


ALABAMA DEPARTMENT OF EDUCATION

Makes Sense Strategies Toolkit
applications for
Grades 6-8 Science

Part 1: Using *Smart Sheets* to teach high-frequency science topics

Part 2: Using *Smart Sheets* to science vocabulary

 Edwin Ellis, Ph.D.
 University of Alabama

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

- Abstract Concepts
- Processes
- Classifications
- Famous people
- Events / Phenomena
- Structures
- Systems & components
- Life Forms
- Procedures
- Problems

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

Concept – Features / Properties / Functions

Identify global patterns of atmospheric movement, including El Nino, the Gulf Stream, the jet stream, the Coriolis effect, and global winds that influence local weather

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

Concept – Features / Properties / Functions

Processes

Describe characteristics common to living things, including growth and development, reproduction, cellular organization, use of energy, exchange of gases, and response to the environment.

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

Concept – Features / Properties / Functions
Processes

Classification systems
Describe organisms in the six-kingdom classification system by their characteristics.

- Recognizing genus and species as components of a scientific name

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

Concept – Features / Properties / Functions
Processes
Classification systems

Famous people
Identify contributions of Aristotle and Linnaeus to the early history of taxonomy



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Concept – Features / Properties / Functions
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Identify contributions of **Aristotle** and **Linnaeus** to the early history of taxonomy

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

Concept – Features / Properties / Functions
Processes
Classification systems
Famous people

Events / Phenomena
Identify functions of organelles found in eukaryotic cells, including the nucleus, cell membrane, cell wall, mitochondria, chloroplasts, and vacuoles.

Example: mitochondria releasing energy for use in cellular respiration

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Events / Phenomena
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Example: **mitochondria releasing energy** for use in cellular respiration

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

- Concept – Features / Properties / Functions
- Processes
- Classifications
- Famous people
- Events / Phenomena
- Structures**

Identify major differences between plants and animals, including internal structures, external structures, methods of locomotion, methods of reproduction, and stages of development.

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

- Concept – Features / Properties / Functions
- Processes
- Classifications
- Famous people
- Events / Phenomena
- Structures
- Systems & components**

Relate major tissues and organs of the skeletal, circulatory, reproductive, muscular, respiratory, nervous, and digestive systems to their functions.

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- Concept – Features / Properties / Functions
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- Life Forms**

Describe characteristics common to living things, including growth and development, reproduction, cellular organization, use of energy, exchange of gases, and response to the environment.

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- Concept – Features / Properties / Functions
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- Classifications
- Famous people
- Events / Phenomena
- Structures
- Systems & components Identify steps within the scientific process.
- Life Forms Applying process skills to interpret data from graphs, tables, and charts
- Procedures**

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

- Concept – Features / Properties / Functions**
 - Main idea } Definition
 - Critical features } Definition
- Examples of the concept } Manifestations & Applications
- Non-examples of the concept } Manifestations & Applications
- Relationships to other concepts } Relational understanding
- Factors that affect the concept } Relational understanding
- Things the concept affects } Relational understanding
- Comparison to other concepts } Relational understanding
- Concept as reflected in specific components or steps

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Science Content Standards


KINDS of science knowledge that tends to be emphasized....

- Concept – Features / Properties / Functions**
 - Main idea } Hierarchic 
 - Critical features } Hierarchic
- Examples of the concept } Cause / Effect 
- Non-examples of the concept } Cause / Effect
- Relationships to other concepts } Compare / Contrast 
- Factors that affect the concept } Compare / Contrast
- Things the concept affects } Compare / Contrast
- Comparison to other concepts } Sequence 
- Concept as reflected in specific components or steps } Sequence 

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Science Content Standards

KINDS of science knowledge that tends to be emphasized....

- Concept – Features / Properties / Functions
 - Main idea } Definition 
 - Critical features } Definition
- Identify global patterns of atmospheric movement, including El Nino, the Gulf Stream, the jet stream, the Coriolis effect, and global winds that influence local weather
- Main idea & features of what the El Nino is
- Main idea & features of what the Gulf Stream is

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Science Content Standards Hierarchic Info
Concepts (Main Idea & Distinctive Features)

Organizer - SMART levels

- Hierarchic** - 1 Main Idea, 2 Main Ideas, 3 Main Ideas, 4 Main Ideas, 5 Main Ideas, 6 Main Ideas
- Conceptual Development** - Matrix & connections, Matrix & double connections
- Cause & Effect** - 12 items
- Sequence** - Steps, Cycle, Sequence of Events

