Inquiring Minds Want to Know About the New Science TEKS

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Objectives

- Explore the clarity, specificity, and vertical alignment in the new science TEKS by analyzing the K-5 matter & energy strand
- Examine elementary & middle school matter & energy TEKS through the lens of inquiry in order to understand the implications for the teaching & learning of science as the new science TEKS are implemented during the 2010-2011 academic year
- Review changes to the high school science TEKS
K-12 New Science TEKS

- National Academy of Sciences definition of **science**:
- “the use of evidence to construct testable explanations & predictions of natural phenomena, as well as the knowledge generated through this process”
Districts “encouraged to facilitate classroom & outdoor investigations”

- Kindergarten & Grade 1
  - 80% of the instructional time
- Grades 2 & 3
  - 60% of the instructional time
- Grades 4 & 5
  - 50% of the instructional time
Elementary Science TEKS

1. Introduction
2. Scientific Processes
3. Science Concepts:
   - Physical Science
     1. Force, Motion, & Energy
     2. Matter & Energy
   - Life Science
     1. Organisms
     2. Environments
   - Earth & Space Science
     1. Earth & Space Science
     2. Earth & Space Science
Analyze K-5
Matter & Energy TEKS

Sort cards

1. Science Concept
2. A, B, C, D

Place cards on chart to show K-5 vertical articulation
Texas Essential Knowledge and Skills (TEKS) 2010-11

<table>
<thead>
<tr>
<th>TEKS</th>
<th>Kindergarten</th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
<th>Grade 4</th>
<th>Grade 5</th>
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</thead>
<tbody>
<tr>
<td>Science Concept</td>
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</table>

(A)
Grades K-5 New Science
TEKS Debrief

- Notice changes to any grade levels?
- Logical Sequence?
- Surprises?
- Concerns?
- Comments?
Matter & Energy

- Grades K.5 - 5.5
- Observe/record/classify properties of matter
- Grades 3.5, 4.5 & 5.5
- 3.5D Explore/recognize mixtures
- 4.5C Compare/contrast mixtures
- 5.5C Demonstrate some mixtures maintain properties of ingredients
Elementary: Types of Investigations

- Descriptive Investigations (K-4)
  - TEA-descriptive investigations involve describing &/or quantifying parts of a natural or man-made system

- Experimental Investigations (5)
  - Testing 1 variable
  - TEA-experimental investigations involve designing a fair test in which variables are actively manipulated, controlled, and measured in an effort to gather evidence to support or not support a causal relationship
Gumballs

Explore
Put two different colored gumballs in a round dish of water. Observe, draw, and describe the pattern of color dispersal (spreading).

Question
What pattern is created if three different colored gumballs are put in a round container of water?

Materials
1. round dish
2. water
3. colored gumballs
4. colors

Procedure
1. Work together as a team.
2. Put water in the dish.
3. Place 3 gumballs of different colors in the dish. Observe.

Prediction
How do you think the colors will pattern as the pigments disperse in the water? Draw and explain your prediction.
Explore
Gumballs

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Put two different colored gumballs in a round dish of water. Observe. Draw and describe the pattern of color dispersal (spreading).

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What pattern is created if three different colored gumballs are put in a round container of water?

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2. Water
3. Colored gumballs
4. Colors

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2. Put water in the dish.
3. Place 3 gumballs of different colors in the dish. Observe.

Prediction
How do you think the colors will pattern as the pigments disperse in the water? Draw and explain your prediction.
Descriptive Investigation
**Descriptive Investigation**

**Gr K-4**

**Data Collection**
Follow your procedure. Record your observational data. Draw and describe how the pigments of color dispersed.


**Conclusion**
Look at the observational data you collected. Write three true statements about it.

1. 
2. 
3. 

**Explanation**
Why do you think the color pigments from the gumballs dispersed in this pattern?


**Next Question**
Make a new question to investigate.
Experimental Investigation

Gr 5

Gumballs

Question

What variables might affect the dispersion pattern of gumball pigments?

Circle the variable you want to test.

Now think about it.

How will this variable affect the dispersion pattern?

How will you observe or measure the difference?

• What will you change? Manipulated or Independent Variable

• What will you observe or measure? Responding or Dependent Variable

• What will you keep the same? Controlled or Constant Variable(s)

Hypothesis

Formulate your hypothesis.

If __________________________, then, __________________________.

