lot of time in one form. For example, it is not unusual for students to remain at the ocean or glacier station for four or five rolls.

11. When the time is up, have students return to their desk to calculate the quantity of beads they gathered for each station.

12. Ask students to create a diagram representing the water movement from station to station by drawing the station, the state of water at that station and the process by which the water arrived at that station.

13. Ask students to go to their original groups to share their diagrams with the others in their group.

14. Distribute a copy of the hydrologic cycle to each group and ask the students to compare the similarities and differences of their diagram with the copy.

15. Ask students to use their experience in the game to discuss whether or not the two-dimensional diagram (the hydrologic cycle) is an accurate representation of the movement of water in the system.

16. Have students return to their seat and conduct a class discussion about how water changes as it moves from place to place. Why might water stay in some areas longer than others? Does water move in a predicable cycle? How do you know?

17. Ask: How do these ideas relate to their topic for the Class project (water pollution)? Chart student ideas. Save the chart to begin Lesson 3.

Teacher Note:
Ed West also did a science Lesson on pollutants to show how little is needed to contaminate the water. He now felt that students had science background on which he could build to help them narrow their topic and refine their questions in Lesson 3.

Water Cycle Table

Station	Die Side Labels	Water Process
Soil	One side *plant*	Water is absorbed by plant roots.
	One side *river*	The soil is saturated, so water runs off into a river.
	One side *ground water*	Water is pulled by gravity; it filters into the soil.
	One side *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	One side *stay*	Water remains on the surface (perhaps in a puddle, or adhering to a soil particle).
Plant	Four sides *clouds*	Water leaves the plant through the process of transpiration.
	Two sides *stay*	Water is used by the plant and stays in the cells.
River	One side *lake*	Water flows into a lake.
	One side *ground water*	Water is pulled by gravity; it filters into the soil.
	One side *ocean*	Water flows into the ocean.
	One side *animal*	An animal drinks water.
	One side *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	One side *stay*	Water remains in the current of the river.
Clouds	One side *soil*	Water condenses and falls on soil.
	One side *glacier*	Water condenses and falls as snow onto a glacier
	One side *lake*	Water condenses and falls into a lake.
	Two sides *ocean*	Water condenses and falls into the ocean.
	One side *stay*	Water remains as a water droplet clinging to a dust particle
Ocean	Two sides *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	Four sides *stay*	Water remains in the ocean.
Lake	One side *ground water*	Water is pulled by gravity; it filters into the soil.
	One side *animal*	An animal drinks the water.
	One side *river*	Water flows into a river.
	One side *clouds*	Heat energy is added to the water, so the water evaporates and goes to the clouds.
	Two sides *stay*	Water remains within the lake or estuary.
Animal	Two sides *soil*	Water is excreted through feces and urine.
	Three sides *clouds*	Water is respired or evaporated from the body.
	One side *stay*	Water is incorporated into the body.
Ground Water	One side *river*	Water filters into a river.
	Two sides *lake*	Water filters into a lake.
	Three sides *stay*	Water stays underground.
Glacier	One side *ground water*	Ice melts and water filters into the ground.
	One side *clouds*	Ice evaporates and water goes to the clouds (sublimation).
	One side *river*	Ice melts and water flows into a river.
	Three sides *stay*	Ice stays frozen in the glacier.

Lesson 3: Select Project
Refine Investigation Questions

Purpose: To select and refine investigation questions to help determine the final project goals.

Outcome: Students will narrow the class project topic and will determine investigable questions appropriate for their grade and time for the project.

Reference: Please see Burrowing Owl portfolio page 4.

Time: Varies and is dependent on how much preliminary research students have to do to narrow the project focus and refine the questions. Suggested time frame: 2-5 class periods.

Materials: Sentence strips
Marking pens
Disney Planet Challenge Handbook:
Page 6, Teacher Page--Selecting Questions to Investigate, Choosing the Project
Page 7, Student Page--Selecting Questions for Our Project

Standards: *English Language Arts*
(Speaking and Listening)
Clarify and support spoken ideas with evidence and examples.
(Reading Comprehension)
Discern main ideas and concepts presented in texts; identify and assess evidence that supports those ideas. Draw inferences, conclusions, or generalizations about text and support them with textual evidence and prior knowledge.
(Writing Strategies)
Establish a topic, important ideas, or events in chronological order. Provide details and transitional expressions that link one paragraph to another in a clear line of thought. Offer a concluding paragraph that summarizes important ideas and details.
Science, Mathematics and History Social Science
Depends on the content of the research

Advanced Preparation:
1. Gather the list of possible topics and people to contact from Lesson 1 that was generated in class.
2. Make a large K-W-L chart.

Procedure:

1. Explain to students that they will narrow their topic and generate possible questions they want to investigate. Explain that the goal for the project should represent something the class can do that will have a lasting impact on the school/community, should be something the class can participate in over a period of time, and should address an important environmental issue or concern in the school/community.

2. Re-introduce the chart from Lesson 1 that contained possible ideas to investigate and people to contact. Ask students to review their ideas, think about what they learned in Lesson 2 about the science in their topic, and identify 4-6 ideas that they think will help them narrow the topic and help them develop questions to investigate.

Teacher Note: Guide the selection by facilitating the conversation so that the students' ideas for preliminary research/gathering of information are doable and reasonable.

3. Structure a limited time and effort for the students to learn more about the topic (for example, see the Burrowing Owl Portfolio Link above).

4. Use a K-W-L Chart and ask students to complete the "W" section of the chart by having students respond to the following prompt: "What do we already know now about this topic?" Record student responses in the "W" section of the K-W-L chart.

