

QuEST

(Quality English and Science Teaching)

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Study Goals

- The overarching goal of the study is to improve the science knowledge of middle grade students and concurrently build their language and literacy skills.
- Major strand of the National Research and Development Center on English-language Learners—CREATE

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QuEST Overview

- First year
 - Pilot testing in six middle-grades classrooms
 - Focus on Earth, Moon, and Sun
 - Collaboration with mainstream science teachers, ESOL specialists, and special education teachers
 - Heterogeneous classrooms composed of ESOL students, native English-speakers, and special education students
 - Community predominantly English speaking with small groups of second-language learners sprinkled throughout classrooms in select schools

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QuEST Overview

- First year
 - Successful elements: cooperative grouping ; ESOL students paired with native-English speakers; use of glossaries with visuals to build general academic and discipline-specific vocabulary; focus on science with explicit attention to building language and writing skills of all students (e.g., questioning the author techniques); alignment with district curriculum; bilingual student materials
 - Lessons learned: need for project staff with deep science expertise; importance of hands-on activities to build conceptual knowledge; focus on over-arching questions in guided reading; need for materials for ESOL specialists aligned with the mainstream classroom instruction

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QuEST Overview

- Second year
 - 10 sixth grade science teachers in five middle schools, teaching 2 classes using QuEST curriculum and 2 classes using regular district curriculum (Prentice Hall). Within teacher, classes were randomly assigned to QuEST or regular curriculum
 - Two 6-week units focused on Living Systems and Environment, aligned with state and district standards
 - Major focus on teaching science and in that context, ensuring ELLS understood the grade-level lessons
 - Focus on building all students' language and literacy skills
 - Significant amount of professional development and mentoring
 - Community in which 98% of students are Latino and come from Spanish-speaking homes

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QuEST Integrates

- Science
- Language and Literacy Development, including writing
- Student Learning Strategies
- Motivation
- Teacher collaboration
- Professional development and mentoring



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Science TEKS Standards

- Force, Motion, and Energy (6.6B; 6.9A)
- Earth/Space (6.14B;6.5B;6.13A,B;6.5B)
- Living Systems and Environment (6.10 B,C)
- Living Systems and Environment (6.11A,B,C)

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Language and Literacy TEKS Standards

- Language Arts Standards (Chapter 110.22)
- English as a Second Language (Chapter 128.22)
 - Listening/speaking
 - Reading
 - Writing
 - Viewing

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QuEST: Student Learning Strategies

- **Word Knowledge**
 - Students learn to use context to clarify meaning of unfamiliar words
 - Students learn to use knowledge of cognates, root words, prefixes, and suffixes to understand word meaning
 - Students learn to use dictionary, glossary, thesaurus, and other word reference resources
- **Knowledge of the syntax of science**
 - Students become familiar with syntax typical of science (e.g. nominalization, use of passive tense)
- **Comprehension Monitoring and Repair**
 - Students become aware of when and where they are having difficulty and what to do about it
- **Question Generation**
 - Students learn how to generate and find answers to their own questions
- **Summarization**
 - Student learn integration and generalization of information

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QuEST: Writing Skills

- Students write for a variety of purposes
 - Comparison Writing
 - Explanatory Writing
 - Informational writing
 - Persuasive writing
- Students revise for composition and written expression (grammar, mechanics, spelling, and sentence structure)

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QuEST: Motivation

- Maximizing hands on experiences
- Optimizing student choice (e.g. choice of which cell type to explore)
- Embedding comprehension strategies in content
- Promoting student collaboration

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QuEST: Support for ESOL students

- Hands-on activities
- Guided reading of student selection
- Development of technical and academic vocabulary
- Bilingual materials
- Student-to-student support

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QuEST Curriculum Cycle

Weekly Cycle

- Days 1-4
 - Warm Up
 - Presentation and application
(hands-on science activity days 1, 2, and 3)
 - Guided reading (Days 1 and 3)
 - Language arts (Day 4)
 - Wrap up
- Day 5
 - Assessment (Week 1, vocabulary; Week 2, science)



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Presentation and Application

QUEST: Week Five, Day Five
Teacher Lessons

Week Five, Day One

Topic: Inside Cells
TEKS 6.10b
Science Explorer pages 142-143

Preparation

- Copy student activity charts and make one teacher copy of each chart to use with the Elmo.
- Read and follow the preparation listed on page 148 of the teacher's guide for A Magnified View of Life.
- Make sure you have fresh Elodea plants and prepared slides of animal cells

Materials

- Student activity charts and teacher copy for Elmo
- Plastic dropper
- Water
- Microscope slide
- Microscope
- Forceps
- Cover slips
- Elodea
- Colored pencils
- Prepared slides of animal cells

Introduction

1. **Student Activity A:** Show What You Know Quiz
2. **Student Activity B:** Warm-Up - have students respond to the question "Plant cells have a cell wall which supports and protects the plant cell. Why do you think animal cells don't have a cell wall?" Discuss responses.

