Understanding Complex Concepts and Vocabulary for Diverse Learners

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*How* we teach is as important as *what* we teach.
Mission:

The Summit School educates children with unique learning profiles to their full potential.

At Miller School of Albemarle we create opportunities for discovery and reflection by engaging the minds, hands, and hearts of our students.
Guiding Principles

• We strive to teach students how to learn, focusing on process over product – it’s not just about the right answers.

• We value explicit instruction in organization and self-advocacy, transforming students into confident, self-managed learners.

• “We believe the teaching of a subject matter content and language should be so integrated that all content teachers are also teachers of language.”

Wineburgh 2019
NGSS and Vocabulary

4. The NGSS Focus on Deeper Understanding of Content as well as Application of Content. The Framework identified a smaller set of Disciplinary Core Ideas that students should know by the time they graduate from high school, and the NGSS are written to focus on the same. It is important that teachers and curriculum/assessment developers understand that the focus is on the core ideas—not necessarily the facts that are associated with them. The facts and details are important evidence, but not the sole focus of instruction.

NGSS: Appendix A
Complete sentences by filling in the blanks with vocabulary words from the glossary:

1. **abdomen**: the third section of the insect body, including the digestive and reproductive organs and most of the circulatory and respiratory systems.
2. **adaptation**: any structure or behavior of an organism that allows it to survive in its environment.
3. **aerobic cellular respiration**: a process by which organisms convert glucose into usable energy.
4. **alga** (plural **algae**): an aquatic protist containing chlorophyll. Algae may be single-celled or multicellular.
5. **antibiotic**: a medicine that can kill many types of bacteria.
6. **aquatic**: living or occurring in water.
7. **archaeae**: a microscopic, single-celled organism that lacks a nucleus and organelles (prokaryotic). Archaeae have different cell walls and cell membranes than bacteria or eukaryotes.
8. **asexual reproduction**: the production of genetically identical offspring from a single parent.
9. **atom**: a particle that is the basic building block of matter.
10. **bacterium** (plural **bacteria**): a microscopic, single-celled organism that lacks a nucleus and organelles (prokaryotic).
11. **behavior**: a manner of acting.
12. **biodiversity**: the variety of life that exists in a particular habitat or ecosystem.
13. **cell**: the basic unit of life. All organisms are cells or made of cells.
14. **cell membrane**: the boundary between a cell and its environment.
15. **cell structure**: a part of a cell with a specific job that enables an organism to carry out life’s functions.
16. **cell wall**: a semirigid structure that surrounds cells of plants, fungi, and bacteria.
17. **chlorophyll**: a green pigment in chloroplasts that captures light energy to make sugars during photosynthesis.
18. **chloroplast**: an organelle containing chlorophyll, found in plant cells and some protists.
19. **cilium** (plural **cilia**): a short hairlike structure that propels protists through their fluid environment.
20. **classification**: a system or way of organizing living things.
21. **coevolve**: when two or more species affect each other’s evolution.
22. **colony**: a group of organisms of the same species living together. A bacterial colony is a visible group of bacteria.
23. **compound microscope**: a microscope that uses two lenses (eyepiece and objective lens).
24. **contractile vacuole**: an organelle found mostly in protists that collects extra water in a cell and expels it.
25. **control**: an experimental test used to compare results with tests where a variable was changed.
Creating Vocabulary Lists

1. Organism
2. Vascular system
3. Nervous system
4. Skeletal-Muscular system
5. Circulatory system
6. Excretory system
7. Digestive system
8. Respiratory system
9. Stimulus
10. Photosynthesis
11. Cellular respiration
Definitions

- Category words
- Shortened definitions
- Definitions are repeated in readings, word wall and notes
How we write definitions

<table>
<thead>
<tr>
<th>Digestive System</th>
<th>Digestive System</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The organs that break down food so that it can be used by the body</td>
<td>• ORGAN SYSTEM responsible for the breakdown of food into usable nutrients for the body</td>
</tr>
<tr>
<td>• Is responsible for both mechanical and chemical breakdown</td>
<td></td>
</tr>
<tr>
<td>• The organs and glands in the body that are responsible for digestion</td>
<td></td>
</tr>
</tbody>
</table>
Write your own

<table>
<thead>
<tr>
<th>Excretory System</th>
<th>Excretory System</th>
</tr>
</thead>
<tbody>
<tr>
<td>• excretory system: organ system that removes excess water and waste from the body; includes the large intestine, liver, skin, lungs, and kidneys</td>
<td></td>
</tr>
</tbody>
</table>
How we wrote it