5. Refer to the **Disney Planet Challenge Handbook, page 6, Teacher Page Choosing the Project, Selecting Questions to Investigate.** Use page 4 to jot notes as students choose their project and questions.

*Teacher Note: A K-W-L chart displays information students already **K**now about a topic; what they **W**ant to Know; and what they **L**earned throughout the lesson or unit of study. The K-W-L chart will be referenced in Lesson 7 when students summarize their learning and record it in the "L" column.*

6. Distribute the **Disney Planet Challenge Handbook**, **page 7, Student Page, Selecting Questions for Our Project**. Have groups of students generate questions they want to explore. Prompt students to record their questions on the top of page 7.

7. Use the following process to help students select questions to investigate.

    - Distribute two sentence strips and a marker to each group. Ask the groups to transfer their two best questions to two sentence strips (one question per strip).

- Have each group share their two sentence strips. Post the strips so that the class can see them. Facilitate a discussion to clump questions that are alike, and then ask the class to select the final questions to use for the investigation.

Teacher Note: The project should consist of several questions that the class wants to answer about the topic. Help students choose questions that provide an opportunity for them to "go deep" in their understanding of the topic. If appropriate, include questions that can be explored through a scientific experiment. (See Lesson 6).

8. Ask students to write the final questions on the bottom of student page 7. Record the questions under the "W" part of the K-W-L chart.

Teacher Note:

See an example of narrowing questions in the Burrowing Owls Portfolio. PLEASE SEE Burrowing Owl portfolio page 4.
From their initial research, the students came up with the following questions:
•How can we protect the burrowing owls and other raptors in the Sacramento watershed area?
•How can we build a burrowing owl habitat?
•What does the government data say about the burrowing owl population?
•How has the population of Elk Grove changed over the years?
•Has human population change hurt the owls?
•What else can we do to save the burrowing owl?
•Do any other raptors need our help?

It is important to keep the project focused. A successful project focuses on one purpose and the students put their energy and time into attaining that purpose. The students focused their questions on the following:

•What does the government data say about the burrowing owl population?
•Has development in Elk Grove hurt the burrowing owl?
•What can we do to protect the burrowing owls?
•How can we increase the burrowing owl population in the Sacramento watershed area?
•How can artificial habitats be built that will attract the burrowing owls and help them reproduce?

From these questions, the students were able to define the goal of their project and set up an action plan.

Lesson 4: Determine Project Goals and Action Plan

Purpose: To determine the goals for the Disney Planet Challenge Class Project and develop an Action Plan for the selected topic.

Outcome:
1. Students will determine the goal for the project, the evidence they will use to know if the goal was met, and explain how meeting the goal can make a difference in their school or community.
2. Students will develop an action plan and timeline to meet the goals of the project.

Reference: Please see Our Starfish portfolio page 4.

Time:

Part I:	Goals of the Project	35 minutes
Part II:	Action Plan	45 minutes

Complete all at once or on two different class periods.

Materials:
Chart Paper
Markers
Disney Planet Challenge Handbook:
Page 8, Teacher Page--Determining a Goal,
Page 9, Student Page--Determining Our Goal
Page 10, Teacher Page--Planning the Project
Page 11, Student Page--Planning the Project
Page 12, Student Page--Planning the Project
Page 13, Student Page--Planning the Project (Personal, Group or Class Timeline)

Standards: Review standards for English-language arts, science, social studies and mathematics to align with actions for this part of the project. See Foreword for suggestions**.**

Advanced Preparation:
1. Consider the local, state, or federal resources that are related to this project and be ready to share information with students.
2. Have the K-W-L chart from Lesson 3 available for review.

Procedure

Part I: Goals of the Project 35 minutes

1. Explain to students that they will now determine a clear goal for the project.

2. Remind students that the goal for the project should represent something the class can do that will have a lasting impact on the school/community, should be something the class can participate in over a period of time, and should address an important environmental issue or concern in the school/community.

3. Review the top choice the class selected for the project and the selected questions generated in Lesson 3.

4. Refer to the **Disney Planet Challenge Handbook, page 8, Teacher Page--Determining a Goal**. Ask students what they would like to accomplish in the project. Why is this project important? What evidence will students use to analyze the impact of the project? How will this goal impact the students, school, parents and/or community? What are the benefits of this project? Jot notes on this page as you facilitate a discussion with your students.

Teacher Note: *Keep the goal realistic, meaningful, and relevant to the project. An example of a goal is, "Our environmental goal is to create a wetlands education program that would be used to teach other kids about wetlands and their importance in our community." The project needs a specific focus and long term impact. The project should be more than a one- time event. Involve others in the project. Make sure the project is doable in a reasonable amount of time.*

5. Refer students to the **Disney Planet Challenge Handbook, page 9, Student Page--Determining Our Goals.** Ask students if there are additional support goals that are part of their big goal. (*e.g. train 5th graders to be docents to lead student tours of the wetlands and conduct science investigations with students on the tours).* Ask students to also record these goals on page 9.

6. Ask students to consider what it would "look like" if their goals were accomplished. Allow students to share with their partner or table group what they envision. What evidence will they use to analyze the impact of the project?

7. Ask students to record their "evidence" ideas on page 9 by completing the prompt: "The evidence we will use to know that we met our goal is…"

Teacher Note: Make sure the project is doable in a reasonable amount of time. Evidence should relate to concrete actions so that students will be able to measure completion. For example: "The evidence we will use to know that we met our goal: 1) the production of an information booklet; 2) trained 5th grade tour leaders; and, 3) tours offered to school and community members.

PLEASE SEE Burrowing Owl portfolio page 5.

8. Discuss with students how this goal will make a difference and will last over time and have long-term impact. Ask students to record these ideas on page 9.

