Biology Course Map

The attached document is part of a framework that was designed to support the major concepts addressed in the Biology Curriculum of the Georgia Performance Standards through laboratory experiences and field work using the processes of inquiry. This framework is a thematic approach that is divided into the four units outlined below. Within each unit, the unifying themes of cells, organisms, ecology and evolution reoccur. Concept maps are attached to each unit outlining the understandings derived from the standards that are addressed for each of the recurring topics. There are several strategies that are common throughout the units such as the use of a laboratory notebook or field sketchbook, written laboratory reports and common teaching strategies. These strategies are described on the following pages. Whereas these units are written to be stand alone units that may be taught in any sequence, it is recommended that the organization unit be taught first and the equilibrium unit taught last.

Unit One Focus: Organization
Life is organized at all levels from cells to biosphere.

Unit Two Focus: Energy Transformations
Energy can be neither created nor destroyed but can be transformed from one form to another as it flows through organisms and ecosystems.

Unit Three Focus: Growth and Heredity
Organisms must be able to grow and reproduce to ensure species survival.

Unit Four Focus: Equilibrium
Survival and stability require that living things maintain biological balance at all levels.

Topics:
- Cell structure and Function
- Evolutionary History
- History of Life
- Classification of Kingdoms
- Ecosystem Structure
- Viruses

Duration (Block): 23 days
Duration (Traditional): 7-9 weeks

Topics:
- Chemistry of Life
- Function of Organic Molecules
- Photosynthesis
- Cellular Respiration
- Cycles of Matter
- Energy Flow
- Food Chains and Webs

Duration (Block): 22 days
Duration (Traditional): 7-9 weeks

Topics:
- Asexual and Sexual Reproduction
- Cell Growth
- Mendelian Genetics
- DNA and RNA Processes
- Chromosomes and Mutations
- Genetic Engineering
- DNA Technology and Cloning
- Biological Resistance
- Bioethics

Duration (Block): 22 days
Duration (Traditional): 7-9 weeks

Topics:
- Cellular Transport
- Homeostasis
- Natural Selection
- Plant Adaptations
- Animal Adaptations and Behavior
- Succession
- Population Genetics

Duration (Block): 23 days
Duration (Traditional): 7-9 weeks
Safety Issues:

Student safety in science education should always be foremost during instruction.

The Characteristics of Science curriculum standards increases the need for teachers to use appropriate precautions in the laboratory and the field. The guidelines for the safe use, storage and disposal of chemicals must be observed.

To ensure student and teacher safety in the science classroom, it is critical that appropriate safety policies and procedures be established in the classroom and that all students and teachers know and follow appropriate safety guidelines. The Internet and many science vendors can offer support for safety guidelines.

Common Teaching Strategies:

There are several teaching strategies that are used throughout the course. For clarification purposes they are described below:

Lab notebook or Field sketchbook: A notebook that students use to record data, journal on assigned topics and complete assigned drawing activities.

Ticket Out the Door: A commonly used summarizing strategy that is effective as a formative assessment tool. Students are given a short writing assignment on the concept covered in class that is to be turned in as they leave the classroom. These brief glimpses into student understanding may be graded or not. The same strategy can be used as a Ticket In the Door to assess student understanding at the beginning of the class on a concept from the day before or as a check on a homework assignment.

KIM diagrams: A three column table where students can organize technical language to allow better understanding of how they relate to the topic of the day. On a KIM diagram, a key term is listed in the first column, an illustration of the key term in the second column and a student derived meaning written in the third column.

Jigsaw activities: An effective grouping strategy that teachers use to facilitate peer teaching in the classroom. Students are first grouped together to become experts on an assigned topic. Student groups are then reorganized in such a manner that new groups are formed containing one student from each of the expert groups. The experts on each topic then serve as a peer teacher to the other students in the newly formed group.

Cloze: A note taking strategy where students either provide missing terms to complete a paragraph using appropriate language for the topic being addressed, or where students generate a paragraph from a list of appropriate terms.
Gallery or Poster Walk: This is a peer assessment strategy. Students place their work on a wall or other location where it can be reviewed by their peers. Students provide written commentary on the posted work and the original creators are given the opportunity to revise their product. 

Teacher note: Students may require training to use appropriate feedback in their commentary.

Flapbook or Flipbook: A type of graphic organizer where students group information in order to see relationships within categories.

10-2 Lecture format: A strategy where teachers limit the introduction of material to a time frame of 10 minutes or less and then students are allowed a 2 minute opportunity to reflect on the material and share what they have learned with their peers.

Glaze the Doughnut: A type of organizer that allows teachers to pre-assess student knowledge or to monitor student progress that resembles a doughnut as one smaller circle is drawn inside another. The big idea is written inside the small circle and the doughnut is “iced” or “glazed” with what the students know about the topic. The information can then be reorganized into tables or organizers.

Name Jar: A strategy to ensure students are randomly selected to answer questions in class. Student names are placed on craft sticks and placed in a jar. During questioning the teacher selects sticks from the jar and the student identified must answer the question. Several blank sticks could be included in which the teacher must answer the questions when they are selected.

KWL: A pre and post assessment strategy often used in classrooms where, at the beginning of the lesson, teachers guide students to identify what they already know about a particular topic and what they need to know about the topic. Following the lesson, the teacher leads students to review what they have learned.

Acrostic: An activity for students to make connections with the language that often accompanies a particular topic. The key term is written vertically on paper and students write words or phrases that relate to that term using the letters that make up the key term.
Regardless of cell type, cellular components function together to maintain homeostasis. SB1a
- Environmental conditions affect organisms at cellular levels. SB1d
- The regulation of cell functions through the expression of genes (enzymes) allows cells to respond to the environment.

Human activities and natural phenomena disrupt the homeostatic nature of the environment SB4c, SB4d
- Ecosystems result from dynamic relationships between organisms and their environment SB4a
- Organisms are interdependent on each other and their environment SB4a
- Diversity among organisms is due to adaptations to changing environmental conditions SB4e, SB4f, SB5d, SB5e

Species evolve over time SB5b
- Evolution is a gradual process SB5b
- Natural selection is a primary factor in evolutionary change SB5d
- Evolution is a consequence of the interactions of
  - the potential for a species to increase its numbers
  - the genetic variability of offspring due to mutations and recombination
  - a finite supply of resources required for life
  - the selection by the environment of those offspring better able to survive and leave offspring. SB5d

Organisms respond to internal changes and external stimuli to maintain homeostasis. SB3b, SB4e, SB4f

Survival and stability requires that living things maintain biological balance at all levels.
# Content and Characteristic of Science Standards for Equilibrium

<table>
<thead>
<tr>
<th>Content Standards:</th>
<th>Characteristics of Science:</th>
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<tbody>
<tr>
<td><strong>SB1. Students will analyze the nature of the relationships between structures and functions in living cells.</strong></td>
<td><strong>SCSh1. Students will evaluate the importance of curiosity, honesty, and skepticism in science.</strong></td>
</tr>
<tr>
<td>a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.</td>
<td>a. Exhibit the above traits in their own scientific activities.</td>
</tr>
<tr>
<td>b. Explain how enzymes function as catalysts.</td>
<td>b. Recognize that different explanations often can be given for the same evidence.</td>
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<tr>
<td>d. Explain the impact of water on life processes (i.e. osmosis and diffusion)</td>
<td>c. Explain that further understanding of scientific problems relies on the design and execution for new experiments which may reinforce or weaken opposing explanations.</td>
</tr>
<tr>
<td><strong>SB2. Students will analyze how biological traits are passed on to successive generations.</strong></td>
<td><strong>SCSh2. Students will use standard safety practices for all classroom laboratory and field investigations.</strong></td>
</tr>
<tr>
<td>b. Explain the role of DNA in storing and transmitting cellular information</td>
<td>a. Follow correct procedures for uses of scientific apparatus.</td>
</tr>
<tr>
<td><strong>SB3. Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.</strong></td>
<td>b. Demonstrate appropriate technique in all laboratory situations.</td>
</tr>
<tr>
<td>b. Compare how structures and function vary among the six kingdoms.</td>
<td>c. Follow correct protocol for identifying and reporting safety problems and violations.</td>
</tr>
<tr>
<td><strong>SB4. Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.</strong></td>
<td><strong>SCSh3. Students will identify and investigate problems scientifically.</strong></td>
</tr>
<tr>
<td>a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.</td>
<td>a. Suggest reasonable hypotheses for identified problems.</td>
</tr>
<tr>
<td>c. Relate environmental conditions to successional changes in ecosystems.</td>
<td>b. Develop procedures for solving scientific problems.</td>
</tr>
<tr>
<td><strong>SCSh4. Students use tools and instrument for observing, measuring, and manipulating scientific equipment and materials.</strong></td>
<td>c. Collect, organize and record appropriate data.</td>
</tr>
<tr>
<td>a. Develop and use systematic procedures for recording and organizing information.</td>
<td>d. Graphically compare and analyze data points and/or summary statistics.</td>
</tr>
<tr>
<td>b. Use technology to produce tables and graphs.</td>
<td>e. Develop reasonable conclusions based on data collected.</td>
</tr>
<tr>
<td>f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.</td>
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</tbody>
</table>
d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.
e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.
f. Relate animal adaptations, including behaviors, to the ability to survive stressful environmental conditions.