Essential Understandings - SMART levels

- Literature** - Story Grammar & Sequence, Character Analysis, Literary Analysis, Story Problem, Questions Inferences, Predictions, Text Format
- Writing** - Level 1, Level 2, Level 3, Level 4, Level 5, Resources, Supplemental, Narrative, Descriptive, Expository, Persuasive
- Vocabulary** - Word Cards, Semantic Tables, Word Comparisons, Word Connections, Features Analysis, LINC5 annotations, Scavenger Hunt, Multiple Meanings
- History & Science Generative Ideas** - Process, Strategy, Place Event, Process, Theory, Ideology, Debate Issue, Policy Conflict, Problem, Invention, Object
- Math** - Mathematical Concepts, Computational Processes, Skills/Themes
- Social / Motivation** - Behavior Theory, Character Building, Perspective Taking, Self-assert, Goal Setting & Self-assessing, Behavior Analysis
- Project Based Learning** - Planning Investigations, Conducting Investigations, Making Presentations, Evaluating Project Processes & Outcomes

SMART Applications for Features

- Instructional Design** - Content Areas Units & Lessons, Library/History Units & Lessons, Anticipation Guides, scaffolding Tactics, Reflective Reviews

SMART Applications for Exports

- MCS Implementation Resources** - Schedules Implementation Strategies, Articles, www.MakesSenseStrategies.com, Acknowledgments

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Science Content Standards Hierarchic Info
Concepts (Main Idea & Distinctive Features)

Albedo: the percentage of the earth's surface that reflects solar energy without being changed

- Planet's overall albedo is 30 percent**
- Earth's Surface**
 - High albedo: Reflects 80 to 90 percent of energy
 - Low albedo: Reflects 5 to 10 percent of energy back into space
 - If cut down and used for houses - higher albedo
 - Influenced by albedo
- Medium albedo**
- Desert Areas**
- Forest**
- Energy budget of earth**
- Albedo can change**
- Albedo change**
 - Change in area: Change in albedo
 - Seasonal influences may change albedo
 - Cities & other man-made structures change albedo

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Science Content Standards Hierarchic Info
Concepts (Main Idea & Distinctive Features)

What is a Theory? is about...
Understanding the meaning of a theory

Order - Specific information about this theory

- A theory is the most logical explanation for events that occur in nature
- A scientific theory is a powerful, time-tested concept that makes useful and dependable predictions about the natural world
- When a scientist proposes a theory it must be tested over and over again
- If a theory survives many tests it may be accepted by the scientific community
- Theories can be wrong and may be changed after additional tests and/or observations

Scientific Method is important to understand about this?

Even if a theory survives many tests and observations here is no guarantee that the theory will be accepted by the scientific community

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Science Content Standards Hierarchic Info
Concepts (Main Idea & Distinctive Features)

TOPIC: Coriolis Effect

- A Force caused by the Earth's rotation.
- It causes objects moving in the northern hemisphere to be deflected towards the right.
- It causes objects moving in the southern hemisphere to be deflected towards the left.
- This force determines which direction the winds and ocean currents move.

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Science Content Standards Hierarchic Info
Concepts (Main Idea & Distinctive Features)

CELLS

- PLANT** - has cell wall, has chloroplasts, has nucleus, has organelles
- PROTIST** - may have cell wall and chloroplasts, has nucleus, has organelles
- ANIMAL** - does not have cell walls or chloroplasts, has nucleus, has organelles
- BACTERIA** - has cell wall, does not have nucleus, does not have organelles

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Science Content Standards Hierarchic Info
Concepts (Main Idea & Distinctive Features)

Geothermal Energy is about...
Heat associated with volcanoes has been harnessed to produce energy.

Order - Ideas

- The Geysers' geothermal field near Santa Rosa, in Northern California produces enough electricity to meet the power demands of San Francisco. The Geysers' area is the largest geothermal development in the world.
- Geothermal heat warms more than 70% of the homes in Iceland.
- Volcanic energy has been harnessed by a geothermal power plant in Kilauea, Hawaii to feed their local utility companies.
- Wells drilled at Casa Diablo, Long Valley Caldera, California tap into Caldera's hydrothermal system by pumping HOT water to supply three geothermal power plants supplying more than enough power for Calaveras and the surrounding communities.
- In addition to being an energy resource, some geothermal waters also contain sulfur, gold, silver, and mercury that can be recovered as a byproduct of energy reduction.

So what? What is important to understand about this?

Geothermal energy can be used to drive turbines, generate electrical power, provide hot water for space heating purposes, heat for greenhouses, industrial uses, or even as hot springs at resort spas.