Teacher Note: Consider how the class might involve others in the project (speakers, local or regional organizations and resources, other classes and teachers, etc.).

Part II: Action Plan 45 minutes

Teacher Note: The Action Plan should be a set of concrete activities students will do to accomplish goals. Use the Disney Planet Challenge, teacher page 10 and student pages 11, 12, and 13 to guide students to develop a concrete plan.

9. Refer to the **Disney Planet Challenge Handbook, page 10, Teacher Page--Planning the Project**. Review the goals and evidence to analyze impact of the project with students. Explain that students will now determine the action plan.

10. Distribute **Disney Planet Challenge Handbook, page 11, Student Page--Planning the Project.** Discuss with students the various actions that need to be done in order to accomplish their goals. Ask students to consider things to do, resources to use, equipment needed, people to contact, etc., and list them on page 11.

11. Brainstorm a list of actions and activities students will do for each of the goals. Brainstorm all the possible things that could be done and prioritize and "clump" items that go together.

12. Distribute **Disney Planet Challenge Handbook, page 12, Student Page--Planning the Project.** Ask students to complete page 12 to help them plan the activities for the project. Organize their Action Plan into the following categories: Activity, Person Responsible, Materials Needed, Due Date.

13. Distribute **Disney Planet Challenge Handbook, page 13, Student Page--Planning the Project (Personal, Group or Class Timeline).** Have students use the monthly calendar to develop a timeline of when activities will be conducted and completed. Use multiple copies of student page 13.

Teacher Note: Consider forming student Action Committees such as publicity, funding, research, historian, materials, etc., to divide the work.

Decide when in the course of the Class Project students should stop and reflect on their progress. Have students do quick writes throughout to help them with their final reflection. Record reflections in student journal or as a class on chart paper.

Activities to Complete the Project (Example)

Activity	Persons Responsible	Materials Needed	Due Date
Research facts about the wetlands and write fact sheets. Read, watch videos, listen to speakers.	Teacher will help collect materials. Contact expert for additional information. All students will write fact sheets.	Books, brochures, videos on wetlands. Internet information on wetlands.	October 30, 2009
Make a personal wetlands vocabulary picture dictionary. Look for word meaning and pictures on the Internet.	All students Teacher will review for accuracy.	List of vocabulary	October 30, 2009
Take a tour of the wetlands with a local people that have background in wetlands and review their materials. Invite them to partner with our class on project.	Students will contact speaker and with the help of the teacher, set up field trip and bus.	None	Fall 2009
Conduct science investigations: 1. Properties of water 2. Test water samples from different parts of the wetlands.	Teacher gathers materials and teaches lessons. All students will do investigations	Wax paper, eye droppers, cups with water, straws, etc.	Fall 2009
Create program to teach other students about the wetlands, (e.g., go over fact sheets, show videos about wetlands, do science investigations with students, and have them take a test to see if they know important information.) Take students on a tour so they can see what a tour is about before becoming docents.	Teacher Make committees with class: Science Committee Tour Committee Presentation Committee	Materials created from above activities.	December 2009-January 2010
Have the students take other classes on tours. Conduct at least 10 tours.	Student committees	Wetland program materials	February 2010
Revise materials that we created for the program and publish for future classes.	Teacher and students	Wetland program materials Computers	March 2010

Lesson 5: Investigate the Project--Research

Purpose: To conduct additional research on the selected topic for the Disney Planet Challenge project. Research is used to gather information from any reliable source (e.g., books, Internet, newspapers/magazines, field trips, interviews, local, state, and federal agencies). Research is also used to implement the action plan.

Outcome: Students will read, research, and record information related to the project; they will implement the action plan.

Reference: Please see Recycling Batteries portfolio page 3.

Time: This portion of the project will take place over time and during multiple class periods.

Materials: Books, newspapers, magazines, Internet resources, local speakers, and materials from organizations related to topic.
Disney Planet Challenge Handbook:
Page 14, Teacher Page--Implementing the Project
Page 15, Student Page--Implementing the Project, Activity Record Log
Page 16, Student Page--Implementing the Project, Pre-project Observations
Page 17, Student Page--Implementing the Project, Information You Want to Remember

Standards: Review standards for English-language arts, science, social studies and mathematics to align with actions for this part of the project. See Foreword for suggestions.

Advanced Preparation:

1. Collect materials from local, state, or federal resources that are related to this project and have available for students.

2. Review Teacher Resource and decide if any of the strategies are appropriate for students.

Procedure

1. Refer to the **Disney Planet Challenge Handbook, page 14, Teacher Page--Implementing the Project.** Review with students the Goals and Action Plan for the project. Explain to the students that they will now begin their action plan. What are the activities noted on the Action Plan? Are there multiple things that need to be done during the same period to

complete activities? What additional information do they need to find out? Use page 14 to guide the implementation of the class project.

2. Distribute **Disney Planet Challenge Handbook, page 15, Student Page--Implementing the Project, Activity Record Log.** Remind students to record the activities as they do them and complete the chart. Have students enter their projected outcomes. As students complete activities have students enter the actual outcomes.

Teacher Note: Rather than having every student complete student page 15, consider having different groups monitor different activities, or completing a large class chart of the activities.

3. Distribute **Disney Planet Challenge Handbook, page 16, Student Page--Implementing the Project, Pre-Project Observations.** Explain that students will be spending several class periods conducting additional research on their project and implementing their action plan. Have students conduct a pre-project observation to collect base-line data. Encourage students to sketch/write about the issue before it is addressed in the project.

Teacher Note: See Lesson 6 for ideas about making quality observations.