**SB5. Students will evaluate the role of natural selection in the development of the theory of evolution.**

b. Explain the history of life in terms of biodiversity, ancestry, and rates of evolution.
d. Relate natural selection to changes in organisms.
e. Recognize the role of evolution to biological resistance (pesticide and antibiotic resistance)

**SCSh5. Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.**

a. Trace the source on any large disparity between estimated and calculated answers to problems.
b. Consider possible effects of measurement errors on calculation.
c. Recognize the relationship between accuracy and precision.
d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.

**SCSh6. Students will communicate scientific investigation and information clearly.**

a. Write clear, coherent laboratory reports related to scientific investigations.
b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
c. Use data as evidence to support scientific arguments and claims in written or oral presentations.
d. Participate in group discussions of scientific investigation and current scientific issues.

**SCSh7. Students analyze how scientific knowledge is developed.**

Students recognize that:

a. The universe is a vast single system in which the basic principles are the same everywhere.
b. Universal principles are discovered through observation and experimental verification.
c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications or prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.
d. Hypotheses often cause scientists to develop new experiments that produce additional data.
e. Testing, revising, and occasionally rejecting new and old theories never ends.
### SCSh8. Students will understand important features of the process of scientific inquiry.

Students will apply the following to inquiry learning practices:

- a. Scientific investigators control the conditions of their experiments in order to produce valuable data.
- b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations’ hypotheses, observations, data analyses, and interpretations.
- c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.
- d. The merit of a new theory is judged by how well scientific data are explained by the new theory.
- e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.
- f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

### SCSh9. Students will enhance reading in all curriculum areas by:

- a. Reading in all curriculum areas
  - Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
  - Read both informational and fictional texts in a variety of genres and modes of discourse.
  - Read technical texts related to various subject areas.
- c. Building vocabulary knowledge
  - Demonstrate an understanding of contextual vocabulary in various subjects.
  - Use content vocabulary in writing and speaking.
  - Explore understanding of new words found in subject area texts.
- d. Establishing context
  - Explore life experiences related to subject area content.
  - Discuss in both writing and speaking how certain
words are subject area related.
- Determine strategies for finding content and contextual meaning for unknown words.
Misconceptions for Equilibrium:

Students think that:

- Humans do not impact the environment. Students should understand that all human activities impact the environment even though the results are not immediately evident.
- Natural disasters always have negative effects. Many natural disasters have positive long term effects that stabilize ecosystems and prevent succession (i.e., forest fires).
- Cells soak up materials (like salt). Students should understand that water moves freely in and out of most cells. Only very small particles that can dissolve in water are likely to pass through cell membranes passively. Solute concentrations determine the direction of the movement of materials in and out of cells.
- New variations occur in response to an organisms need, environmental conditions or use. Students should understand that variations among sexually reproducing organisms come about as a result of mutations, and recombination as a result of meiosis and random fertilization.
- Populations change because all individuals in that population change. Students should understand that populations change as a result of natural selection as organisms that are more favorably suited for their environment reproduce at higher rates.
### Balanced Assessment Plan for Equilibrium

<table>
<thead>
<tr>
<th>Informal Observations:</th>
<th>Selected Responses</th>
<th>Constructed Responses</th>
<th>Performance Assessments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student responses to Word Splash activities and KWL activities.</td>
<td>KIM diagrams on cellular transport and populations</td>
<td>Journal entries and reflective paragraphs</td>
<td>Cellular transport mechanism project presentation</td>
</tr>
<tr>
<td>Lab notebook entries</td>
<td>Venn Diagrams on Osmosis, and extinction</td>
<td>Ticket Out the Door responses</td>
<td>Homeostasis Project Jigsaw presentation</td>
</tr>
<tr>
<td>Ticket Out the Door responses</td>
<td>Graphic Organizers for Homeostasis examples</td>
<td>Operation Cat Drop assessment questions</td>
<td>Natural Disaster Presentation</td>
</tr>
<tr>
<td>Monitor peer teaching</td>
<td>Natural Selection Cloze</td>
<td>Lab reports on diffusion and osmosis, adaptations and aquatic succession</td>
<td>Documentary Video or Newsletter for Cat Drop</td>
</tr>
<tr>
<td>Monitor peer assessments</td>
<td>Human Impact - Glaze the Doughnut activity responses</td>
<td>Population Trend graphing lab results</td>
<td>Town Hall Meeting</td>
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<td></td>
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<td>Gallery Walk paragraphs</td>
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<td>Symbiosis RAFT</td>
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<td>Essay questions</td>
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</table>

### Culminating Activity for Equilibrium

Town Hall Meeting to discuss the construction of a coal plant.  
[Town_Hall_Meeting](#) See pages 43-44.
Internet Resources for Equilibrium

http://www.strange-loops.com/scicatdrop.html

http://en.wikipedia.org/wiki/DDT


http://www.emc.maricopa.edu/faculty/farabee/biobk/BioBookANIMORGYSY.html

http://en.wikipedia.org/wiki/Homeostasis

http://www.colorado.edu/eeb/web_resources/cartoons/homeo.html


http://physioweb.med.uvm.edu/homeostasis/
Sequence of Activities, Tasks, and Assessments for Equilibrium
Narrative Version Follows

Day 1:

1. Hook: Operation Cat Drop- How the use of DDT led to chaos.
   Students will read “Operation Cat Drop” and write their thoughts about the article in their
   journals OR create an illustration depicting the events described in the article.
   *Operation Cat Drop* (pages 20-21)
   Explain that “Operation Cat Drop” will be revisited throughout the unit.

2. Conduct a brief KWL or use a word splash to assess prior knowledge of associated terms such
   as homeostasis, equilibrium, cell membrane structure, osmosis, diffusion, and cellular transport.

3. Give students gummy bears (or similar objects) and have them predict what will occur if they
   are placed in water and left overnight. Allow them to set up an experiment to test their
   predictions. Provide students with metric rulers and balances to allow data collection that will
   provide evidence to support their predictions.

4. Introduce and allow students to set up the Aquatic Succession lab. Explain to students that
   they will be collecting data for approximately three weeks that will be used to complete the lab.
   Students will be required to make observations and predictions on a daily basis. Their
   observations should be drawn and comments made in their lab notebook.
   *Teacher note: Students may need guidance on making observations and predictions.*
   *Aquatic Succession* (pages 24-25) General procedures for use of a lab notebook and lab report
   format can be found in the attached document *Laboratory Report* (page 41)

Day 2:

1. Data collection for Gummy Bear Osmosis.

2. Conduct a group discussion on osmosis and diffusion and have students complete the
   Osmosis Venn. *Osmosis Venn* (page 22)
   Ask students what would happen if different materials were used.

3. Working in groups, write a hypothesis, design and perform an experiment to demonstrate
   diffusion and osmosis. Provide cups, beakers, graduated cylinders, gummy bears, salt, distilled
water, sugar and starch solutions, iodine, baggies, dialysis tubing or other appropriate materials for student use.

Teacher Note: Traditional labs such as a potato or elodea osmosis lab and a semi-permeable membrane lab using dialysis tubing or baggies could be used as demonstrations and are attached. A sample experiment using gummy bears is also attached. Baggie Diffusion (page 27) Potato Osmosis, (page 26) Gummy Bear Osmosis (page 29)

4. Make observations for succession lab and record data in their lab notebooks.

Day 3:
1. Complete osmosis and diffusion experiment and assign a formal lab report for homework. A sample lab report format and rubric are attached. Laboratory Report (page 41) Lab Rubric (page 42)
2. Conduct a brief lecture on cell membrane structure and transport. Include language within the lecture such as: phospholipid bilayer, carrier proteins, passive transport, active transport, osmosis, diffusion, hypotonic, hypertonic, isotonic, endocytosis, exocytosis, Na+ K+ or ion pump.
3. Have students complete a KIM diagram (where students illustrate and describe terms) for cellular transport terminology.  Cell_Transport_KIM (page 23)

Sample KIM

<table>
<thead>
<tr>
<th>Key Terms</th>
<th>Illustration</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Write the term</td>
<td>Draw a picture</td>
<td>State the meaning</td>
</tr>
</tbody>
</table>

4. Make observations for succession lab and record data in their lab notebooks.
5. Osmosis Diffusion Assessment or Ticket out the door: Osmosis Diffusion Assessment (page 28)

Day 4:
1. Review cell membrane structure, transport terms, Venn and KIM diagrams.
2. Introduce project to design a visual aid to show one cellular transport mechanism. Cell_Membrane_and_Transport_Project (pages 30-31)
3. Make observations for succession lab and record data in their lab notebooks.
Day 5:
1. Presentations of visual aid for Cellular Transport
2. Cat Drop Assessment at Cellular Level: You are a scientist for the CDC. Based on the information you have learned about how materials enter and leave a cell; write a hypothesis to show how DDT may have entered the cells of the organisms in “Operation Cat Drop”.
3. Make observations for succession lab and record data in their lab notebooks.