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Science Content Standards **Hierarchic Info** (Main Idea & Distinctive Features)

Classification Systems

Classification of Plants is about...
Classifying plants into categories of similar and different characteristics

Main Idea	Details
Vascular plants have xylem and phloem tubes for transporting water, nutrients and food to the various plant parts.	<p>Side:</p> <ul style="list-style-type: none"> Ferns, horse tails, and club mosses About 12,000 species Typically spread using underground stems Reproduce using spores <p>Conifers:</p> <ul style="list-style-type: none"> About 500 species Reproduce using seeds made in cones when wind carries pollen from male to female cones <p>Flowering:</p> <ul style="list-style-type: none"> About 250,000 species Dominant vegetation Reproduce using seeds made in flowers
Nonvascular plants do not have tubes for transporting fluids.	<p>Side:</p> <ul style="list-style-type: none"> Tend to live in damp places near the ground <p>Algae:</p> <ul style="list-style-type: none"> About 12,000 species Range in size Have no roots Reproduce using spores in swellings on fronds <p>Mosses and liverworts:</p> <ul style="list-style-type: none"> About 24,000 species Small, green land plants Reproduce using spores made in capsules

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Science Content Standards **Hierarchic Info** (Main Idea & Distinctive Features)

Structures

Layers of the Atmosphere is about...
Different layers of air above the earth's surface. Contains various gases like O₂ & CO₂, & dust from earth surface & space

Order	Main Idea	Details
5	Exosphere	Outer layer of the earth's atmosphere... last layer before space... very high up where the atmosphere is very thin... where atoms and molecules escape into space.
4	Thermosphere	Makes up only a small part of the atmosphere's mass... temperatures are very high because gas particles are absorbing solar radiation.
3	Mesosphere	Temperatures decrease with height until the atmosphere reaches its coldest temperature of -90°C (-130°F)... THE layer where many meteors burn up while entering the earth's atmosphere.
2	Stratosphere	Very stable part of the atmosphere so many airplanes or jet fly here... temperature increases with height... contains good ozone molecules that protect life on Earth by absorbing some of the sun's harmful UV rays.
1	Troposphere	Bottom layer of the atmosphere... where we live... much denser than the layers above it... temperatures decrease as you go higher... all of the earth's weather takes place in the troposphere.
0	Earth's surface	All atmosphere is above earth's surface

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Science Content Standards **Hierarchic Info** (Main Idea & Distinctive Features)

Systems & Components

The Muscular System is about...
A complex system and major component of an animal's body that provides movement and proper organ function.

Component	Details
Skeletal Muscle	
Smooth Muscle	
Cardiac Muscle	

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Science Content Standards **Hierarchic Info** (Main Idea & Distinctive Features)

Life forms

Infectious Diseases is about...
Diseases that are caused by bacteria, viruses, or protozoa in the body.

Disease	Caused by	Symptoms	Vaccine
Chickenpox	Caused by virus	Skin rash, fever, discomfort	Vaccine
Influenza	Caused by virus	Chills, fever, body aches	Vaccine
Malaria	Caused by protozoa	Attack of chills, high fever	Medicine (not very effective)
Plague	Caused by bacteria	Swelling of legs, high fever, rapid heart beat	Vaccine (not very effective)
Rabies	Caused by virus	Biting of bite site, muscle spasms	Vaccine: M-RB
Rubella (German measles)	Caused by virus	Rukey nose, rash, tender lymph nodes	Vaccine: MMR
Yellow Fever	Caused by virus	Fever, yellow skin, stomach bloated	Vaccine and control mosquito
West Nile Virus	Caused by virus	Headache, chills, vomit, coma, death	Control mosquito population

So what? What is important to understand about this?
Infectious diseases can be harmful to your body, but can also be prevented. Take care of yourself and practice good hygiene.

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Science Content Standards **Hierarchic Info** (Main Idea & Distinctive Features)

Processes

Metamorphosis of Insects is about...
The process of an insect changing from one form to another.

Stage	Details
Larval Stage	<ul style="list-style-type: none"> Young insect has a soft tubular body and looks like a worm. Larvae usually are voracious eaters that can do a lot of damage to plants or a host animal. Example: the caterpillar that turns into a butterfly.
Pupal Stage	<ul style="list-style-type: none"> Pupae is usually a dormant stage. The intermediate stage between the larva and the adult. The body tissue of the young insect converts from larvae to the adult.
Adult Stage	<ul style="list-style-type: none"> The last stage of metamorphosis. In this stage the insect lays eggs, and the cycle begins over again. Some insects that spend at least part of their lives in water undergo an incomplete metamorphosis.

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How to access **Hierarchic Smart Sheets**...