4. Begin the action plan by displaying the collected resources for the students. Review what is available for students to read or view. Decide the best way to divide the information for students to research. Distribute **Disney Planet Challenge Handbook, page 17--Student Page, Implementing the Project, Information You Want to Remember.** Encourage students to record the information they are learning.

Teacher's Note: If necessary, use strategies from Teacher Resource to help students make sense of the content readings.

5. If the class has not already decided on work groups, facilitate a discussion to group students into appropriate work groups. For example, in the wetland project, some students might be grouped as tour leaders; some may work on a publicity committee; some might work on the letter writing campaigns. PLEASE SEE Our Starfish portfolio page 12.

6. Continue to have students use the **Disney Planet Challenge Handbook, page 15--Student Page, Implementing the Project, Activity Record Log.** Periodically provide time for students or groups to share information with the class. Display information for others to see and to have available during the course of implementing the project.

Teacher Note: If the project lends itself to scientific experimentation, incorporate Lesson 6 as part of the project's activities.

Teacher Resource
Strategies to Help Students Make Sense of Content Readings

1. Before reading, select 10 –15 words that students will need to know before reading. Give each student a piece of paper and ask him/her to fold it into fourths. Review each word with students and ask them to record the following information in each box:
   a. Write the word and any appropriate prefix or root word definitions.
   b. Define the word in as many ways as possible.
   c. Illustrate what the word means and/or draw an example of how the word is used in context.
   d. Write a number 1-4 (4 is the highest) to rate student understanding of the word.
   e. Review student papers and provide further instruction on vocabulary for students before reading.
   f. Create a word wall with appropriate vocabulary.

2. Introduce the concept to students, writing the word on the chalkboard. Ask students to generate a list of other words or phrases that come to mind when they think of the target word. The words may come from the Word Wall.
   a. Lead a class discussion on students' responses.
   b. Write a list of words from their responses that fit appropriately with the target word on the chalkboard.
   c. Direct students to find a definition of the word in the textbook, glossary, or dictionary.
   d. Read the definition of the target word and direct students to compare their generated list of words with the definition.
   e. Direct students to look over the words on the board very carefully and with the definition in mind to decide on at least three words from the list that will help them remember the target word.
   f. Tell students to write their selected words in the concept wheel (a circle with four sections) to help them remember the concept
   g. Ask students to write a sentence using the words in the concept wheel.
   h. Give students 4x6 sticky-notes. As students read, ask them to record ideas they are learning from their readings. Each Post-It should contain one idea. After reading ask students to share their sticky-notes. Clump or group ideas that go together and order the sticky-notes into a sequence that best describes the content they read. Ask students to re-write the information into paragraphs that go together.

3. Ask students to use the following frames to record what they are thinking and learning as they read.

   "I know something about this from _____ ."
   "Two questions I have about this section are ___ ."
   "I'm not sure what this is about, but I think it may mean ____ ."
   "These pictures help me understand because ___ ."

"The big idea here is ___ ."
"I'm confused about ___ ."
"Now I understand ___ ."
"I learned ____ ."

4. Ask students to fold a paper into fourths and give these headings to the sections: Predict, Clarify, Summarize, Questions

   a. Explain to students that as they read, they are to record related ideas in each box (written or illustrations).

   b. Predict--What do they predict the section will be about? How do they think this information will help them understand more about the topic?
   "I predict that ___ because ___ ."
   "This is like ____ ."
   "This is going to be about ___ ."

   c. Clarify--What information did they read about that helped clarify what they didn't quite understand?
   "I'll reread this because ___ ."
   "This is the same as ___ ."
   "This is different because ___ ."
   "I'd like to talk to someone about ___ ."
   "I thought I knew this, but now I understand ____ ."

   d. Summarize--After reading a "chunk" of material, what are the key ideas in that section?
   "I learned that ___ ."
   "I can picture ___ ."
   "What I understand about this reading so far is ___ ."

   e. Questions--What questions do students still have about the topic?
   "A question I have about this is ___ ."
   "I wonder if ___ ."
   "Two questions I have about this section are ___ ."

5. As students read, ask them to create a visual map with words and pictures of what they are learning. Connect ideas that go together. Share maps with other students and add to maps with new information learned from others.

6. Explain to students that as they read a selection they are to think about words, phrases, or sentences that "jump out" at them and help them make meaning or understand the text.

a. Provide each student with a highlighter pen and ask him/her to highlight the parts that were significant in helping him/her learn more about the topic.
b. Ask students to share their ‘golden lines” and explain how the golden lines helped them understand.
c. Summarize the text using the golden lines.

Lesson 6:
Investigate the Project: Conduct an Experiment

Teacher Note: *Remember that the Disney Planet Challenge Project includes an action project appropriate to the content of the goal. One of the activities related to the project may include an experiment with variables and controls. If the Class Project has a question(s) that can be answered by an experiment, use this lesson to build students' experimental design skills.*

Purpose: To provide a series of activities to help students understand each stage of the experimental design process.

Outcome: Students will be able to conduct an experiment related to their Disney Planet Challenge Class Project.

Reference: Please see Recycling Batteries portfolio page 4.

Time: This lesson will be taught over several days.

Teacher Note: The activities in this lesson will guide your students in doing their experiment. Only the observation piece is "generic" as written; the rest should be tied directly to your project. If you wish, you can preview the observation piece and apply those skills directly to the project. The amount of time needed to plan, conduct, and summarize the experiment will depend on the complexity of the experiment(s).