Day 6:
1. Homeostasis Project Jigsaw: Students are given an example of homeostasis and asked to research and describe the mechanisms involved in maintaining homeostasis for that organism. Students with scenario one will group and discuss the mechanisms, scenario two students will meet, etc. Form new groups containing one student from each scenario and each student will present their examples and discuss the mechanisms to the others.
   Homeostasis_Project (pages 32-34)  Homeostasis_Graphic_Organizer (page 35)
   (TEACHER NOTE: Examples are included in the project directions. The point of these activities is to give different examples of organisms using different homeostatic mechanisms; the different mechanisms are not intended to be specifically assessed. The concept is that organisms must maintain homeostasis or they do not survive to pass along their genes. This understanding provides a basis for other concepts and understandings in this unit such as an organism’s failure to reproduce may alter the gene pool and disrupt equilibrium resulting in evolution.

2. Make observations for succession lab and record data in their lab notebooks.

Day 7:
1. Homeostasis Project Jigsaw continued. Groups of students will select one representative organism from each kingdom and research one homeostatic mechanism and one homeostatic imbalance (such as a disease or disorder) for each organism. Each group will create a poster to display their information.
2. Make observations for succession lab and record data in their lab notebooks.
Day 8:
1. Homeostasis Project Jigsaw continued. Students complete their posters and display them in the classroom. Have students perform a gallery walk, where they complete a graphic organizer on the examples of homeostasis for organisms in the six kingdoms. Have students write down the three best examples of homeostatic balance and imbalance as a Ticket Out the Door or a homework assignment. Students should also critique their work by writing a reflective paragraph describing what they did well and what they could have done to improve their work.
2. Make observations for succession lab and record data in their lab notebooks.

Day 9:
1. Quiz and Cat Drop Assessment at Organism Level – Using what you have learned about the various means organisms have for maintaining homeostasis; describe a possible homeostatic imbalance caused by DDT in one or more of the organisms mentioned in “Cat Drop”. Write a hypothesis predicting how your proposed homeostatic mechanism works and design a controlled experiment that could be done to test your hypothesis.
2. Aquatic Succession (jar or pond) microscopic observations. Have students discuss their observations and make predictions in their lab notebooks.

Day 10:
1. Conduct a discussion on natural selection and the adaptations organisms have for survival, how they may have evolved and what happens when organisms are not well adapted to their environment. Include examples from the Homeostasis Project Jigsaw, genetically altered organisms and bacterial resistance to antibiotics.
2. Students will design a cloze and then switch theirs with another student so that each student will complete another student’s cloze. See attached for an example: Natural_Selection_Cloze (page 36)
3. Have students write in their journal about the adaptations (either physical or behavioral) of a group of organisms of their choice. Students could choose any organism they find interesting or they could use a family pet, animals they see in their neighborhood, organisms they would encounter at the beach or on a hike in the mountains or at a favorite vacation site.
4. Make observations for succession lab and record data in their lab notebooks.
Day 11:
1. Have students design and perform an Adaptation or Predator/Prey Lab where students construct camouflage organisms from construction paper, newspaper, or other materials and predict what adaptations or colors of prey will survive predators in a variety of habitats represented by different fabrics or other materials available in the classroom. Include a variety of materials such as spoons, forceps, straws, toothpicks, pipe cleaners, scissors, dissecting pins, needles and/or tongs and have students act as predators for their prey. Have students write a formal lab report for their lab, include data tables and graphs of their trials as well as descriptions of the adaptations of both the predators and prey represented in their lab, how those adaptations may have evolved and to predict what may happen to those adaptations in the future. A sample lab report format and rubric are attached. Laboratory_Report (page 41) Lab_Rubric (page 42)
2. Make observations for succession lab and record data in their lab notebooks.

Day 12:
1. Conduct a discussion on what happens to organisms that do not have adaptations for their environment. This should include several examples of causes of extinction and the fact that extinction leaves available niches for speciation.
2. Have students complete a Venn diagram for extinction and speciation, include causes and results. Extinction_Venn (page 37)
3. Cat Drop Assessment – Evolution Level: Using what you have learned about adaptations and natural selection, explain how some cells or organisms could become resistant to DDT or other pesticides.
4. Make observations for succession lab and record data in their lab notebooks.

Day 13:
1. Review ecological organization and ecological relationships using a KWL or a Word Splash. Include language such as species, population, communities, ecosystem, biome, symbiosis, mutualism, commensalisms and parasitism. (Teacher Note: students should be familiar with these terms; the concept that will be introduced is how the interaction of organisms affects their
populations which has an effect on the equilibrium of ecosystems and can have long term results.

2. Conduct a brief lecture on populations; use a KIM diagram for population growth language. 
   Population_KIM (page 38)
4. Make observations for succession lab and record data in their lab notebooks.
5. Ticket Out the Door: Based on what you have learned about carrying capacity in the population trend activity, is there a carrying capacity for humans?

Day 14:
1. Pair students and have them complete the graphic organizer on symbiotic relationships in the Symbiosis RAFT activity sheet, then have them select a symbiotic relationship and create a graph and write a letter as described. Symbiosis_Raft (page 40)
2. Make observations for succession lab and record data in their lab notebooks.

Day 15:
1. Conduct a brief lecture on succession. Include language such as primary and secondary succession, pioneer species, and climax community.
2. Aquatic Succession Lab – Make final observations. Describe and diagram the stages of succession in pond or lake. Predict what might slow this process down or speed this process up. Write a formal lab report. A sample lab report format and rubric are attached: Laboratory_Report Lab_Rubric (page 41-42)

Day 16:
1. Video or short clip on natural disasters.
2. Discuss recent disasters such as 2005 Hurricane Katrina, or the 2004 Tsunami.
3. Have student groups research different natural disasters and produce a safety poster, or a leaflet or public service announcement from FEMA, describing what causes the disaster, what occurs during the disaster and what precautions a person should take in the event of this disaster as well as the environmental impacts from the disaster.
Teacher note: It is important that students realize that natural disasters can be beneficial in the long term. Examples include the benefits of water restoration in the Everglades from recent hurricanes, the benefits fire or volcanic activity have had on the reproductive cycles of plants or how fires prevent successional changes in forests.

Day 17:
1. Complete posters and present.
2. Complete a graphic organizer with each of the natural disasters presented and a brief discussion of how each interrupts or impacts succession. Teacher note: Emphasize that the impact on succession can be positive or negative depending on the organisms affected.

Day 18:
1. Glaze the Doughnut activity for Human Impact on the Environment
   Draw a small circle (doughnut hole) on the board and write the Big Idea inside. Example: Human Impact
   Draw a larger circle outside of the small circle (the doughnut)
   Task – Ice the doughnut with what you know about human impact on the environment. All students contribute, accept all answers and ask the students how this information could be organized and have students reorganize the information in their notes. Example, students may draw the table, label columns and place items in the correct columns.

Day 19:
1. Have students read a current event article on the proposed use of DDT in Africa. Teacher Note: There are several recent articles on the Internet regarding this current issue. See links in resource section above.
2. Cat Drop Assessment – Ecology Level: From the perspective of an environmental group opposed to the world-wide use of DDT, or a community Health Organization’s effort to use DDT to eradicate Malaria, create a media presentation (video, pamphlet, or newsletter) of the potential and realized effects of putting DDT back into a community.
Day 20:
1. Cat Drop Assessment- Ecology Level Continued and Presentations

Day 21:
1. Introduce the Town Hall Project – Town_Hall_Meeting (page 43-44)

Day 22:
1. Town Hall Meeting cont.

Day 23:
1. Conduct the Town Hall Meeting
2. Summative assessment - Sample essay questions attached Summative_Assessments (page 45)
OPERATION CAT DROP ARTICLE AND TEACHER NOTES

The following summary refers to a little known operation conducted many years ago in an attempt to correct the unforeseen consequences of using DDT to control the mosquito population to prevent Malaria in a small village.

The entire article can be viewed at http://www.strange-loops.com/scicatdrop.html

This article is used as a hook in this unit to introduce the concept of equilibrium and the consequences of disrupting the equilibrium at all ecological levels.