[Expected Response: students should say that most animals have something else that provides them with structure, like a skeleton (an internal or exoskeleton), or they may say that some animals or other non-plant cells are unicellular and do not need that type of support.]

QUEST: Week Five, Day Five
Teacher Lessons

Application

1. **Student Activity C:**

Review the instructions for A Magnified View of Life with students. See student activity charts for lab procedure. The lab was adapted from *Unit 2 Resources*, page 28. Make sure students know what diagrams and questions to complete. Review the rules of microscope use and the techniques for using a microscope.

2. Have students complete the lab.

Wrap-Up

1. **Student Activity D:** Students respond to the question "What are the main differences between plant and animal cells?" Discuss as time permits. You may want to post the differences in a prominent place to refer to during the rest of the cell unit.

[Expected Response: plant cells have chloroplasts and cell walls. Animal cells do not. Plant cells are usually rectangular in shape, while animal cells are often round.]

2. **Student Activity E:** Introduce Academic Words Glossary Part One homework.

Application



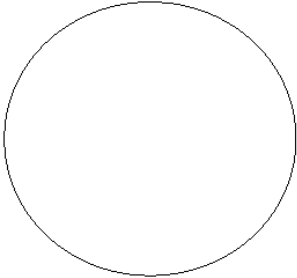
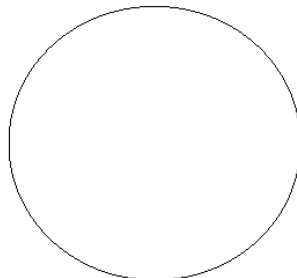
Student Activity C

A MAGNIFIED VIEW OF LIFE

Follow the steps below to observe and record characteristics of plant and animal cells.

Part One: Observing Plant Cells

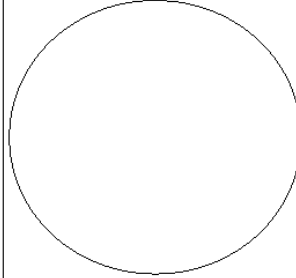
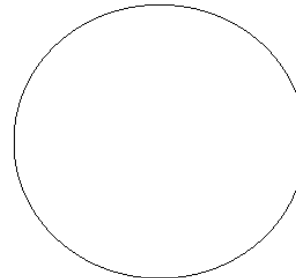
1. Place a drop of water in the center of a slide
2. With forceps, remove a leaf from an Elodea plant. Place the leaf in the drop of water on the slide. Make sure that the leaf is straight and flat.
3. Put a coverslip on the leaf. If there is a bubble, tap the slide very gently to get rid of it.
4. Use a microscope to examine the Elodea leaf under low power. Then, carefully switch to high power.
5. In the space below, draw and label what you see under low power and high power, including the colors of the cell parts. Give your drawing a title and record the magnification. Make sure you include the power in your title as well.

 Total Magnification: _____	 Total Magnification: _____
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6. Remove the leaf and discard it according to your teacher's directions.
7. Clean and dry your slide and coverslip.

Part Two: Observing Animal Cells

1. Put a prepared animal slide under the microscope.
2. Observe the animal cell under low power and high power.
3. In the space below, draw and label what you see under low power and high power. Make sure you remember to label the organelles that you see. Give your drawing a title and record the magnification. Make sure you include the power in your title as well.

 Total Magnification: _____	 Total Magnification: _____
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Application

Part Three: Thinking About Observations.

Answer the questions below.

1. What natural color appeared in the plant cells? What structures give the plant cells this color?

2. Why is it important to record your observations while you are examining a specimen?



Student Activity D

WRAP UP

What are the main differences between plant and animal cells?



Student Activity E

GLOSSARY HOMEWORK

Complete Week 5 Academic Words Glossary, Part One. For each word, read the definition, and then write a sentence using that word.

Sample—Guided Reading Student Sheet

QUEST: Week Seven, Day Four
Student Activities A-B, Student Chart and Teacher Copy



Student Activity B

GUIDED READING

After you discuss each question, answer the key questions and fill in the missing words for the auxiliary questions. .

Auxiliary Questions

A 1: Where do people get their energy? What is a heterotroph?

People get their energy from the _____ they eat. _____ are living things that get their energy from the _____ they eat.

A 2: Where do plants get their energy? What is an autotroph?