Organizer SMART sheets

- Hierarchic**: 1 Main Idea, 2 Main Ideas, 3 Main Ideas, 4 Main Ideas, 5 Main Ideas, 6 Main Ideas
- Compare / Contrast**: Main Concepts, Main & Subconcepts, Main & Detail, Main & Subconcepts
- Cause / Effect**: 12 Events, 12 Causals
- Sequence**: Main / Cause, Sequence of Events

Essential Understandings SMART sheets

- Literature**: Story Structure & Sequence, Character Analysis, Literary Analysis, Story Problems, Questions, Inferences, Predictions, Text Proof
- Writing**: Level 1, Level 2, Level 3, Level 4, Level 5, Research, Supplemental, Narrative, Organizational, Persuasive
- Vocabulary**: Main Concepts, Subconcepts, Main & Subconcepts, Main & Detail, Main & Subconcepts
- History & Science Generalistive Skills**: Process Group, Place Event, Process Theory, Inquiry, Debate Issue, Policy Conflict, Problem, Invention, Object
- Math**: Mathematical Concepts, Computational Processes, Rules / Theorems
- Social / Media Literacy**: Behavioral Library, Character Building, Perspective Taking, Self-control, Goal Setting & Self-assessment, Behavior Analysis
- Project / Inquiry Learning**: Planning Investigations, Conducting Investigations, Making Presentations, Evaluating Project Processes & Outcomes

SMART planners for Teachers

- Instructional Design**: Content and Units & Lessons, Library/Strategy Units & Lessons, Anticipation Guides, Scaffolding Tactics, Reflective Reviews

SMART planners for Leaders

- MSIS Implementation**: Resources, Schoolwide Implementation Strategies, Articles

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Science Content Standards

Kinds of science knowledge that tends to be emphasized...

Abstract Concepts	Relationships to other concepts	} Relational understanding
Processes	Factors that affect the concept	
Classifications	Things the concept affects	
Famous people	Comparison to other concepts	
Events / Phenomena		
Structures		
Systems & components		
Life Forms		
Procedures		

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Cause / Effect Relationships

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Science Content Standards Cause / Effect

Organizer SMART sheets

- Hierarchical
- Compare / Contrast
- Cause / Effect**
- Classify / Categorize
- Classify / Sequence of Events

Essential Understandings SMART sheets

- Literature
- Writing
- Vocabulary
- History & Science
- Math
- Social / Motivation
- Project based Learning
- SMART Tools for Teachers
- SMART Tools for Leaders

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Science Content Standards Cause / Effect

Abstract Concepts

Force and Motion is about Force and work causing the motion or movement of objects.

When	Then
Force is applied to an object...	Motion occurs in that object.

A force is a push or pull, and can change how an object moves.

A force can change the direction and the speed of an object.

You need to use different amounts of force to move different objects.

The heavier the object is, the more force you need to move it.

Motion happens when an object changes position in relation to other objects.

A moving object might change directions or travel a farther distance.

Motion can be measured by speed, fast or slow, and speed depends on the amount of force that was used.

Work is done when a force results in motion.

So what? What is important to understand about this?
Force can cause motion, different types of force cause different types of motion, and work is only done if force results in motion.

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Science Content Standards Cause / Effect

Life Forms

The Great Kapok Tree is about What happens when the rainforest is destroyed

This...	Caused this...
Chopping down the rainforest	Habitats of animals to change
Chopping down trees	Soil to wash away
People settling on land	Causes animals to leave their natural homes
Removing understory plants	Less production of oxygen
Clearing all plants	Children to live in area without beauty of trees

So what? What is important to understand about this?
People and animals depend on a natural habitat.

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Science Content Standards Cause / Effect

Life Forms

Endangered Loggerheads is about How beach development is endangering sea turtles

Start with	Add this	Results in
Turtles bury eggs in the sand.	Beach development & tourists	Baby turtles die.
Sea Turtles crawl onto beach and bury eggs	Houses & Hotels line the water front for thousands of miles.	Baby turtles attracted to bright lights
Sun incubates eggs; baby turtles dig out of sand	Street lights, Car lights, flashing signs, carnivals	Crawl toward bright lights, away from sea
Attracted to movement & glimmer of light on water	Tourists using the beaches	Babies get lost, disoriented
Crawl toward light to get to the sea & swim away	Beach buggies	Eaten by predators & dehydrated

So what? What is important to understand about this?
IF we don't turn off our lights on the beach at night; THEN the Loggerhead may become extinct.

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Science Content Standards Cause / Effect

Process

Physical and Chemical Changes in Matter
The two ways that matter can change forms.