“Operation Cat Drop” Summary:

In a small village many years ago, people were dying of Malaria. In an attempt to save lives, the World Health organization decided to use DDT to kill off the mosquitoes that were known to transmit the disease. The mosquito population was drastically reduced and the number of villagers contracting Malaria declined. Over time, the thatched roofs of the villagers began to collapse as DDT killed a parasitic wasp that kept a thatch eating caterpillar in check. In addition, other insect eating organisms were affected as DDT moved through the food chain. Eventually the cats that kept the rat population in check also died. As the rat population increased so did the incidence of rat born illnesses. Now the villagers were dying of other diseases in a town overrun by rats and no roofs over their heads. In an attempt to rectify the situation, the World Health Organization developed a plan they called Operation Cat Drop and parachuted live cats into the village to control the rat population to prevent the villagers from dying.

The following teacher notes address assessments referencing “Operation Cat Drop” that are used throughout the unit.

Teacher notes for Cat Drop Assessment for Cellular processes:
DDT is a chemical toxin used to kill unwanted insects (agricultural pests and human disease vectors). One of the insects DDT kills is the mosquito responsible for transferring Malaria from one human to another human. Using the information in the section on cellular homeostasis, write a hypothesis that proposes a way in which DDT might enter into an insect’s cells to cause its death.

(Teacher’s notes #2: Diffusion and active/passive transport are plausible; osmosis is not. “Absorbed” must be related to one of processes above).

Teacher Notes for Cat Drop Assessment for Organism Processes:
DDT causes nerve cells in an insect to become “leaky:” Nerves lose too many sodium ions (NA+) too fast, and can no longer transmit impulses.
Background information: sodium, potassium and chloride are ions involved in the transmission of a signal from one end of a nerve cell to the other end. Sodium and potassium temporarily trade places inside and outside of the membrane as the signal travels along the nerve cell (much in the same way electricity moves along a wire). DDT causes sodium to remain permanently outside the membrane, therefore blocking the movement of the signal. Without signals, systems in the insect (e.g. feeding and respiration, walking and flying) cannot work properly leading to the death of the insect.

How is the action of DDT (in causing sodium leaks in the nerves of insects) an example of disruption to homeostasis in the organism?

Experimental Design: Develop an experiment that will test the hypothesis written in Part I.

Teacher Notes for Cat Drop Assessment for Ecology Section:
Unfortunately, the use of DDT for killing some insects (pests and parasites) has many secondary consequences that are seen as harmful to the environment. Effects on an ecosystem (dynamic equilibrium) may not be predictable or evident for several years, or even decades. Reread “Operation Cat Drop”.

From the perspective of an environmental group opposed to the world-wide use of DDT, create a media presentation (video, pamphlet, or newsletter) with a visual diagram of the potential and realized effects of putting DDT back into a community (village) in “balance”. Describe how DDT affects multiple points in the community in predicted and in unexpected ways.

Teacher Notes for Cat Drop Assessment for Evolution Section:
Rapid resistance to DDT appears in the mosquito population after long-term use. Discuss how pests can build up a resistance to pesticides over time. Describe how the rate of evolution can be impacted by human actions in the environment.
Osmosis Venn Diagram:

Using two related terms, write the characteristics that are different inside circles drawn under each term. In the center, create a third circle between the related terms and write the characteristics that apply to both terms.

Osmosis and Diffusion Venn Diagram

Teacher Note: You can use the same diagram to compare other related terms here such as passive and active transport, endocytosis, exocytosis, or hypotonic and hypertonic. This graphic organizer may help some of your more visual learners.
**Cellular Transport - KIM Diagram**

Read your text discussing cellular transport. Construct a KIM diagram for the terms

<table>
<thead>
<tr>
<th>Key term</th>
<th>Illustration</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active transport</td>
<td></td>
<td></td>
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<tr>
<td>Passive transport</td>
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<tr>
<td>Phospholipids</td>
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<td>Protein Channels</td>
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<td>Hypotonic</td>
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<td>Hypertonic</td>
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<tr>
<td>Isotonic</td>
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</tbody>
</table>
Lab – Aquatic Succession:
Successional Changes in an Aquatic Ecosystem

Problem: Observe succession of a pond ecosystem under various environmental conditions.

Materials per group:
- 3 clear jars
- Bottled water
- Microscope
- Slides with cover slips or depression slides
- 3 droppers
- Pond water with plant materials
- Cooked rice (not instant)

Procedures:
1. Label jars A, B, & C.
2. Place same amount of water in each jar.
3. Place the following materials in the jars:
   - Jar A - water only
   - Jar B - water and 3 grains of rice
   - Jar C - water, 3 grains rice, 2 Tablespoons pond water with plant material
4. Determine the environmental conditions under which your jars will be placed. (Note: all three jars should be placed under the same condition).
5. Hypothesize what will occur in each jar.
6. Record hypotheses in lab notebook or on a data sheet.
7. Make observations (using naked eye and microscope)
   a. Record information on data sheet
8. Make observations daily or at least 2-3 times per week for 3 weeks.

After 3 weeks:
Write a formal lab report; be sure to include the following:
   a. Description of the experimental set-up, including the need for the three jars.
   b. Data tables showing results from the 3 week period.
   c. Conclusions that discuss the possible reasons for their results and whether or not their results supported their hypotheses.

Teacher notes:
This activity will be ongoing for approximately 3 weeks; students will need to make daily observations in their log books or lab notebooks.
Encourage groups of students to simulate different environmental conditions such as light, dark, cold, hot, outside, colored bottles, contaminants (soil run off, oil, detergents, fertilizer) covered, not covered. You may want to include a graphic organizer at the end of the three weeks for students to compare and discuss the results under different conditions.
Discuss and assess the need for the three different jars in order to establish a control for the experiment.
Other Lab tips:
Use glass jars or plastic soda bottles
Tap water can be used if left out overnight
Use 1 dropper per jar, do not cross contaminate
Clean up of equipment each time is crucial.
Teacher note: the following activity is a possible alternate lab activity to show aquatic succession on a much larger scale and will likely take longer than 3 to 4 weeks to complete.

**Succession: Pond to Field**

**Objective:** Simulate the natural process of succession in a pond from aquatic to terrestrial ecosystem.

**Materials:**
- small clear plastic shoe box or small children’s pool
- sand
- soil
- Mulch
- seeds (grass, weeds, onion, alfalfa)
- straw/grass
- lawn clippings or leaf litter
- pond water
- rocks

**Methods:**

1. Add ½ inch sand across bottom of container.
2. Add 1 inch soil across top of sand.
3. Carefully pour four inches of pond water into container. Elevate one end to create a deep end and pond shore.
4. Document with photographs/sketches.
5. Allow to sit for two weeks, adding several handfuls of mulch.
7. After 2-3 weeks, add several handfuls of mulch and some seeds.
9. Observe the changes that occur over the next several weeks, as water evaporates organic matter decomposes and seeds grow.
10. Document with photographs/sketches.

**Culminating Activity**

1. Describe/diagram the stages of succession in a pond/lake.
2. Predict what might slow this process down.
3. Predict changes that may speed up this process.
Potato Osmosis

Problem: How do salt water and fresh water affect the movement of water in and out of a cell?

Materials: Two potato slices, two beakers, salt water, distilled or tap water (per lab group)

Procedures:

1. Place one potato in fresh water.
2. Place one potato in salt water.
3. Wait and observe the changes at least 20 min.
4. Record data (make a table).

Questions to Consider:

1. What happened to the potato in salt water?
2. What happened to the potato in fresh water?
3. What do we call the movement of water in and out of a cell?
4. Did water move in or out of the potato cells in salt water? Draw a diagram.
5. Did water move in or out of the potato cells in fresh water? Draw a diagram.
6. What is the term we use when too much water leaves a cell?
7. What do we call it when too much water enters a cell?
8. Which potato experienced plasmolysis?
9. Which potato experienced cytolysis?
Baggie Diffusion or Diffusion Through a Cell Membrane

Problem: Using a baggie, design an experiment to show how it can be used as a model for a cell membrane.

Possible Materials: Starch solution, glucose solution, water, glucose test strips, iodine solution, beakers, test tubes, two plastic fold over sandwich bags (per lab group)

Sample Procedures:

1. Label three beakers A, B and C.
2. Add 50 ml of water to each beaker.
3. Add 10 ml of iodine to beakers A and C.
4. Add 10 ml of starch to beaker B.
5. Put 10 ml starch in sandwich bag.
6. Twist tie shut and put in beaker A.
7. Put 10 ml iodine in another sandwich bag.
8. Twist tie shut and put in beaker B.
9. Put 10 ml starch in test tube and place in beaker C.
10. Allow to sit for 15 minutes.
11. Collect data and create a data table.
12. Write a lab report on your findings.

Questions to consider:

1. What does the plastic bag represent?
2. What is the purpose of the test tube in beaker C?
3. What diffused through the bag?
4. Explain how you know what diffused.
5. Was this active or passive transport?