Plants use the sun's _____ to make their own _____.
_____ are living things that make their own _____ using the sun's energy.

A 3: What is chlorophyll and what does it do?

Chlorophyll is a chemical in plant cells that _____ or absorbs light _____.

A 4: What is the definition of photosynthesis?

_____ is the process by which a cell of an _____ captures the energy in _____ and uses it to make food.

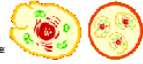
A 5: What happens during a chemical change?

During a chemical change, substances may _____ to form new _____.

Key Question 1: What happens during the process of photosynthesis?

Sample Writing Activity

QUEST: Week Five, Day Five
Student Activities B - D, Student Chart and Teacher



INSIDE CELLS, Part Two Day 3



Student Activity A WARM UP

Fill out the chart below to describe the characteristics of a plant, animal, and bacterial cell. During groupwork, you will use this information to help you write a compare/contrast paragraph.

Characteristic	Plant Cell	Animal Cell	Bacterial Cell
Cell Membrane			
Cell Wall			
Chloroplast			
Cytoplasm			
Nucleus			
Shape			

Student Activity C WRITING FOR SCIENCE!

In this assignment you will be comparing two kinds of cells. You have already brainstormed for your writing in Student Activity A from Day 3. You will be using that brainstorm for the next part. Follow the steps below to write a compare/contrast paragraph.

Step 1: Choose your topic

Use Student Activity A from Day 3 to choose your topic. Out of the three types of cells (plant, animal and bacterial), which two are you going to compare? For example, you could compare plant and animal cells.

_____ and _____

Step 2: Plan your writing

Use Student Activity A from Day 3 to help you plan your writing.

- Choose two different characteristics to compare. For example, you could compare the cell wall and the nucleus of both plant and animal cells.
 - Characteristic #1: _____
 - Characteristic #2: _____
- Examine the similarities and differences of the characteristics.
 - How is Characteristic #1 the same in both cells?

 - How is Characteristic #1 different in both cells?

 - How is Characteristic #2 the same in both cells?

 - How is Characteristic #2 different in both cells?

Sample Writing Activity

- Write a **topic sentence**. Explain what you are going to write about in your paragraph. Introduce the topic to the reader.

Topic Sentence: _____

- Write a **concluding sentence**. End your paragraph by explaining what you wrote in your paragraph. End the paragraph well.

Concluding Sentence: _____

Step 3: Write!

Use the space below to write your paragraph.

Vocabulary Assessment

QUEST: Week Five, Day Five
 Student Activities B - D, Student Chart and Teacher



INSIDE CELLS, Part One Day 1



Student Activity A SHOW WHAT YOU KNOW Vocabulary Quiz.

network	organelles	distribute
cell membrane	constant	mature
attached	nucleus	cell wall
encounter	specific	regulate

- _____ means happening all the time and never stopping.
- A _____ is a system of things that cross or connect.
- _____ means adult or fully grown.
- _____ means connected.
- _____ means to spread something out over a large area.
- _____ means exact or particular.
- _____ means to control or to manage. It also means to adjust or to keep at some standard.
- To _____ something means to meet or interact with it.
- _____ are smaller structures within the cell that carry out specific functions.
- _____ is a structure of the cell that is either located just inside the cell wall or is an outside boundary that separates the cell from its environment.

- _____ is the cell's control center, directing all of the cell's activities.
- The _____ is a rigid layer of nonliving material that surrounds the cells of plants and some other organisms.






Student Activity B WARM UP

Plant cells have a cell wall which supports and protects the plant cell. Why do you think animal cells don't have a cell wall?




Sample Academic Glossary

Week Six Academic Words Student Glossary, Part One

Directions: Read each word's definition, then write a sentence of your own.


<p>adequate <i>adecuado</i></p>	<p><u>Adequate</u> means good enough.</p> <p>This man is shivering because he is not wearing <u>adequate</u> clothing for the cold weather.</p> <p><i>Adecuado</i> significa apropiado para las condiciones o circunstancias. Algo que es suficiente.</p> <p>Your sentence: _____</p>	
<p>concentrated <i>concentrado</i></p>	<p><u>Concentrated</u> means brought together in one place. Most of the tall buildings are <u>concentrated</u> in the downtown area of the city.</p> <p><i>Concentrado</i> significa reunido en un mismo lugar.</p> <p>Your sentence: _____</p>	
<p>consequence <i>consecuencia</i></p>	<p><u>Consequence</u> is the result of an action. The <u>consequence</u> of staying up too late is that you are tired the next day.</p> <p><i>Consecuencia</i> es el resultado de una acción. Algo que pasa como resultado de algo.</p> <p>Your sentence: _____</p>	