When This occurs...	Then It results in...	So Is it a chemical or physical change?
- You combine ice cream and milk.	→ You get a milkshake	→ This is a physical change.
- You cut a piece of wood.	→ You now have two pieces.	→ This is a physical change.
- You leave the bread in the toaster too long.	→ Your toast burns.	→ This is a chemical change.
- You mix a Kool-aid packet and water.	→ You get Kool-aid.	→ This is a physical change.
- You squeeze oranges.	→ You make orange juice.	→ This is a physical change.
- Fireworks are lit with fire.	→ The fireworks explode.	→ This is a chemical change.
- The food is left out all night.	→ The food spoils.	→ This is a chemical change.
- You dissolve salt into water.	→ You made salt water.	→ This is a physical change.
- You cut the grass with a lawn mower.	→ Shorter blades of grass.	→ This is a physical change.
- You leave your bike out in the rain.	→ A rusted bike.	→ This is a chemical change.

So what? What is important to understand about this?
We need to understand that changes in matter are all around us all the time.

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Science Content Standards Cause / Effect

Process

Plate, Tectonics and Life on Earth
The ability of living things to respond to changes in the environment

This ...	Caused This ...	Which Has caused this ...
Movement of plates causes changes in climate & geographic features	→ Living things respond to changes in order to survive	→ Diversity Increases or Decreases
As plates move toward or away from equator, environment changes	→ Colder environments = less food, more fat & hair needed for warmth	→ Animals & plants that can adapt to new environments survive. Those that can't, die out.
When landmasses join together	→ Big landmasses: animals can easily move to suitable places avoiding more challenging environments	→ Diversity Decreases
When landmasses split apart	→ Small landmasses: animals adapt to local conditions, & are cut off from competitors & enemies	→ Limits the types of living things with which a species can interact. Diversity increases
Species mutate constantly occur in all living things	→ If changes from mutations match changes in environment, animal more likely to survive	→ If changes from mutations mismatch changes in environment, animal more likely to die out

So what? What is important to understand about this?
The evolution of Earth's living things is strongly linked to movement of the lithospheric plates

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Science Content Standards Cause / Effect

Structures

Tides

During a new moon or a full moon, the sun, moon and earth are in a straight line.

When they are aligned, the gravitational attraction of the sun reinforces the gravitational attraction of the moon.

This compound gravitational attraction of the sun and moon causes the tides to be at their highest point.

These high tides are called **spring tides**.

This shows the effect of the moon phases on Earth's ocean tides.

At quarter moons, the sun and moon are at right angles.

The gravitational attraction of the sun works in opposition to the gravitational attraction of the moon.

These low tides are called **neap tides**.

This oppositional gravitational attraction causes the tides to be at their lowest point.

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Science Content Standards Cause / Effect

Events / Phenomena

Discovery of Photosynthesis
How the experiments of Van Helmont, Priestley, and Ingenhousz reveal that in the presence of light, plants transform CO₂ and H₂O into carbohydrates and release O₂.

This	Caused this...	Which led to...
Van Helmont experiment	→ Led to the discovery of the "hydrate," or water portion of the carbohydrates produced by photosynthesis	→ Led to the discovery that plants need light to produce oxygen
John Priestley experiment	→ Created an experiment to find out if plants grow by taking material out of the air - measured dry soil and a small seed, after five years the mass of the soil was the same - concluded that the mass of the plant gained came from the water, did not realize air changed it too	→ Led to the discovery of the oxygen portion of the photosynthesis equation
Jan Ingenhousz experiment	→ Performed Priestley's experiment and discovered that the candle only remained lit in the presence of light	

So what? What is important to understand about this?
Photosynthesis is a series of reactions that uses energy from the sun to convert water and carbon dioxide into sugars and oxygen

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How to access Cause / Effect Smart Sheets...

Organizer SMARTsheets

- Hierarchy: 1-Main Idea, 2-Sub-Ideas, 3-Sub-Ideas, 4-Sub-Ideas, 5-Sub-Ideas, 6-Sub-Ideas, 7-Sub-Ideas
- Compare / Contrast: Venn, Matrix, Venn, Matrix, Venn, Matrix, Venn, Matrix, Venn, Matrix
- Cause / Effect: C-Chain, C-Chain
- Sequence: Input, Output, Sequence of Events