Teacher note: Set up osmosis lab first, and then set up diffusion lab since they both have a wait time. Finish the osmosis lab while the diffusion lab is sitting. Quantities of materials may need to be adjusted depending on the materials available. Dialysis tubing is a very good semi or selectively permeable membrane that is often used in osmosis and diffusion labs. Be sure to follow appropriate safety guidelines for chemicals if iodine is used.
Osmosis/Diffusion Assessment/Activity

1. Diagram and describe the movement of molecules by diffusion using the terms below.

2. Diagram and describe the movement of molecules by osmosis using the terms below.

3. Diagram and describe the movement of molecules by active transport using the following terms.

High Concentration
Low Concentration
Equilibrium
Selectively Permeable Membrane
Osmotic Pressure
Solute
Solvent
Solution
Integral Protein (Channel)
Facilitated Diffusion
Active Transport
Energy Required
Energy Not Required

Teacher note: Osmosis/Diffusion Assessment
The teacher can have students select one of the three activities to complete and then come together as a class and discuss or some teachers may choose to make this an individual essay assignment. The terms listed are suggested; others may be included or the list may be omitted from the assignment.

Alternative Assessment Using the QX5 Digital microscopes:

Provide students with Elodea sprigs or onion skin along with a variety of salt solutions. Students should prepare a video clip of the cells in each of the following solutions:

- Hypertonic
- Isotonic
- Hypotonic

Students could also prepare a photo gallery of a representative cell in a “before” and “after” format for each of the solutions listed above.
Gummy Bear Osmosis

What will happen to a gummy bear if left in water overnight?

Procedures:
1. Students predict what will happen.
2. Make gummy bear measurements such as color, length, width, height, mass, volume, and density. Record data in table. Sample data table below.
3. Place gummy bear in a labeled cup of 50 ml of water and allow to sit overnight
4. Remove gummy bear from the water, repeat measurements and record.
5. Determine the change for each measurement and record.

<table>
<thead>
<tr>
<th>Experiment Data:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>Change</td>
</tr>
</tbody>
</table>

Questions to Consider:
1. Was your hypothesis correct? Why or why not?
2. Which change is greater, volume or mass? Explain.
3. Was there a change in density? Why?
4. How do your results compare to those of your classmates?
5. Was the amount of water gained by the gummy bear the same as the amount of water lost in the container? Explain.

Teacher Notes:
Test your gummy bears before trying the lab with your students. Some gummy bears do not absorb water as well as others. Encourage students to investigate further. Ask students to predict what will happen to gummy bears if left in water another day, or if different water temperatures are used. Allow them to investigate their predictions.
Cell membrane and cellular transport

Purpose: To show an understanding of how materials enter and exit the cell.

Language: phospholipids, protein channels, (transmembrane proteins) active transport, passive transport, ATP, osmosis, diffusion, facilitated diffusion, ion [solute] pump, endocytosis, exocytosis

Materials: activity sheet, textbooks, colored pencils or markers, household items

Items for cell model

Divide students into 6 groups. Assign each group a transport mechanism.
- diffusion
- osmosis
- facilitated diffusion
- ion pump
- endocytosis
- exocytosis

Procedures:
1. Research your topic using your textbook and other sources provided. Be sure to include the following information:
   - Is the transport mechanism passive transport or active transport?
   - Does material enter through the phospholipids, protein channels or use other means?
   - Does material move from hypertonic to hypotonic solutions or hypotonic to hypertonic solutions?
   - What is an example of the materials that may enter or leave the cell through this transport method?
   - Be able to explain how the transport mechanism works with an oral presentation and appropriate visual aid such as a poster.
   - Be able to demonstrate the transport mechanism by creating a 3D model of the cell membrane and the materials moving in or out of the cell. Your group should choose common household items to be the molecules and structures involved in the process.
   - Be able to explain why this mechanism is important and how the mechanism is applicable in today’s society.
2. You will have 2 class days to complete this project, and then oral presentations will begin. You will have a graphic organizer to complete while listening to the other class presentations.
3. Select two transport mechanisms and compare and contrast.

TEACHER NOTE: Students may need an example to get them started such as; design a way to get a piece of candy into a plastic bag without damaging the bag.

This is a good time for students to write a reflective paragraph critiquing his or her oral presentation and work. Ask them what they did well, what can they improve upon and, after seeing the class presentations, what would they have done differently.

Georgia Department of Education
Kathy Cox, State Superintendent of Schools
10/2/2006 2:45 PM Page 30 of 57
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# Graphic Organizer: Cellular Transport

<table>
<thead>
<tr>
<th>Transport Mechanism</th>
<th>Passive or Active Transport</th>
<th>Cell membrane component that molecules pass through. Example: phospholipids, protein, etc.</th>
<th>Direction molecules move into cells. Hypotonic to Hypertonic OR Hypertonic to Hypotonic</th>
<th>Brief description of mechanism</th>
<th>Example of materials that enter/exit cells using this mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diffusion</td>
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<tr>
<td>Osmosis</td>
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</tr>
<tr>
<td>Facilitated Diffusion</td>
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<tr>
<td>Ion pump</td>
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<tr>
<td>Endocytosis</td>
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<tr>
<td>Exocytosis</td>
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</table>
Teacher Notes: Introduction to Homeostasis Project

This activity is designed to show students that homeostasis is a necessary function of life in all organisms. Students will be given examples and scenarios from all kingdoms to research and report on. You can start the lesson by explaining common examples of homeostasis found in human body systems. Then, encourage students to relate these examples to common organisms found in other kingdoms.

Lesson Hook:
Access prior knowledge of homeostasis by asking students the following questions:

   How does a human being cool down on a hot day? A dog? A snake?
   How does a cow take in water? Lose water? An oak tree? A paramecium?

You may want to make it a textbook scavenger hunt and have students compete against each other to answer the questions.

After a class discussion on homeostasis; explain to your students that they will be conducting a research activity looking at how different organisms in the different kingdoms maintain homeostasis. You can take time to review the 6 kingdoms or refer students to the Kingdom Wall made in the Organization Unit.

Differentiation on topics
You can have students look at a particular homeostatic process such as nutrient uptake and removal in the different kingdoms OR
Have students research different organisms, recognize a homeostatic process and research it OR
give students a list of scenarios or organisms to research. A sample list is provided.

Differentiation of Assessment
To increase writing in the classroom, a one-page paper can be required from each student as well as a group project of a poster.
A gallery walk with a graphic organizer will ensure students are exposed to a variety of examples of homeostasis in all kingdoms.
A reflective paragraph based on their performance is a good way to encourage students to critique their work.
Ticket out the Door questions or an essay quiz about homeostasis is also a good way to see if the concept of homeostasis was understood.
Homeostasis Project

Purpose: To demonstrate knowledge of the homeostatic process.

Materials: Activity sheet and rubric, graphic organizer, textbooks, online material and other resource materials, poster-board, markers and/or colored pencils

Groups: Groups of six. Each student will research a different organism in one of the six kingdoms

Procedures:

1. Each member of the group will research examples of homeostatic balance and homeostatic imbalance. Once you are given your kingdom, you will regroup into a kingdom group. Each person in the kingdom group (Fungi Friends, Protists Pals, etc.) should pick a different organism and/or scenario to research.

2. You will be asked to write a one-page paper explaining how the organism maintains homeostasis and what happens to the organism when homeostasis is not maintained. You should have at least two sources for the paper.

3. When the research and paper are complete, students will regroup into their original groups. Each group will create one poster showing examples of different organisms in homeostatic balance and imbalance. Each student summarizes their research onto note cards and includes an illustration. Each Kingdom (and student) in the group should be represented on the poster.

4. Once the posters are hung in the room, hall etc, each student should complete a graphic organizer by reading each poster and identifying the homeostatic mechanism for each example.

Possible scenarios to consider:

1. Human Body Temperatures. (Kingdom Animalia)
   The normal human body temperature is 37°C. This represents the optimum enzyme activity within the body. Explain the mechanism and reason the body temperature will rise to 39°C when some systemic or superficial infections occur.

2. E coli Bacteria in different environments (Kingdom Eubacteria)
   Geese release feces into the local lake. The normal bacterial organism, E. coli, found in the gut of the geese will go from a hypertonic environment (the gut) into a hypotonic environment (the lake). E. coli survives well in both environments. Use your knowledge of osmosis in a cell; explain how homeostasis is maintained in E. coli from this example.

3. Amoeba or Paramecium (Kingdom Protista)
   When a human stays too long in the bathtub, their fingers become wrinkled. Explain how protists such as the amoeba and the paramecium live in an aquatic habitat and maintain their cell integrity. Explain what will happen if this mechanism does not work properly.
4. Salmon spawning (Kingdom Animalia)
   Several species of aquatic organisms can live in a salt water environment and a fresh
   water environment. Salmon, for example, migrate from their principle ocean habitat into
   a secondary freshwater habitat for spawning. Considering the osmotic effects on cells in
   different water habitats, explain homeostasis (osmoregulation) in the salmon.