QUEST: Week Six Academic Words
Student Glossary, Part One

<p>job <i>trabajo/ mandado</i></p>	<p>A <u>job</u> is something that has to be done, or a piece of work. It is this boy's <u>job</u> to mow the lawn.</p> <p><i>Un trabajo/ mandado es algo que se tiene que hacer.</i></p> <p>Your sentence: _____</p>	
<p>likewise <i>igualmente</i></p>	<p><u>Likewise</u> means similarly, or in the same way. The girl watches how her teacher plays the piano so that she can do <u>likewise</u>.</p> <p><i>Igualmente significa de la misma forma, de igual manera, así mismo o también.</i></p> <p>Your sentence: _____</p>	
<p>located <i>localizado</i></p>	<p><u>Located</u> means where something is. This famous tower is <u>located</u> in Paris, France.</p> <p><i>Localizado significa el lugar determinado o el lugar específico donde algo se encuentra o donde algo está.</i></p> <p>Your sentence: _____</p>	

Sample Technical Glossary

QUEST: Week Six Technical Words
Student Glossary



**Week Six Technical Words
Student Glossary**

Directions: Read each definition, then write the technical word in the blank next to its definition. Draw a picture of the word if there is a box underneath it.

Word	Definition
_____	<p>A permeable substance is a substance which allows other substances such as water to pass through it. Sand and gravel are permeable because water can pass through them.</p> <p><i>Permeable significa que el agua y otras sustancias pueden pasar a través. La arena y grava/ gravilla son permeables porque el agua puede pasar a través de ellos.</i></p>
_____	<p>Selectively permeable means that some substances can pass through while others cannot. The cell membrane is selectively permeable; water can usually pass through it, but salt usually cannot pass through it.</p> <p><i>Electivamente permeable significa que algunas sustancias pueden pasar a través de la membrana celular.</i></p>
_____	<p>Diffusion is a process in which molecules move from an area of high concentration (a lot of molecules) to an area of low concentration (not a lot of molecules). When you put cream in coffee it diffuses through the coffee.</p> <p><i>Difusión es el método principal por el cual pequeñas moléculas se mueven dentro y fuera de las células. Durante la difusión, las moléculas se mueven de un área de mayor concentración (muchas moléculas) a un área de menor concentración (menos moléculas).</i></p>

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QUEST: Week Six Technical Words
Student Glossary

_____	<p>Molecules are particles that are made of two or more atoms bonded together. Water molecules have 2 hydrogen atoms combined with one oxygen atom.</p> <p><i>Las moléculas son partículas que están hechas/ formadas de dos o mas átomos unidos. Las moléculas de agua tienen 2 átomos de hidrógeno combinados con un átomo de oxígeno.</i></p>
Picture: _____	
_____	<p>Osmosis is the process where water molecules move in and out of cells. Osmosis is a specific type of diffusion, involving water and a selectively permeable membrane. When water enters a cell through osmosis, the cell becomes swollen.</p> <p><i>Osmosis es el proceso cuando agua se mueve adentro y fuera de las células. Osmosis es difusión, pero con agua.</i></p>
Picture: _____	
_____	<p>Active transport is the movement of materials through a cell membrane using energy.</p> <p><i>Transporte activo es el movimiento de materiales a través de la membrana celular utilizando/ usando energía.</i></p>
_____	<p>Passive transport is the movement of materials through a cell membrane without the use of energy. Diffusion and osmosis are examples of passive transport.</p> <p><i>Transporte pasivo es el movimiento de materiales a través de la membrana celular sin utilizar/ usar energía. Difusión y osmosis son ejemplos de transporte pasivo.</i></p>
Picture: _____	

Technical Words Practice

QUEST: Week Six Technical Words
Student Glossary

Week 6 Technical Words Practice

1. Active transport is the movement of _____ through a _____ using _____.
2. Molecules are particles that are made of two or more _____ bonded together. Water _____ have 2 _____ atoms combined with one _____ atom.
3. Permeable means that _____ such as _____ can pass through. Sand and gravel are _____ because _____ can pass through them.
4. Passive transport is the movement of _____ through a cell _____ without using _____. Diffusion and osmosis are _____ of passive transport.
5. Osmosis is the process where water _____ move in and out of cells. When water enters a cell through _____, the cell becomes swollen. Osmosis is a specific type of _____, involving water and a selectively _____ membrane.
6. Diffusion is process in which _____ move from an area of high _____ (a lot of molecules) to an area of _____ concentration (not a lot of molecules.)
7. Selectively permeable means that some _____ can pass through while others _____. The cell membrane is **selectively permeable** so for example, _____ can usually pass through but _____ usually cannot pass through.