Part I:	Observations (if done as a generic lesson)	45 minutes
Part II:	Developing a Testable Question	
Part III:	The Experimental Design	
Part IV	Data Collection	
Part V:	Graphing Results	
Part VI:	Making Summary Statements	
Part VII:	Drawing Conclusions	

Materials:
Chart paper
Markers
Objects to observe (e.g., leaves, pictures, rocks)
Hand lenses
Measuring tools (e.g., ruler, graduated cylinder, thermometer)
Other science materials related to the project
Disney Planet Challenge Handbook:
Page 18, Teacher Page--Implementing the Project, Conducting the Experiments
Page 19, Student Page--Conducting Experiments
Page 20, Student Page--Conducting Experiments

Sentence Strips

Standards:
Strand I: Scientific Thinking and Practice
Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting and validating to think critically.

K-4 Benchmark I: Use scientific methods to observe, collect, record, analyze, predict, interpret, and determine reasonableness of data.

1. Use instruments to perform investigations (e.g., timers, balances) and communicate findings.
2. Observation from interpretation and understand that a scientific explanation come in part from what is observed and in part from how observation is interpreted.
3. Conduct multiple trials to test a prediction, draw logical conclusions, and construct and interpret graphs from measurements.
4. Collect data in an investigation using multiple techniques, including control groups, and analyze those data to determine what other investigations could be conducted to validate findings.

Benchmark II: Use scientific thinking and knowledge and communicate findings.

1. Communicate ideas and present findings about scientific investigations that are open to critique from others.
2. Describe how scientific investigations may differ from one another (e.g., observations of nature, measurements of things changing over time).
3. Understand how data are used to explain how simple system functions (e.g., a thermometer to measure heat loss as water cools).

Benchmark III: Use mathematical skills and vocabulary to analyze data, understand patterns and relationships, and communicate findings.

1. Multiple trial using simple mathematical techniques to make and test predictions.
2. Use mathematical equations to formulate and justify predictions based on cause-and-effect relationships.
3. Identify simple mathematical relationships in a scientific investigation (e.g., the relationship of the density of materials that will or will not float in water to the density of water).

Advanced
Preparation: Collect all hands-on materials related to investigation.

Procedure

Part I: Observations (45 minutes)

1. Explain to students that they will participate in a series of activities to experience the experimental design process, or "work like a scientist." These activities will help them with collecting additional information related to their project.

2. Ask students to tell you what they think a scientist does. Chart responses. Responses will probably include ideas such as do research, conduct experiments, work with chemicals, etc. Explain to students that scientists often try to answer a question with an experiment.

3. Explain that scientists often begin their understanding of a topic by making observations and that as good "student scientists," students need to develop their skills of observation.

4. Distribute an assortment of objects for observations (e.g., leaves, rocks, or shells) and hand lenses to students. Make available measuring tools for students to use as they observe their object. Ask students to work with a partner and make as many observations as they can about their object and record what they observed.

Teacher Note: If possible, ask students to make observations on something related to the project, e.g., water that was collected from a local river they are considering for protection. Otherwise, this activity will teach students how to make scientific observations for future use in their Disney Planet Challenge project.

5. Ask students to share their observations and chart their responses. Clump responses into these groups, without labeling why they were clumped: those observations made with sight (color, shape, etc.), those made with other senses (texture, smell, taste--if appropriate-- sound), those that include a quantitative descriptor (words related to size, measurement, mass, quantity, etc.) and those that contain inferences. (e.g., it was eroded).

6. Ask students to discuss why the clumping was done as it was. Elicit from the students the "labels" for the clumps. Explain to students that a quality scientific observation is:

    - qualitative (i.e., the qualities or characteristics of what's being observed, made through any of the five senses--touch, sight, hear, taste, smell);
    - quantitative (i.e., use of tools to measure, rulers, scales, thermometer); and,
    - does not include inferences, opinions, or explanations.

7. Explain to students that observational writing, when precise and accurate, helps scientists describe the world around them and build on the work of others. Accurate observational writing represents the observations in the most direct way possible using words and phrases that are not subject to interpretation or explanation.

Teacher Note: If the above activity was conducted out of context of the project, before going on to the next step, students should make observations related to the project and the remainder of the investigation should focus on the content of the project. Have students use the Disney Planet Challenge Handbook, Student page 16, to record their observations. If they

already recorded their observations in Lesson 5, ask the students to review what they wrote/drew and determine if it needs revision based on their new understanding of what makes a quality observation.

Part II: Developing a Testable Question

8. Display the class project questions. Ask the class to discuss which could be answered by conducting an experiment. Choose those that are testable and indicate a cause-and-effect relationship. For example, "How does the amount of contaminants in the water affect how quickly it absorbs into the ground?"

9. Explain to students they will use these questions as the basis of their scientific experiment(s). The first thing that they need to do is to narrow the focus of their question by identifying factors that can be changed (variables).

10. Based on the observations (see note below), ask students to brainstorm things they could change or vary in an experiment (e.g. type of chemicals in water, amount). Record ideas on a class chart.

Teacher Note: If students made observations about their project, they can review these observations to determine ideas for step 10 and 11. If they have NOT made observations of their project, they need to do so before they can refine the question(s) for the experiment(s).

11. Based on the observations (see note above), ask students to brainstorm things they could measure or observe in an experiment (e.g., students measure the dissolved oxygen in the water, measure temperature of the water at different intervals). Record ideas on a class chart.

12. As a class, choose one thing from the list of things to change and one thing from the list to measure. The other ideas could be used for additional experiments if time permits.

13. Ask students to now develop a testable question by completing this prompt: "How will changing (insert what students want to change—e.g., the size of the habitat) affect (insert what they want to measure—e.g., the amount of animal species)?"

14. Distribute the **Disney Planet Challenge Handbook, Student Page 19--Conducting the Experiment.** Have students record their testable question on page 19.

Teacher Note: If there are several questions with which students will experiment, use additional pages 19 and 20 for each question.