5. Psychrophiles (Kingdom Archeabactria)
   What extreme environments would you find these bacteria in and what allows them to
   leave there? (Hint: natural antifreeze)

6. Plant transpiration (Kingdom Plantae)
   Describe the process of homeostasis in a plant leaf. Use the stomata of the plant leaf to
   describe plant transpiration.

7. Bacteria’s natural enemy (Kingdom Fungi)
   Explain how some fungi have a natural ability to defend against bacteria in their habitat.
   Be able to explain the defense mechanism involved, the specific organisms with this trait
   and how humans were able to capitalize on this trait.

8. Blood sugar (Kingdom Animalia)
   Explain what happens to your blood sugar immediately after, and for several hours after,
   eating a meal. How is this different for a person who has diabetes?

9. Halophiles Habitat (Kingdom Archeabacteria)
   Be able to explain how these bacteria are able to live in brine pits that have a salt content
   that is 10X the concentration found in ocean water.

10. Euglena (Kingdom Protista)
    How are euglena capable of obtaining food in any situation? What is the purpose of the
       eyespot?

11. Cellular Respiration (Kingdom Plantae)
    Since plants are autotrophs, how and why do they carry out cellular respiration and how
    does this process benefit the plant?

12. Plant Tropisms (Kingdom Plantae)
    Explain what happens when seeds germinate and begin to grow into young plants. How
    do the roots grow downward and the shoots grow upward against the force of gravity and
    toward the sun?
Example of organism and homeostatic mechanism

<table>
<thead>
<tr>
<th></th>
<th>Poster 1</th>
<th>Poster 2</th>
<th>Poster 3</th>
<th>Poster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom Archeabacteria</td>
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<tr>
<td>Kingdom Eubacteria</td>
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<td>Kingdom Protista</td>
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<td>Kingdom Fungi</td>
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<tr>
<td>Kingdom Plantae</td>
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<tr>
<td>Kingdom Animalia</td>
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Natura lSelection Cloze

Teacher Note: This is intended to help students learn key terms associated with natural selection and be able to link the concepts together. If students are not familiar with a Cloze, give them the sample Cloze provided. This will give them an example to guide them and help them review the concepts of Darwin’s work. Be patient, it will be difficult for students to link concepts together, especially if this is a new task. Provide plenty of feedback and allow students to work in small groups if you are comfortable with that. Do not settle for 15 sentences of definitions as you should see several sentences linking the concepts together.

Sample Cloze: Place these words in the appropriate blank in the cloze:

species fitness fittest evolution suited

Charles Darwin is best known for his work on the Theory of _________________. His most famous work is the book, Origin of the _________________. Darwin stated that some organisms have traits that are better ________________ to the environment; he called this advantage a high degree of _________________. It is often referred to as survival of the _________________.

You and your partner should use the following words to create a Cloze. You need to show an understanding of the terms and be able to link to concepts together. Read through the rubric provided and use your textbooks to gather information on the terms listed below to create a Cloze that other students will complete.

Terms:
1. natural selection 6. descent with modification 11. variation
2. fitness 7. speciation 12. mutations
3. adaptation 8. extinction 13. genetic recombination
4. traits 9. homologous 14. genetic drift
5. survival of the fittest 10. vestigial 15. reproductive isolation
Extinction and Speciation - Venn Diagram

Teacher Note: Use a Venn diagram to have students review the concepts presented in class or in written material. You can give students a list of words or just give them the concept to make their own.

Make a Venn diagram comparing and contrasting extinction and speciation

Extinction                                      both                                      Speciation
{differences}                                  {same}                                   {differences}
Population Genetics KIM Diagram

Complete the graphic organizer for language used in the study of populations

<table>
<thead>
<tr>
<th>Key term</th>
<th>Illustration</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exponential growth</td>
<td></td>
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<tr>
<td>Logistic growth</td>
<td></td>
<td></td>
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<tr>
<td>Carrying capacity</td>
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</tr>
</tbody>
</table>
Activity: Population Trends

**Purpose:** To demonstrate understanding in population models and graphing techniques.

**Materials:** Lab paper & graphing paper

**Procedures:**
1. Make a graph for each of the populations below. Be sure to label the X and Y axis and time. ALSO be sure to have a key for the graph
2. Use the graphs to answer the following questions

**Data Table:**

<table>
<thead>
<tr>
<th>Days</th>
<th>Number of Fruit Flies</th>
<th>Generations</th>
<th>Number of Rabbits</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>10</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>10</td>
<td>15</td>
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<td>200</td>
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<td>72</td>
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<td>35</td>
<td>320</td>
<td>93</td>
<td>950</td>
</tr>
<tr>
<td>40</td>
<td>320</td>
<td>100</td>
<td>1100</td>
</tr>
</tbody>
</table>

**Questions:**
1. What type of growth pattern is exhibited by the fruit fly population, exponential or logistic? ____________________________________________________________________________

2. What type of growth pattern is exhibited by the rabbit population, exponential or logistic? ____________________________________________________________________________

3. Are the two growth patterns the same? Why or Why not?

4. Does either graph indicate if there is a carrying capacity for the population?

5. When does this population reach its carrying capacity?

6. What is the maximum number of individuals that can be supported at that time?

7. Animals such as foxes and cats often prey on rabbits. Based on the growth curve of the rabbit population, what might have happened if a group of predators moved into the rabbit's habitat during the tenth generation?
Symbiosis RAFT

PURPOSE: To understand that organisms have complex relationships with other organisms within an ecosystem and when one is disrupted, the other is also affected.

KEY TERMS: symbiosis, mutualism, commensalisms, parasitism, predation, predator, prey

PROCEDURE:
1. Use your textbook and internet sources to find the meaning and examples of different relationships
2. Complete the graphic organizer
3. Write a letter using the RAFT method by choosing one of the relationships and examples from the graphic organizer.

RAFT
Role – You are the head of an environmental group.
Audience - You are writing a government agency (or company) in a county located in your biome.
Focus – There has been a problem with one of the organisms in a symbiotic relationship. Describe how the decline in the population of one organism in the relationship can affect the other organism and the ecosystem. Be sure to describe and graph to illustrate the populations in your letter.
Task – Write a letter and create a graph describing the problem.

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Meaning</th>
<th>Benefits …</th>
<th>Organisms are called</th>
<th>Examples</th>
</tr>
</thead>
</table>
| Symbiosis    | A close relationship between two organism of different species | one or both | n/a | Mutualism  
Commensalisms  
Parasitism  
Predation |
| Mutualism    | | | n/a | |
| Commensalism | | | n/a | |
| Parasitism   | | | | |
| Predation    | | | | |
Laboratory experiences are an important part of science education. These experiences in the classroom allow students the opportunity to practice the processes of scientific inquiry in order to promote scientific literacy and problem solving skills necessary to develop an understanding of scientific concepts. Skills employed while doing lab include reading, writing and critical thinking as well as the appropriate use of laboratory equipment, precision and accuracy of measuring and organizing data.

For this class you will be required to keep a lab notebook. The lab notebook will be stored in the classroom and will be used for all labs.

**Lab Focus Question:**
What is the purpose of this lab? Why is the lab being done? The lab group is responsible for developing an appropriate lab focus question.

**Lab Procedure:**
You are expected to write a descriptive paragraph explaining how the lab was conducted. You may not use any personal pronouns such as I, we, us, etc. The narrative should contain only that information a reader would need to be able to explain how the lab was conducted. Be sure to include all equipment and/or solutions, chemicals, etc., needed to complete the lab. Make sure that no “understood” procedures are included (i.e. materials were gathered).

**Lab Questions:**
You are expected to answer all questions in a lab. The questions should be answered in complete sentences and be correct. Calculations, when required, are clearly shown. Specific formulas or equations for reaction during the lab are shown.

**Safety:**
All safety procedures are expected to be followed and all safety equipment is expected to be worn while anyone in the lab is still working.

**Work Ethic:**
Group works together cooperatively, is continually on-task and all members of group are participating. There is no horseplay or wasted time.

**Format:**
Blue or black ink is recommended with no whiteout. Proper spelling and grammar is followed and no 1st or 3rd person personal pronouns are used. Conclusion is written in such a way that lab focus question is easily identifiable. All sections are written in proper paragraph form, (remember, one sentence is not a paragraph).