Essential Understandings SMARTsheets

- Literature: Story Elements & Sequence, Character Analysis, Literary Analysis, Story Problems, Questions, Inferences, Predictions, Text/Pencil
- Writing: Level 1, Level 2, Level 3, Level 4, Level 5, Research, Supplemental, Narrative, Descriptive, Expository, Persuasive
- Vocabulary: Word Cards, Semantic Fields, Word Connections, Word Connections, Features Analysis, LMS, Inferences, Scavenger Hunt, Multiple Meanings
- History & Science: Generalizable Ideas, Fiction, Group, Place, Event, Process, Theory, Ideology, Debate, Issue, Policy, Conflict, Problem, Inference, Output
- Math: Mathematical Concepts, Computational Processes, Rules / Theorems
- Social / Media/Arts: Behavior Library, Character Building, Perspective Taking, Self-control, Goal Setting & Self-advocacy, Behavior Analysis
- Project Based Learning: Conducting Investigations, Making Presentations, Evaluating Project Progress & Outcomes

SMARTplanners for Teachers

- Instructional Strategy: Content Area Units & Lessons, Library/Strategy Units & Lessons, Anticipation Guides, Scaffolded Tactics, Reflective Reviews

SMARTplanners for Leaders

- MS: High-Implementation Resources, Schoolwide Implementation Strategies

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Science Content Standards

Kinds of science knowledge that tends to be emphasized...

Abstract Concepts	Relationships to other concepts	} Relational understanding
Processes	Factors that affect the concept	
Classifications	Things the concept affects	
Famous people	Comparison to other concepts	
Events / Phenomena	Compare / Contrast	
Structures		
Systems & components		
Life Forms		
Procedures		

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Science Content Standards Compare / Contrast

Organizer SMART sheets

- Organizer: Hierarchic
- Organizer: Compare / Contrast
- Organizer: Cause and Effect
- Organizer: Sequence

Essential Understandings SMART sheets

- Literature
- Writing
- Vocabulary
- History & Science Generative Ideas
- Math
- Social / Motivation
- Project Based Learning
- SMART strategies for Features
- SMART strategies for Explanations
- MCS Implementation Resources

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Science Content Standards Comparison Life Forms

Plant Cells	Animal Cells
Different	Different
Have Chloroplasts- make food for the cells	Have a nucleus
Have cell walls- supports and protects a plant cell	Have chromosomes
	Have cell membranes
	Have cytoplasm
	Have vacuoles
	Have mitochondria
	Unlike plant cells, animal cells do not have anything unique to only animal cells.
	Everything they have is common to plant cells.

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Science Content Standards Comparison Life Forms

	Bald Eagle	Red-Tailed Hawk
Food	DIFFERENT They eat fish and use their talons or claws to catch them.	SIMILAR Carnivores
Habitat	They live near lakes, rivers, marshes, and seacoasts	Temperate Deciduous Forest
Color	The Bald Eagle has a white head and tail and a blackish body.	Both have white somewhere on their body.
Nests	They create their nests using sticks. The eggs are white.	The females lay two to three eggs at a time. Make nests of sticks in tall trees.

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Science Content Standards Comparison Structures

	Intrusive Igneous Rocks	vs	Extrusive Igneous Rocks
Subtopics	Different	Similar	Different
Where the igneous rock is formed	Intrusive igneous rocks are formed within in the earth.		Extrusive igneous rocks form at the earth's surface after they are ejected (as lava) through volcanoes.
How rate of cooling affects the rock formation	Because intrusive rocks cool slowly, crystals within the rock have time to form.	All igneous rocks are formed when hot, molten magma or lava cools.	Extrusive rocks cool very quickly and so crystals do not have time to form.

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Science Content Standards Comparison Events / Phenomena

	El Nino	La Nina
Causes	Weaker than normal trade winds	Stronger than normal trade winds
Ocean Temperatures	Warming of the ocean temperatures in the east-central equatorial region	Ocean temperatures that are 1-2°C cooler than average in the east-central equatorial region.
Effects on Weather Globally	More hurricanes in the Pacific, added rainfall in Ecuador and Peru, Indian monsoon rainfall way below normal	Increased Atlantic hurricane activity, Indian monsoon heavier, decreased rainfall in tropical Pacific
Effects on U.S.	Stormy weather for the South during the winter months, warmer in the northeast	Warmer and drier in Southeast, colder over Alaska.

So what? What is important to understand about this?
Even changes of ocean temperatures on a different side of the world, can have an effect on the weather in my state.

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Science Content Standards Comparison Events / Phenomena

	Solar Eclipse	Lunar Eclipse
Subtopics	Different	Similar
How often they occur	There are 5 a year. They last no more than 7.5 minutes.	Both occur every year, but you can see them only if the sky is clear
How long they last	During a total solar eclipse, the moon appears to completely cover the sun.	They last about 2 hours
How they look	A solar eclipse occurs when Earth passes through a new moon's shadow.	An eclipsed moon looks like a dim red circle.
What causes them	Both involve what you see (or don't see) due to a shadow	A lunar eclipse occurs when the full moon passes through Earth's shadow.