Materials

List: Sketch your setup:

Procedure

List the steps you will follow.
Experimental Investigation
Gr 5

### Data Collection
Record your observational data in the diagram below.

<table>
<thead>
<tr>
<th>Draw</th>
<th>Describe</th>
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</tbody>
</table>

### Conclusion
Write three true statements about your results.

1. 
2. 
3. 

### Explanation
State your explanation for these results.

### Next Question
Based on your findings, make a new question.
Experimental Investigation
Experimental Investigation
Middle School Science TEKS

- Grades 6-8: science is interdisciplinary but each grade has a different content focus:
  - Grade 6 - Physical Science
  - Grade 7 - Organisms & Environments
  - Grade 8 - Earth & Space Science

- Conduct laboratory & field investigations 40% of the instructional time
Middle School Science TEKS

1. Introduction
2. Scientific Processes
3. Science Concepts:
   - Physical Science
     - Matter & Energy
     - Force, Motion, & Energy
   - Earth & Space Science
     - Earth & Space Science
   - Life Science
     - Organisms & Environments
Matter & Energy

TEKS 6.5
C. Differentiate between elements & compounds at the most basic level

TEKS 7.6
A. Identify that organic compounds contain carbon & other elements such as hydrogen, oxygen, phosphorus, nitrogen, or sulfur

TEKS 8.5
D. Recognize that chemical formulas are used to identify substances & determine the number of atoms of each element in chemical formulas containing subscripts
Middle School
Science TEKS

TEKS 6.2, 7.2, and 8.2

A. Plan & implement comparative & descriptive investigations

B. Design & implement experimental investigations
Middle School Investigations

- Descriptive Investigations
- Comparative Investigations
  - TEA-comparative investigations involve collecting data on different organisms/objects/features, or collecting data under different conditions (e.g., times of year, temperatures, locations) to make a comparison
- Experimental Investigations
Unfolding

Explore: Observe what happens when you fold the petals of a paper flower and then place in water.

Question: How long does it take for the paper flower to unfold?

Prediction: The paper flower will take ___ minutes and ___ seconds to unfold in water.

Materials: 1. Timer
          2. 4 cut-out paper flowers
          3. Container of water

Procedure:
1. Work together.
2. Fold the petals of one paper flower.
3. Place the flower in water and start the timer.
4. When the last petal unfolds, stop the timer.
5. Record the time as data on the chart.
6. Do 3 more trials.

Data Collection:
Record your times in the chart. Convert to seconds and then graph your results.

<table>
<thead>
<tr>
<th>Trials</th>
<th>Time</th>
<th>Seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>2</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>3</td>
<td>:</td>
<td>:</td>
</tr>
<tr>
<td>4</td>
<td>:</td>
<td>:</td>
</tr>
</tbody>
</table>

Time for Paper Flower to Unfold in Seconds
Conclusion: write three statements about the results of your investigation.

- 
- 
- 

Explanation: State your explanation for these results.

- 
- 
- 

Next Question(s)?? Write one or more questions that you could answer with an investigation.

- 
- 
- 

Descriptive Investigation
Reading in Science

- Elementary
  - Learning to Read
- Middle School
  - Reading to Learn
Reading Strategy

**Read the lines**
What is a polymer? Describe what happens to the polymer making up paper when you bend it and put it in water?

[Cellulose Molecular Structure]

**Read between the lines**
Describe the polymer, cellulose. What evidence supports the claim that the cellulose making up paper is pliable?

[Flower Diagram]

**Read beyond the lines**
Why is cellulose an organic compound? What would happen if you put one folded paper flower in warm water and another in cold water?
Paper is made of cellulose fibers. Cellulose is a polymer. A polymer is a compound made of repeating units. The repeating units in cellulose are sugar molecules that are linked together to form a chain. Cellulose is an organic compound because it contains carbon. The generic chemical formula for cellulose is \((C_6H_{10}O_5)_n\).

When you bend the petals of the paper flowers, the cellulose chains in the fibers move so the paper will bend without breaking. If paper is bent gently, it will go back to its original position. When a substance can bend elastically, we say it is pliable.

When you put the paper flower in water, the cellulose fibers in the paper are attracted to the water so the water enters the chains of cellulose. Water makes the paper flower pliable.

The water absorbed by the cellulose in the paper flower causes the paper petals to unfold.

Where the petals are bent, the swollen cellulose fibers push the petals back to their original position.