15. Help students develop a hypothesis (a cause-and-effect relationship) by changing their testable question into an "if/then" statement. For example: If the contaminants inserted into the water increase, then the time it takes to absorb into the ground will increase.

Teacher Note: A guess is not the same a prediction or a hypothesis. A guess does not have a basis in prior experience. A prediction is based on prior experiences and repeated observations. A hypothesis is a specific prediction expressed as an "if/then" statement. A hypothesis indicates the variable to be tested.

Part III: The Experimental Design

16. Explain to students that they will design a plan to test the hypothesis. Note that the various steps for the plan include materials, steps for the experiment, what will be measured, and how data is collected and recorded.

Teacher Note: In a fair test, only one variable is tested at a time. All other factors are held constant or controlled. In this example, the location of water testing is kept constant.

The variable that is changed is called the manipulated variable (or the independent variable); the effect that is measured is called the responding variable (or the dependent variable). In this example, the size of the habitat is the manipulated variable and the number of animal species is the responding variable.

17. In small groups ask students to decide on a procedure for the experiment: What sequential steps do they need to do? What will they control? What will they test? How will they measure the results?

Teacher Note: If students are having difficulty writing a plan for the experiment provide additional opportunities to write sequential procedures, e.g., steps to making a peanut butter and jelly sandwich, or directions to the lunch room, etc.

18. Have groups share their ideas and decide on a sequential plan that they will follow for the experiment. Chart the steps.

19. Ask students to discuss what materials they will need for the experiment. Make a class list.

Part IV Data Collection

Teacher Note: At this point, students should be conducting the experiment and collecting real data. A recommendation is to help students understand the use of a T-chart for recording data before they begin to collect the data.

20. Explain to students that organizing data is an important science thinking skill. There are many ways to organize. A particularly helpful method for charting information from a scientific experiment is called the T-chart. Explain that in a T-chart (which looks like the letter "T"), is titled with the effect of the manipulated variable on the responding variable (e.g. The Effect of Contaminants on Ground Water Seepage.). The data is written so that the manipulated variable data is recorded in the left-hand column and the responding variable data is written in the right-hand column.

Teacher Note: Eventually students should be able to develop their format for recording data. The T-chart is a good basic way to help them think about organizing their data.

21. Ask students to consider if they need to do several trials and calculate an average for their data. In this case their T-chart might look like this:

The Effect of Contaminants on Ground Water Seepage

Amount of Sodium Bicarbonate (g)	Time it takes to travel through water

22. Ask students to record their data on Student Page 19 or to create a data chart of their own. If students are working in groups have them also record their data on a whiteboard to share with the class.

23. Display the charts or white boards and ask students to share their data. Compare and contrast the data collected. Ask students to discuss similarities and differences in the data; reasons and possible variables that might have caused differences in the data. PLEASE SEE Recycling Batteries portfolio page 5, and Burrowing Owls portfolio page 8.

Part IV: Graphing Results

24. Explain to students that data from the T-chart (or other data collection method) can be easily graphed. Tell students that graphing is a type of communication that shows the relationships between two variables in the experiment.

Teacher Note: Three major types of graphs are commonly used to indicate relationships:

Bar graphs are used to show the relationships between a discontinuous variable and a continuous variable. A discontinuous variable is one for which there is not intermediate values. A continuous variable has intermediate values. For example, if you were to graph the annual rainfall in several cities, the cities are discontinuous, while the annual time frame is continuous. Pictographs, using pictures to show the relationships, are types of bar graphs. Histograms, which show the frequency of how often something occurs, are also a type of bar graph.

Circle graphs are also called pie graphs. These types of graphs compare parts to the whole and thus are good for representing percentages. Like bar graphs, circle graphs also compare discontinuous variables and continuous variables. Circle graphs are based on a fraction of a circle. Assign each set of data a fraction and multiply by 360 degrees. This provides the total degrees for each data sector. The circle can be drawn with a compass and a protractor can be used to measure the angle for the sector line. If you have a computer program for pie charts, use it!

Line graphs, also called coordinate and plot graphs, show the relationship between two continuous variables. An example is a graph that shows the relationship between the height of a person and his/her age. For line graphs, the data points should be connected by a line. Sometimes this results in a line that is straight. Other times, the resultant line is curved. Sometimes the data points are such that one cannot draw a smooth line to connect all of the points. In this case, help students to learn to draw the "best fit" line.

25. Distribute the **Disney Planet Challenge Handbook, Student Page 20,** graph paper, graph chart paper or white boards to students. Explain to students that they will use the data collected in Part IV, choose an appropriate graph to display the data, and make the graph.

26. Use the following graphing rules to assist students with the appropriate way to graph data. *If necessary make the graph together as a whole class, modeling each step.*

a. The manipulated variable or independent variable is on the x axis with the numbers increasing from left to right.
b. The responding variable or dependent variable is on the y axis with the numbers increasing from bottom to top.
c. The graph is labeled with a descriptive name, which indicates the relationship of the variables.
d. Each axis is labeled with the name of the variable.
e. Units of measure are labeled on the axis and the intervals along each axis should be evenly spaced.
f. The scale for the two axes does not have to be the same—and the scale should be selected for clarity.
g. Numbers on the axis are positioned on the grid line.

27. Ask students to share why they chose a particular graph (e.g., we used a line graph because it showed change over time) and to share what the graph describes about the relationship

between the variables (e.g., as the amount of used motor oil decreases, the quality of water increases).

28. Post the graphs. Compare graphs if students have different representations or if groups have done different experiments. PLEASE SEE Burrowing Owl portfolio page 9.

Part VI Summary Statements

Teacher Note: Writing summary statements is often a step left out of the experimental design process. Typically, students write a summary statement as if it were their conclusion, or do not adequately observe the relationships evident in the data before writing a conclusion.