So what? What is important to understand about this?
They both occur when Earth, the Sun, and the Moon line up.

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Science Content Standards Comparison

Systems & components

	Tundra	Boreal Forest (Taiga)	Temperate Deciduous Forest	Tropical Rain Forest	Grassland	Desert
Terrain	It is flat and covered with snow most of the year. High and mountainous in the summer due to the permafrost.	Spotted with many lakes, much of the ground is swampy.	It ranges from flat to mountainous.	It is hilly, for the most part, by thick vegetation.	It is flat with very fertile soils.	It is flat with either rocks or sand covering the ground.
Climate	It is cold and dry with temperatures ranging from 20°F in the winter to 50°F in the summer.	Temperatures range from 20°F in the winter to 60°F in the summer.	There are four distinct seasons—fall, winter, spring, and summer—and rainfall is moderate.	It is warm and humid with more than 200 rainy days a year.	There are two types: the warm-wet and the warm-dry.	It is dry, with less than 20 inches of rain falling each year. There are very hot and cold deserts.
Plants	There are mostly perennials, most of the short growing plants are grasses, sedges, and small flowers are common.	There are mostly deciduous trees such as spruce and jack pine.	This is characterized by trees that lose their leaves in fall and winter.	There are four kinds of tropical rain forest: emergent, canopy, understorey, and forest floor.	Grasses, wildflowers, and small shrubs make up this biome.	Species here, like the cactus and the snake plant, are adapted to store water.
Animals	Some live here year-round, like the porcupine and muskrat. Many migrate to warmer climates in winter.	Moose, skunks, beavers, and many other mammals are inhabitants of the taiga.	Wild turkey, white-tailed deer, and many other mammals are common in this biome in North America.	An hour half of all species ever lived on earth are found here, including monkeys, gorillas, apes, etc.	Grass-eating animals and small ground animals such as prairie dogs are common in North America. Rabbits and a variety of birds are common species in Africa.	Many animals found here, including snakes and scorpions, are nocturnal.

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Science Content Standards Comparison

Life forms

Topics	Eagle	Crow	Owl	Seagull	Hawk	Sparrow	Dove	Osprey	Bluebird	Martin	Conclusion about the topic
Predator	X	X	X	X	X	X	X	X	X	X	Most of these birds eat more animals than insects.
Forms pellets	X	X	X	X	X	X	X	X	X	X	3 of every 10 birds eat pellets
On every continent except Antarctica	X	X	X	X	X	X	X	X	X	X	Not very many birds live all around the world
Has some nests for life	X	X	X	X	X	X	X	X	X	X	Many birds like to keep the same mate for life
4 claws (talons) - tynchids & crushes food of food	X	X	X	X	X	X	X	X	X	X	The larger birds tend to have four talons
Nocturnal	X	X	X	X	X	X	X	X	X	X	Only the owl is nocturnal (hunts at night)
Helps to balance population of rodents	X	X	X	X	X	X	X	X	X	X	Mainly big birds eat rodents
Used to symbolize certain characteristics	X	X	X	X	X	X	X	X	X	X	People of ten use birds as symbols
Steals other birds' food	X	X	X	X	X	X	X	X	X	X	Our national bird (Bald Eagle) is a thief!!!

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How to access Comparison Smart Sheets...

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Science Content Standards

Kinds of science knowledge that tends to be emphasized...

- Abstract Concepts
- Processes
- Classifications
- Famous people
- Events / Phenomena
- Structures
- Systems & components
- Life Forms
- Procedures

Sequence

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Science Content Standards

Sequence

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Science Content Standards

Sequence

Process

These are the steps to ...

Ocean currents moving warm water towards the poles and cool water to the equator.

Step 1: The Earth is heated unevenly by the sun causing the equator to be warm and the poles to be cold.

Step 2: Global winds blow across the ocean and create currents in the ocean.

Step 3: Because of the Coriolis Effect, the oceans do not flow straight into the continents with the global winds. Instead, the ocean currents are deflected right in the Northern hemisphere and left in the southern hemisphere.

Step 4: These currents push the warm water from the equator towards the poles and the cool water from the poles to the equator.

Why are these steps important?
The warm ocean currents help to warm climates, and the cold ocean currents help to cool climates.

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Science Content Standards Sequence

Process

Producers, Consumers, & Decomposers
is about...
The different parts of the food chain and their function in an ecosystem.

Producers
Plants use sunlight & water to produce their own food.
Thus all plants are producers.
All animals depend on producers for food.