Heat also makes the cellulose chains in paper more pliable. What do you think would happen if you used warm water and cold water in your investigation?

How do real flower buds open?

Within each flower bud is a completely developed miniature flower (petals, sepals, etc). In order to bloom, plants utilize a mechanism similar to how they grow other cells. The cells in the flower petals swell from turgor pressure exerted by the uptake of water. This expansion of cells is mediated by plant hormones, such as the auxins, which affect the elasticity of the cell walls.
Comparative Investigation

Unfolding

Observe: Compare the 3 flower patterns.

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Number of Petals</th>
<th>Number of Sides of Center</th>
<th>Shape of Center</th>
<th>Length of Each Side of Center</th>
<th>Perimeter of Center</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.75 cm</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3 cm</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>2.5 cm</td>
<td></td>
</tr>
</tbody>
</table>
Experimental Investigation

**Question:** How will the number of petals affect the time it takes for the petals to unfold if the perimeter of the center of the flower stays the same?

**Hypothesis:** (If, then) ____________________________

<table>
<thead>
<tr>
<th>What is changed?</th>
<th>What will you measure?</th>
<th>What is kept the same?</th>
</tr>
</thead>
<tbody>
<tr>
<td>manipulated variable</td>
<td>responding variable</td>
<td>controlled variable(s)</td>
</tr>
</tbody>
</table>

**Materials:**
- timer
- 3 cut out paper flowers
- container of water

**Procedure:** List your steps.

- ____________________________
- ____________________________
- ____________________________
- ____________________________
- ____________________________
Experimental Investigation

Data Collection: Make a chart or a table and record your data. Organize the data into a graph.

Title:

Label:

Label:

Conclusion: Write three statements about the results.

Explanation: State your explanation for this result.

Next Question(s): Write one or more questions you could investigate.
High School Science TEKS

- Conduct laboratory & field investigations 40% of the instructional time
- Investigative Procedures
  - Descriptive*
  - Comparative*
  - Experimental*

*Biology
High School - 7 courses with same title & 1 replaced

1. Aquatic Science
2. Astronomy
3. Biology
4. Chemistry
5. Physics
6. Environmental Systems
7. Integrated Physics & Chemistry
8. Geology, Meteorology, & Oceanography replaced by capstone course, Earth & Space Science
Other Science Courses

- AP Biology
- AP Chemistry
- AP Physics B
- AP Physics C
- AP Environmental Science
- IB Biology
- IB Chemistry
- IB Environmental Systems
Other Science Courses

- Scientific Research & Design
- Anatomy & Physiology of Human Systems
- Medical Microbiology
- Pathophysiology
- Principles of Technology I
- Principles of Technology II
- College Courses
High School - 8 courses

- TEKS
  1. Introduction
  2. Scientific Processes
  3. Science Concepts
- New or Expanded Content
- TEA Website Resource
  - Science TEKS Transition Analysis Resource
Science TEKS Transition Analysis Resources

November 2009

The State Board of Education (SBOE) adopted new K-12 science Texas Essential Knowledge and Skills (TEKS) in March 2009. The implementation date for these new science TEKS is the 2010-11 school year. These new curriculum standards are rigorous and include more specificity than previous standards. The new curriculum standards in grades 6-12 are also closely aligned with the College and Career Readiness Standards (CCRS).

As with all revised curriculum standards, teachers and other educators need time to prepare and to understand the changes in the standards. This document was prepared to show a number of important aspects to the new K-12 science TEKS, including the following:

1. New or expanded content in the 2010 science TEKS for a specific grade level or course
2. The outgoing movement of a science content from one grade level to another
3. The incoming movement of a science content from one grade level to another
4. Science content from the 1998 TEKS that are not included in the 2010 TEKS for a specific grade level or course

The Texas Education Agency (TEA) will provide professional development opportunities on the new science TEKS in spring/summer 2010.

We hope that these TEKS transition analysis resources will help educators prepare for the implementation of the new science TEKS in 2010-2011.

Elementary School TEKS Transition Analysis – Grades K-5
Middle School TEKS Transition Analysis – Grades 6-8
High School TEKS Transition Analysis – Biology, Chemistry, Physics, IPC

Science resource documents can be found in the science section of the TEA curriculum webpage:
http://www.tea.state.tx.us/index.aspx?id=2427&menu_id=728&menu_id2=783
Closure - Objectives

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Thank you!

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