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Sample Guided Reading Lesson

Application:

2. Student Activity B (27 minutes): Guided Reading The Cell and Energy (pages 163-164)

Teacher Note: The portion of the text you will use for this lesson has been typed out for you below. Academic vocabulary is highlighted throughout the text and the technical vocabulary is underlined. As you are reading with the students, please explain the meanings of these words as necessary. There are three types of questions:

- Key questions (indicated by K) require students to write complete answers in student charts.
- Auxiliary questions (indicated by A) are presented in cloze, or fill in the blank format. Students are required to use their readings to write the missing words in the sentences in their student charts.
- Oral Questions (indicated by O) require an oral answer only, but may need to be corrected or elaborated upon.

Before beginning, read key questions to students. Tell them to remember the questions as they are listening to the text. Students are not to answer the questions until they have encountered them in the text.

Tell students to read along in the text as you read aloud. It may be helpful to have them use bookmarks to help them keep track of what you're reading. Tell them you will ask them questions during the reading session and they will either answer the questions orally or write answers in their student charts.

Use the ELMO projector to show students the figures included in this lesson. Point to the figures as you are explaining the pictures.

Key Questions

Question 1: What happens during the process of photosynthesis? Write the equation for photosynthesis and explain it.

Introduction

It's a beautiful summer afternoon-- a perfect day for spending time in the park. Dogs play together under a nearby tree. Blue jays swoop down from the tree's branches, hunting for food. "Let's go for a bike ride," suggests your cousin. "Great idea," you say, and you ride off down the path.

Dogs playing, birds flying, people biking--all of these activities **require** energy. Where do you think this energy comes from? Believe it or not, the energy comes from the sun. In fact, the sun is the source of almost all the energy used by living things on Earth.

Partner Talk: What things do you like to do that require energy?

(Answers will vary, but could include bike riding, walking, playing sports, etc.)

O: What is the source of almost all the energy used by living things on Earth?

(The sun)

What is Photosynthesis?

All living things need energy. Their cells need energy to carry out functions that sustain life such as transporting substances into and out of cells. You and other heterotrophs eat food to supply your cells with energy. But plants and some other organisms are autotrophs that use the sun's energy to make their own food.

Partner Talk: Give an example of why a cell needs energy.

A 1: Where do people get their energy? What is a heterotroph? (People get their energy from the food they eat. Heterotrophs are living things that get their energy from the food they eat.)

A 2: Where do plants get their energy? What is an autotroph? (Plants use the sun's energy to make their own food. Autotrophs are living things that make their own food using the sun's energy.)

The process by which a cell of an autotroph captures the energy in sunlight and uses it to make food is called photosynthesis (foh toh SIN tuh sis). Chloroplasts contain chemicals that absorb light. One of these is chlorophyll, which gives chloroplasts their green color. Chlorophyll and other light-absorbing chemicals capture light energy and use it to power photosynthesis. In plants, it occurs in their cell's chloroplasts.

QuEST: Year Two Summary

- Successful elements: focus on district and state standards; strong science expertise; hands-on activities aligned with text-book content; exposure of all students to grade-level text with scaffolding; partner work; extensive professional development
- Lessons learned: need for more professional development with on-going mentoring; importance of partner training; need for more integration of science text and hands-on activities; importance of writing associated with reading; context matters (lack of native-speaking models, less district capacity)
- Results: data currently being analyzed (researcher-developed assessment of science knowledge aligned with curriculum and standardized test of reading)
- Teacher overall rating of curriculum at 9.2 on a 10 point scale, with guided reading rated as the weakest element

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QuEST: Next Steps

- Third Year
 - November - May (including testing)
 - 20 6th grade science classrooms
 - 10 teachers teach QuEST for 12 weeks and then provide standard instruction for 12 weeks, 10 teachers provide standard instruction for 12 weeks and then teach QuEST for 12 weeks (AB,BA)

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Summary-Program Elements

- Alignment with state and district standards and materials
- Focus on making grade-level science content accessible to all students
- Concurrently building students' language proficiency
- Use of peer work to help all students develop language proficiency and content knowledge
- Ongoing assessment
- Collaboration
 - Teacher/teacher
 - Teacher/researcher

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Summary-Ongoing Challenges

- Generic issues related to working in a high-poverty district with high concentrations of language-minority students
 - Teacher quality and lack of district infrastructure to support teacher development
 - Staff turn-over
 - Few peer role models
 - Impact of poverty on student learning
- Lack of a robust knowledge base on how to give very limited English proficient students access to grade level content

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