Consumers
Since animals can not make their own food from sunlight, they have to eat producers or other living things.
This makes animals consumers because they are consuming food from something other than themselves.

Decomposers
Decomposers are the last step in the food chain.
Decomposers eat off of the dead animals and plants.
They turn the dead animals and plants into minerals and gases.

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Science Content Standards Sequence

Systems & components

There are five steps to:
The Respiratory System

Step 1
Breathe in through your nose and mouth.
Goals: Stimuli warm and moister the air you breathe. The hair and mucus in your nose helps to trap dust and germs to prevent them from entering your lungs.

Step 2
Air travels to the trachea.
Goals: Air travels from your nose/through your throat and larynx (voice box) to your trachea. Your trachea is also known as your windpipe.

Step 3
Air then travels through the bronchae to the bronchioles.
Goals: The trachea branches to each lung. The bronchae are called bronchi (bronchae). These bronchi become smaller tubes inside the lung and are called bronchioles.

Step 4
Air enters the air sacs.
Goals: From the bronchioles, the air enters the air sacs that are covered with capillaries.

Step 5
Air reaches the capillaries.
Goals: Once the air reaches the capillaries that cover the air sacs, an exchange of gases occurs. Oxygen from the air sacs goes into the blood and carbon dioxide from the blood goes into the air sacs. After the exchange is made, you exhale carbon dioxide while oxygen is being carried to cells.

Why are these steps important?
These steps are important because if help us to understand why we breathe, why breathe without having to think about it, and if happens that something breathing into steps allows us to see what is going on in our bodies, and how complex the process is.

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How to access Sequence Smart Sheets...

Organizer SMARTsheets

- Hierarchic**
1 Main Idea 2 Main Ideas 3 Main Ideas 4 Main Ideas 5 Main Ideas 6 Main Ideas
- Compare / Contrast**
Venns Matrix Conclusions Matrix & double conclusions
- Cause / Effect**
CE Tables CE webs
- Sequence**
Steps Cycles Sequence of Events

Essential Understandings SMARTsheets

- Literature**
Story Structure & Sequence Character Analysis Literary Analysis Story Problem Questions Inferences Predictions Text/Purpose
- Writing**
Level 1 Level 2 Level 3 Level 4 Level 5 Resources Supplemental: Narrative Descriptive Expository Persuasive
- Vocabulary**
Word Cards Semantic Tables Word Comparisons Word Connections Features Analysis LINC's mnemonics Scavenger Hunts Multiple Meanings
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Person Group Place Event Process Theory Ideology Debate Issue Policy Conflict Problem Invention Object
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Mathematical Concepts Computational Processes Rules / Theorems
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The are quite a few great resources in the Makes Sense Strategies Tool-kit for addressing these standards

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Essential Understandings SMARTsheets Projects

HOME

Planning Projects Conducting Investigations Making Presentations Evaluating Projects

Information Sources TEST Plans Hypothesis Testing

FIND research strategy
 INVENT problem-solving strategy
 TEST research strategy

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Project-based Learning: Implementing Investigations

TEST Strategy for Designing Experiments

Name: _____ Date: _____

Target a question Ask a question that you hope your experiment or research will provide an answer to.

What happens to _____ when _____ is added or subtracted from _____?

What do _____ know or think about _____?

How well does _____ work when trying to _____?

How did _____ change over _____ amount of time?

What are the parts of _____?

How does _____ change when _____?

What is the difference between _____ and _____?

Complete one of these questions or write a different question here.

Establish the kind of information you will need to answer the question If you plan to ...

Repeatedly **count** something: What will be measured? **How** will it be measured?

Count the number of times something happens: When should the counting occur? **How** often?

Make a list of observations and then categorize them later: What will you be looking for during the observations?

Survey people to get opinions: Who will be surveyed? **What** will you ask them about?

Set a plan for collecting the data Note the steps you will follow from the beginning to the end of your experiment.

Tally the data Note the calculations that will need to be performed on the data to make sense of it.

Subtract numbers in each category?

Compute averages, means, or percentages?

Subtract numbers from different categories to determine difference?

Other calculations?

Show the results Decide how the data will be visually displayed.

Tables show numerical differences.

Line Graphs show changes over time.

Bar graphs show differences in quantities.

Pie charts show differences in percentages.

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Project-based Learning: Implementing Investigations

Hypothesis Testing

Name: _____ Date: _____

We observed this ...

The observations led us to this hypothesis ...

So then we tested the hypothesis by ...

Results of the tests led us to conclude that ...

Specific observations

Details of hypothesis

Testing procedure

Details of conclusion