**Conclusion:**
The conclusion should be written in paragraph form and should answer the lab focus question using data obtained as supporting evidence. Be sure to identify the data as either qualitative or quantitative or both. Also, explain how the skills and concepts studied in today’s lab are relevant in today’s society.
### Lab Rubric:
#### Lab Focus Question:

<table>
<thead>
<tr>
<th>Teacher</th>
<th>Criteria</th>
<th>Peer</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>Present and relevant to the topic</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Present and closely related to the topic</td>
<td>5</td>
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<tr>
<td>0</td>
<td>Absent or not directly related to the topic</td>
<td>0</td>
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</table>

**Lab Procedure:**

| 5       | Written as a descriptive paragraph with relevant steps and materials included | 5   |
| 3       | Written as a list with relevant steps and materials included | 3   |
| 0       | OR Written as a paragraph but missing relevant steps and or materials | 0   |

**Lab Results:**

| 5       | All results are clearly written; proper units are used when necessary | 5   |
| 3       | Results are present, some without proper units or some results are missing | 3   |
| 0       | No results are included OR less than 50% of the results are included | 0   |

**Lab Questions:**

| 5       | Answered in complete sentences, calculations, when required are clearly shown; specific formulas or equations for reactions during the lab are shown | 5   |
| 3       | Answers not in complete sentences, most calculations, formulas or equations are shown OR less than 80% of these are shown correctly | 3   |
| 0       | Answers, calculations formulas and/or equations missing OR less than 50% of these are shown directly. | 0   |

**Safety:**

| 5       | All safety procedures were observed; all safety equipment was used correctly; group was not cited for a safety violation | 5   |
| 3       | Safety procedures were observed, safety equipment was used; group cited for ONE safety violation. | 3   |
| 0       | Safety procedures were not observed; safety equipment was not used; group was cited for more than one safety violation. | 0   |

**Lab Conclusion:**

| 10      | Written in paragraph form answering the lab focus question using data as supporting evidence, also explains how the information discovered in the lab is applicable in today’s society, data is identified as either qualitative or quantitative | 10   |
| 5       | Paragraph format absent but lab focus question is addressed using appropriate data OR paragraph format present and application to today’s society is missing OR data is not properly identified as qualitative or quantitative | 5   |
| 0       | Paragraph format absent, lab focus question is not addressed using appropriate data and application to today’s society is missing and data is not identified as qualitative or quantitative | 0   |

**Format:**

| 5       | Neatly presented, uses appropriate grammar, and adheres to format. | 5   |
| 3       | Neatly presented, few grammar mistakes, minor format mistakes | 3   |
| 0       | Neatness absent, frequent grammar mistakes, does not follow format | 0   |

**Work Ethic:**

| 5       | Group is on task; no horseplay; works cooperatively; all members actively participate | 5   |
| 3       | Group is redirected one time; 80% of members work cooperatively and actively participate | 3   |
| 0       | Group is redirected more than one time, 50% of members work cooperatively and actively participate. | 0   |

**Total points earned = Lab grade**
Town Hall Meeting Project

You live in a quiet semi-rural wooded housing development. Your neighbors are friendly and the community often participates in outdoor cookouts and nightly activities. Farming and horticulture are major occupations and sources of income in the area. Also located in the woods is a population of deer. You and your neighbors enjoy watching the deer in the cool of the evening.

Recently, an out of state power company has asked to move a coal fired electric plant onto forested land adjacent to the neighborhood. Local city and county officials are in favor of the proposed power plant. Government officials feel the power plant will be a boost for the local economy. The plant opening will create many new jobs in the area.

The following information has been released about the power company:

- The company is owned by a conglomerate in another state.
- None of the electricity produced by the power company will be used in your area. The electricity produced will be channeled to critical areas in another part of Georgia due to their high population (thus higher need).
- Most jobs are highly skilled. Some will require training in coal fired electrical production.
- Due to security, the plant will have large security lights on all night around the plant.
- Power lines will run in all directions from the power plant.
- From time to time a warning whistle will blow to warn workers of certain operations occurring at the plant.

You will be assigned a role and must prepare for a debate. You must research the following in preparation for the debate:

- The habitat and needs of the white-tailed deer.
- How a coal fired electric plant operates and its effect on the environment.
- Local laws concerning zoning for businesses.

Project Requirements:

1. Write a minimum of 1 page (typed, double-spaced, 12 pt font) about the white-tailed deer’s habitat and needs. Explain what would happen to the ecosystem if the deer population decreased due to the habitat destruction.
2. Write a minimum of 2 pages (typed, double spaced, 12pt. font) about coal fired electric plants. Include how they operate and how they affect the environment. You may draw a diagram of the coal fired electric plant for 5 bonus points.
3. Write a minimum of 1 page (typed, double spaced, 12 pt font), summarizing the zoning laws for businesses in your area.
4. Write a position paper to explain your viewpoint (based on the role you have been assigned) on the building of the power plant. In your paper you need to cite the information you have uncovered in steps 1-3.
5. Be prepared to state your position on the building of the power plant before the city council. Your objective is to ensure the city council will rule in favor of your
position on the building of the power plant. Use the information you have researched to justify your position.

6. Even though you will be working as a group, each participant in the group is required to contribute (meaningfully) during the debate.

Groups:
Local businesses
Neighborhood representatives
Power Company
Department of Natural Resources
Cellular Biologists
Property owner of the proposed site of the power plant
City Council members
Sample Summative Assessments – Equilibrium Essay Questions

I. Equilibrium – Choose two examples of equilibrium/homeostasis, one at the micro level and one at the population level or higher. Compare and contrast the two on at least 3 aspects of maintaining a steady state.

II. Choose an ecosystem, food chain or food web and describe the changes that would take place over time following a major event or disturbance in their environment. Examples: natural disaster, disease, introduced predator or competitor, habitat destruction, loss of a food source, toxin introduction, over-population, over-hunting, fishing, etc.

III. A population of deer lives in a national park area in your community. Describe changes that could take place in this deer population if the trees were removed and replaced by edible shrubs that never grow more than five feet tall. Assume the population survives for at least 30 generations (a long time). Also, because of the tree removal, rainfall changes from 30 inches per year to 10 inches per year, making water scarcer.
Sequence of Activities, Tasks and Assessments for Equilibrium: Table Version

<table>
<thead>
<tr>
<th>Day</th>
<th>Characteristics of Science and Content Standards</th>
<th>Enduring Understandings</th>
<th>Teacher and Student Activities/Tasks</th>
<th>Assessments</th>
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| 1   | SB1d, SB3b, SCSh1a,b, SCSh2a,b,c, SCSh3a,b,c, SCSh4a, SCSh5c,d, SCSh8a, SCSh9a,c,d | • Environmental conditions affect organisms at cellular levels.  
• Organisms respond to internal changes and external stimuli to maintain homeostasis. | • Operation Cat Drop Hook (page 20-21)  
• KWL cellular transport language pre-assessment  
• Gummy Bear prediction and data collections Gummy Bear Osmosis (page 29)  
• Set up aquatic succession lab Aquatic Succession (page 24) | • Journal observation  
• Responses to KWL  
• Predictions |
| 2   | SB1d, SB3b, SCSh1a,b,c, SCSh2a,b,c, SCSh3a,b,c,d,e,f, SCSh4a, SCSh5c,d, SCSh6a,b,c, SCSh7d,e, SCSh8a,b,c | • Environmental conditions affect organisms at cellular levels.  
• Organisms respond to internal changes and external stimuli to maintain homeostasis. | • Gummy Bear observations and data collection  
• Osmosis/Diffusion discussion and Venn Osmosis Venn (page 22)  
• Osmosis Experiment  
• Alternate activities: Baggie Diffusion (page 27) Potato Osmosis (page 26)  
• Succession Observations | • Student responses  
• Venn diagrams  
• Lab report |
| 3   | SB1a,d, SB3b, SB4e,f, SCSh1a,b,c | • Regardless of cell type, cellular components function together to maintain homeostasis.  
• Environmental conditions affect | • 10-2 Lecture on Cell membrane structure and transport  
• Cellular Transport KIM Cell_Transport_KIM (page 23) | • KIM responses  
• Osmosis TOD  
• Lab report |
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<td><strong>Organisms at cellular levels.</strong></td>
<td><strong>Succession Observations</strong></td>
<td><strong>Osmosis Ticket out the Door</strong></td>
<td><strong>Monitor student groups</strong></td>
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<td><strong>Osmosis Diffusion Assessment</strong> (page 28)</td>
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<td>6</td>
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<td>• The regulation of cell functions through the expression of genes</td>
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<td>Student responses on graphic organizer</td>
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<td>Reflective paragraph</td>
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<td>- Environmental conditions affect organisms at cellular levels.</td>
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<td>Aquatic Succession</td>
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| 10  | Species evolve over time.  |
| SB5b,d,e | - Evolution is a gradual process.  |
| SB4e,f | - Natural selection is a primary factor in evolutionary change.  |
| SCSh1a,b,c | - Evolution is a consequence of the interactions of:  |
| SCSh7a,b,c,d,e |   - the potential for a species to increase its numbers.  |
| SCSh8b,c,d,e,f |   - the genetic variability of offspring due to mutations and recombination.  |
| SCSh9a,c,d |   - a finite supply of resources required for life.  |
| Natural Selection Discussion |   - the selection by the environment of those offspring better able to survive and leave offspring.  |
| Natural_Selection_Cloze (page 36) |  |
| Succession Observations |  |
| Student Responses |  |
| Cloze |  |
| 1 | SB5b,d,e, SB4a,e,f, SCSh1a,b,c, SCSh2a,b,c, SCSh3a,b,c,d,e,f, SCSh4a,b, SCSh5a,b, SCSh6a,b,c,d, SCSh8a,b,c | • Diversity among organisms is due to adaptations to changing environmental conditions. |  |
| 11 | Students design Adaptation/Predator Prey Lab, Succession Observations | Lab Report |