Modeled writing is a "think aloud" demonstration of the writing process. The teacher demonstrates how a person goes about the process of writing through verbalization and a description of his/her process.

29. On chart paper, use a "think aloud" to model how students might write a summary statement. The summary statements should describe only what is evidenced by the graph, summarize the data without inferences or conclusions, and should provide results related to the hypothesis. A summary statement describes the relationship between variables on a graph. It should tell what happens to the responding variable as the manipulated variable changes.

30. Ask students to look at their graph and write several summary statements on their chart paper (or white board) and on Student Page 20.

Part VII: Drawing Conclusions

Teacher Note: The conclusion is a synthesis of the summary statements and is based on evidence and a logical argument. It should wrap up the cause-and-effect relationship, as well as discuss any unresolved questions or error analysis of the data. The conclusion should answer the original questions, or explain why it cannot be answered at this time.

Because the experiment(s) are PART of the project, consider having students develop draft conclusions that will be supported (or refuted) by other data that they collect from their research or other activities.

If groups did different experiments (for example, different variables that might affect the quality of the water), the conclusion should be a synthesis of the various experiments.

31. Explain to students that they are ready to draw preliminary conclusions based on the patterns and relationships found in the data from the summary statements.

32. Ask students to review their summary statements and write a preliminary conclusion on sentence strips. The conclusion should relate to their question.

Teacher Note: Determine if several experiments need to be synthesized for a more accurate conclusion. If so, have students link their preliminary conclusions into a coherent conclusion for the total findings.

33. Ask students to share their conclusion sentence strips. Ask them to think about the next question they might ask.

34. Have students add their findings to the K-W-L chart AND the Activity Log.

Teacher Note: Save the Conclusion Sentence Strips for Lesson 7 when students summarize findings from all parts of the project.

Teacher Resource
Experimental Design Processes Notes

Science Experiments are usually documented in a formal report that details the experiment. Often, the report makes references to "raw" notes that were kept in a science log. Although the steps of an experiment are not necessarily sequential, the report is usually written with these components:

Process	Activity
Observation	Observations may be qualitative and/or quantitative using a variety of tools to measure. Observational writing is objective and free of inference and opinion.
Question	Use observations to determine the question. The purpose of the experiment should be in the form a question that can be tested through experimentation. The question should arise from the observations as something that was a discrepant event, or something that sparked the interest/curiosity of the experimenter.
Hypothesis	Develop the hypothesis from the question. It is more than an "educated guess". It must be testable using variables and controls. The hypothesis should be stated in an if/then statement.
Procedure	The procedure is the detailed steps of the experiment and must be clear, without little or no interpretation of what to do next. The procedure should include the list of materials and how they were used. Discussion of Fair Test using control, manipulated (independent) variable, responding (dependent) variable.
Data Collection Graphing	Observations should be written using the criteria for observational writing. Measurements need to be part of the data collection. The data should be represented in charts or tables that are clearly labeled and contain relevant information. If variables are used in the experiment, a T-chart is the chart of choice. The data collected should also be represented in a pictorial form through a graph. The graph can be a bar graph, pie graph or point (coordinate) graph. The graph should clearly show the relationship between the variables.
Summary Statements	Summary statements should describe the data; only data can be included in a summary statement. This statement should also contain as much quantitative information as possible, identifying things like the average, mean, mode, or range, as well as the data that seems to lie outside of what was expected. The summary statements are based on evidence from the data.
Conclusion	The conclusion is based on the summary statements. It should wrap up the cause-and-effect relationship as well as discuss any unresolved questions or error analysis of the data. The conclusion should answer the Problem/Question or explain why it cannot be answered at this time. Synthesizing the evidence from all parts of the experiment go into a concluding statement. Concluding statements from the experiment(s) should be added to other concluding statements for the project.
Generalization/Application	Broadening the conclusion to other situations uses the conclusion to explain or apply to a new area. Generalizations are usually made after repeated trials and are based on expectations from these previous experiences.

Lesson 7:
Synthesizing Findings: Reflect On Process

Purpose: To summarize the findings from the project and reflect and evaluate the project's impact-and long-term benefit

Outcome: Students will summarize their findings and reflect and evaluate the goals at the completion of project.

Reference: Please see Recycling Batteries portfolio page 15, and Our Starfish portfolio page 16.

Time: Several class periods over a couple of weeks
Part I Drawing Conclusions
Part II Evaluating the Impact of the Project

Materials: Chart paper
Markers
Disney Planet Challenge Handbook:
Page 22, Teacher Page--Evaluate the Project
Page 23, Student Page--Evaluate the Project
Page 24, Teacher Page--Teacher Reflection
Page 25, Student Page--Reflections

Standards: Review standards for English-language arts, science, social studies and mathematics to align with actions for this part of the project.

Advanced Preparation: Have students gather their conclusions (e.g., sentence strips from Lesson 6; comments/learning from Lesson 5), as well as from their Activity Logs, previous reflections, and any other prompts that were used to synthesize information.

Procedure

Part I Drawing Conclusions

1. Congratulate students for their efforts and for their hard work. Explain to students that now that the investigation portion of the project is complete, they will now have an opportunity to synthesize what they learned from the various components of the project and determine their major findings and learning.

2. Refer to **Disney Planet Challenge Handbook, page 22, Teacher Page--Evaluate the Project.** Distribute **Disney Planet Challenge Handbook, page 23, Student Page--Evaluate the**

Project. Help students review their information and data. Have students work in groups to organize their findings in a manner that others can understand. Help students document their results, e.g., amount of money raised, energy saved, cans recycled. Use Activity Logs, notes from research, preliminary conclusion sentence strips, reflections etc.

Teacher Note: If students have worked in committees to gather information, have each committee report on its findings. If the class has worked as a whole group on each component, review each component and the findings.

3. When the class has had an opportunity to review the information from all groups, divide the class into small groups (preferably that worked on different parts of the project). Ask groups to brainstorm 3-5 major things you learned that you think others would want to know?

4. Have each group share their ideas, then build consensus for the 3-5 major findings that will be used in the portfolio.

Part II Evaluating the Impact of the Project

5. In small groups, have students reflect on the impact of the project. Use the following questions as discussion prompts:
   - What was the overall effect of the project?
   - What were some of the challenges and successes observed through this project?
   - What were some of the educational benefits of doing this project?
   - What is the long-term environmental benefit for students, parents, and/or the community as result of doing this project?
   - How have students grown/changed as a result of their participation? What responsible actions did they do, will continue to do now?
   - What are some possible next steps?

Teacher Note: Consider dividing these questions among the groups, and having groups report on their discussion. Also consider sharing your teacher reflections with the students ***Disney Planet Challenge Handbook. page 24, Teacher Page--Teacher Reflection.***

6. Ask students refer to **Disney Planet Challenge Handbook, page 25, Student Page--Reflections.** Have each student complete his/her individual final reflection.

Lesson 8: Prepare Portfolio

Purpose: To provide information to guide student in putting the class project portfolio together; to generate other ideas for sharing their project.

Outcome: A completed portfolio

Reference: Please see Burrowing Owl portfolio, Our Starfish portfolio, and Recycling Batteries portfolio

Materials: Disney Planet Challenge Handbook:
Page 26, Teacher Page--Assemble the Class Portfolio
Page 27, Teacher Page--Portfolio Specification Checklist
Cover Sheet A
Cover Sheet B
Disney Planet Challenge Rubric
Chart paper, marking pens
11" x 17" white construction paper
Glue, tape, scissors
Several colors of construction paper
Optional--Stickers, scrapbooking materials; DVD or CD

Time: 4-6 class periods over several weeks

Standards: Review standards for English-language arts and visual and performing arts to align with actions for this part of the project.

Advanced Preparation:

1. Collect all pictures and artifacts taken/created during the project.
2. Student reflections completed; Disney Planet Challenge Handbook, page 25, Student Page--Reflections
3. Teacher reflection completed; Disney Planet Challenge Handbook, page 24, Teacher Page--Teacher Reflection.
4. Carefully review Disney Planet Challenge Handbook, page 27--Portfolio Specification Checklist.
5. Review the Presentation portion of the Disney Planet Challenge Rubric.
6. Make copies of the "10" column of the rubric for each work group of students.

7. Review the Grand Prize project portfolios on the Disney Planet Challenge website.

Teacher Note: The Class Project judges are classroom teachers, selected individuals from the different environmental agencies, and science professional development providers. They are trained to use the rubric to objectively score the projects. Thus it is important to help your students follow the rubric in assembling their portfolio.

Keep in mind that you and your students know your project best. Help your students tell their story clearly and concisely by making sure that all information included in the portfolio is linked to the project's goals and action plan.

Procedure:

1. Explain to students that now that the project is completed, it is time to put together a portfolio that shows the work that has been accomplished. Explain that it is important to tell the story of their project concisely and clearly so that it makes sense to someone else (the judges).

2. Make a large chart of the Portfolio Specification checklist (page 27 from the Handbook) and share with the students. Explain that the portfolio can only be 16 pages (excluding the cover). If possible, give student the opportunity to see portfolios from past winners that are on the Disney Planet Challenge web site.

3. Explain that the whole class will create the portfolio by working together in different work groups. Help the class decide on work groups for putting the portfolio together: Who will do the "write-up" and explanation of how the project was selected? Who will do the goal and what did the class hoped to accomplish? Who will summarize the findings?

4. Facilitate students selecting a work group.

5. Distribute the copy of the "10" column of the rubric to each work group. Ask students to review and discuss in their group what they think needs to be included in order to get a score of 10.

6. Distribute one sheet of chart paper and marking pens to each group. Have the groups chart what they think should be included in the portfolio and how it addresses one of the components on the rubric. Ask groups to share their charts.

For Example:	*Integration*	*Use of Resources*
	List of books we read	*Name of speakers and what they shared*
	Graphs we made	*Names of local agencies who visited*
	Letters we wrote	

7. Have groups use the ideas on the charts and gather the information for their portion of the portfolio: What photos, articles, and student communications would be important to include? Make sure students are aware of the guiding questions for their portion and make sure those questions are addressed in their information.

8. Have each work group share the information they have gathered and explain how each piece is important to be included in the portfolio. For example, how do the "artifacts" show that we accomplished our goal? Indicate changes from beginning to end? Demonstrate long-term impact?

9. Explain to students that the last section of the rubric is "Overall Quality of Presentation" and the rubric says "Overall presentation of portfolio is original, creative, and artistic, showing sustained effort and quality attention to detail." Ask students how they want to address this portion of the rubric-- do we want to address this portion of the rubric in our portfolio?" Chart students' ideas. Decide how the portfolio is going to be finalized.

10. Have work groups work on their portion of the portfolio and then assemble the whole portfolio. As a class, re-check the checklist to make sure that the portfolio is complete.

11. Make copies of the completed portfolio. Send one to Disney!

12. Ask students how they would like to publicize their results to the school and to the community.

Teacher Note: Spread the word about your project! Invite the local press and the media to share your class's accomplishments. Involve the entire school, family members, friends and the community. Consider sharing your project with another school, at a board meeting, or other district professional development events.