| 2 | SB5b,d,e | • Species evolve over time |  |
| 12 | | • Evolution is a gradual process |  |
|  | | • Natural selection is a primary factor in evolutionary change |  |
|  | | • Evolution is a consequence of the interactions of |  |
|  | | o the potential for a species to increase its numbers |  |
|  | | o the genetic variability of offspring due to mutations and recombination |  |
|  | | o a finite supply of resources required for life |  |
|  | | o the selection by the environment of those offspring better able to survive and leave offspring |  |
|  | | • Organisms are interdependent on each other and their environment |  |
|  | | • Diversity among organisms is due to adaptations to changing environmental conditions |  |
|  | | • Extinction and Speciation |  |
|  | | • Student |  |
| 13 | SB4a,e,f  
|    | SB5d,e  
|    | SCSh1a,b,c  
|    | SCSh3c,d,e,f  
|    | SCSh4b,c  
|    | SCSh5d  
|    | SCSh6a,b,c,d  
|    | Evolution is a gradual process  
|    | Natural selection is a primary factor in evolutionary change  
|    | Evolution is a consequence of the interactions of  
|    | o the potential for a species to increase its numbers  
|    | o the genetic variability of offspring due to mutations and recombination  
|    | o a finite supply of resources required for life  
|    | o the selection by the environment of those offspring better able to survive and leave offspring  
|    | Diversity among organisms is due to adaptations to changing environmental conditions  
|    | Ecosystems result from dynamic relationships between organisms and their environment  
|    | Organisms are interdependent on each other and their environment  
|    | Diversity among organisms is  
|    | Ecological organization review  
|    | Population lecture and KIM  
|    | Population trend graphing lab  
|    | Succession Observations  
|    | TOD: Carrying Capacity for Human Population  
|    | Student responses  
|    | KIM answers  
|    | Lab report  
|    | TOD  
| 13 | SB4e,f  
|    | SCSh1a,b,c  
|    | SCSh7a,b,c,d,e  
|    | Evolution is a gradual process  
|    | Natural selection is a primary factor in evolutionary change  
|    | Evolution is a consequence of the interactions of  
|    | Extinction and Speciation Venn  
|    | Cat Drop assessment: Evolution Level  
|    | Succession Observations  
|    | Venn diagrams  
|    | Cat Drop answers  

Georgia Department of Education  
Kathy Cox, State Superintendent of Schools  
10/2/2006 2:45 PM Page 51 of 57  
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<table>
<thead>
<tr>
<th>Page</th>
<th>SB4a,e,f SB5d,e SCSH1a,b,c SCSH9c,d</th>
<th>due to adaptations to changing environmental conditions</th>
<th>Symbiosis_Raft (page 40) Succession Observations</th>
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<tr>
<td>14</td>
<td>SB5b,e SB4a,c,d,e,f SCSH1a,b,c SCSH2a,b,c SCSH3a,b,c,d,e,f SCSH4a,b SCSH6a,b,c,d SCSH7d,e SCSH8a,b,c,d,e,f</td>
<td>Ecosystems result from dynamic relationships between organisms and their environment Organisms are interdependent on each other and their environment Diversity among organisms is due to adaptations to changing environmental conditions</td>
<td>10 – 2 Succession Lecture Complete Aquatic Succession lab and write a formal lab report</td>
<td>Student responses Lab report</td>
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<td>15</td>
<td>SB4a,c,d,e,f</td>
<td>Evolution is a gradual process Human activities and natural phenomena disrupt the homeostatic nature of the environment Ecosystems result from dynamic relationships between organisms and their environment Organisms are interdependent on each other and their environment Diversity among organisms is due to adaptations to changing environmental conditions</td>
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<td>16</td>
<td>SB4a,c,d,e,f SB5b,d,e SCSH1a,b,c SCSH6c,d</td>
<td>Human activities and natural phenomena disrupt the homeostatic nature of the environment</td>
<td>Natural disaster video Whole group discussion of recent disasters Group research on disasters to</td>
<td>Student responses</td>
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<tr>
<td>17</td>
<td>SB4a,c,d,e,f</td>
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<td>SB5b,d,e</td>
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- Ecosystems result from dynamic relationships between organisms and their environment
- Organisms are interdependent on each other and their environment
- Diversity among organisms is due to adaptations to changing environmental conditions

- Evolution is a gradual process
- Human activities and natural phenomena disrupt the homeostatic nature of the environment
- Ecosystems result from dynamic relationships between organisms and their environment
- Organisms are interdependent on each other and their environment
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- Natural disaster project continued
- Presentations and completion of graphic organizers

- Presentations
- Graphic Organizers

- Presentations
- Glaze Doughnut Activity for Human Impact

- Natural disaster presentations continued
- Glaze Doughnut Activity for Human Impact

- Presentations
- Glaze Doughnut results
<table>
<thead>
<tr>
<th>Homeostatic nature of the environment</th>
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<tbody>
<tr>
<td>• Ecosystems result from dynamic relationships between organisms and their environment</td>
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<tr>
<td>• Organisms are interdependent on each other and their environment</td>
</tr>
<tr>
<td>• Diversity among organisms is due to adaptations to changing environmental conditions</td>
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<thead>
<tr>
<th>Regardless of cell type, cellular components function together to maintain homeostasis.</th>
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<tr>
<td>• Environmental conditions affect organisms at cellular levels.</td>
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<tr>
<td>• Organisms respond to internal changes and external stimuli to maintain homeostasis.</td>
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<td>• Natural selection is a primary factor in evolutionary change</td>
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<td>• Evolution is a consequence of the interactions of</td>
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<td>o the potential for a species to increase its numbers</td>
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<td>o the genetic variability of offspring due to mutations and recombination</td>
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<thead>
<tr>
<th>Current event reading on DDT use in Africa</th>
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<tbody>
<tr>
<td>• Cat Drop Assessment – Ecological Level- Students produce and present media presentation of potential and realized effects of DDT use in Community</td>
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<tr>
<th>Cat Drop assessment</th>
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<tbody>
<tr>
<td>19-20 SB1a,b,d SB2b SB3b SB4a,c,d,e,f SB5d,e SCSh1a,b,c SCSh6c,d SCSh7a,b,c,d,e SCSh9a,c,d</td>
</tr>
</tbody>
</table>

Georgia Department of Education
Kathy Cox, State Superintendent of Schools
10/2/2006 2:45 PM Page 54 of 57 All Rights Reserved
- A finite supply of resources required for life
- The selection by the environment of those offspring better able to survive and leave offspring
  - Human activities and natural phenomena disrupt the homeostatic nature of the environment
  - Ecosystems result from dynamic relationships between organisms and their environment
  - Organisms are interdependent on each other and their environment
  - Diversity among organisms is due to adaptations to changing environmental conditions

21-23
| SB1a,b,d | SB2b |
| SB3b | SB4a,c,d,e,f |
| SB5b,d,e | SCSh1a,b,c |
| SCSh6c,d | SCSh7a,b,d,e |
| SCSh8c,f,e | SCSh9a,c,d |

- Regardless of cell type, cellular components function together to maintain homeostasis.
- Environmental conditions affect organisms at cellular levels.
- The regulation of cell functions of genes (enzymes) allows cells to respond to the environment.
- Organisms respond to internal

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<thead>
<tr>
<th>Town Hall Meeting Introduction, preparation and presentation</th>
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<tbody>
<tr>
<td>Town_Hall_Meeting (page 43-44)</td>
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<tr>
<td>Summative Assessment Sample essay questions attached</td>
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<tr>
<td>Summative_Assessments (page 45)</td>
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</tbody>
</table>

- Monitor Student discussion
- Presentations
changes and external stimuli to maintain homeostasis.
- Species evolve over time
- Evolution is a gradual process
- Natural selection is a primary factor in evolutionary change
- Patterns of evolution vary and can be impacted by human activities
- Evolution is a consequence of the interactions of
  - the potential for a species to increase its numbers
  - the genetic variability of offspring due to mutations and recombination
  - a finite supply of resources required for life
  - the selection by the environment of those offspring better able to survive and leave offspring.
- Human activities and natural phenomena disrupt the homeostatic nature of the environment
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