<table>
<thead>
<tr>
<th>Excretory System</th>
<th>Excretory System</th>
</tr>
</thead>
<tbody>
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<td>• ORGAN SYSTEM responsible for exiting wastes from the</td>
</tr>
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<td>body</td>
</tr>
<tr>
<td>the large intestine, liver, skin, lungs, and</td>
<td></td>
</tr>
<tr>
<td>kidneys</td>
<td></td>
</tr>
</tbody>
</table>
Actual Vocabulary List

1. **Organism** any living thing
2. **Vascular system** ORGAN SYSTEM a group of veins that carry sugars and water to all parts of a plant
3. **Nervous system** ORGAN SYSTEM responsible for sensing the environment and sending signals to respond to those senses
4. **Skeletal-Muscular system** ORGAN SYSTEM responsible for the structure and movement of the body
5. **Circulatory system** ORGAN SYSTEM responsible for distributing nutrients and oxygen throughout the body while moving wastes to organs to exit the body
6. **Excretory system** ORGAN SYSTEM responsible for exiting wastes from the body
7. **Digestive system** ORGAN SYSTEM responsible for the breakdown of food into usable nutrients for the body
8. **Respiratory system** ORGAN SYSTEM responsible for turning air into usable oxygen for the body
9. **Stimulus** anything in the environment that causes a reaction in an organism
10. **Photosynthesis** PROCESS by which plants use the chloroplast to make sugar
11. **Cellular respiration** PROCESS by which organisms use sugar to make energy
Vocabulary

- Word Wall
- Definitions
- Quizlet vs other study methods
- Brain Frames
Amino Acids

Definition: building blocks of protein.
Definition: change in the sequence of DNA; can be helpful, harmful, or neutral; can be inherited or acquired
Organ
Tissue
Cell
Organelle
Nucleus
Chromosome
DNA
Membrane
Protein
Gene
Trait
Alleles
Phenotype
Genotype
physical traits
part of a cell, contains DNA
molecule used by the cell to function and grow
small section of DNA, instructions for making a protein
characteristic determined by genes
different versions of the same gene, always in a pair
all of the genes of an organism
T2 Science Vocabulary

Science Fair Project Timeline

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Topic</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Literature Review</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Project Design</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Experiment Setup</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Data Collection</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Report Writing</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Presentation Preparation</td>
<td>3/1-3/31</td>
</tr>
<tr>
<td>Final Preparations</td>
<td>3/31</td>
</tr>
</tbody>
</table>
|科学比赛项目时间表

Engineer: person who uses what they know about math and science to design things that solve problems

Technology: thing designed to help solve a problem

Submersible: VEHICLE made to explore areas underwater without people onboard

Mass: MEASUREMENT amount of matter in a substance, MEASUREMENT how packed something is, mass divided by volume

Density = Mass / Volume

Temperature: MEASUREMENT of the average energy of a substance
Organism: Any living thing
Cell: Smallest thing that is alive, the building block of all organisms.
Organelle: Structures inside of a cell, like organs.

Nucleus: Organelle that surrounds the cell and controls what comes in and out of the cell.
Membrane: Organelle that produces the cell's energy.
Mitochondria: Organelle that produces the cell's energy.

Chloroplast: Organelle only in plant cells - makes energy from sunlight through photosynthesis.
Cell Wall: Organelle only in plant cells - gives structure and support.

Cellular Respiration: Process by which organisms use sugar to make energy.
Photosynthesis: Process by which plants use the chloroplast to make sugar.
Let’s try it
Warm Ups

- Morphology development
- Clarifying Words/Sign Posts*
- Access prior knowledge
  - Open ended
  - Discussion based
- Review previous material

*Modified from Heinemann and Beers
Examples

- List words that begin with the prefix Circ-
- List words that begin with the prefix Micro-
- How do you measure a pile of sand?
- How do we stay safe in the lab?
<table>
<thead>
<tr>
<th>List words with the prefix &quot;micro-&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>microchip</td>
</tr>
<tr>
<td>microscope</td>
</tr>
<tr>
<td>microscopic</td>
</tr>
<tr>
<td>microwave</td>
</tr>
<tr>
<td>microorganism</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>List words with the prefix &quot;circ-&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulatory</td>
</tr>
<tr>
<td>Circle</td>
</tr>
<tr>
<td>Circular</td>
</tr>
<tr>
<td>Circling</td>
</tr>
<tr>
<td>Circulating</td>
</tr>
<tr>
<td>Circulation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How could you measure a pile of sand?</th>
</tr>
</thead>
<tbody>
<tr>
<td>- scale</td>
</tr>
<tr>
<td>- measuring spoons</td>
</tr>
<tr>
<td>- ruler</td>
</tr>
<tr>
<td>- measuring cups</td>
</tr>
<tr>
<td>- measuring stick</td>
</tr>
<tr>
<td>- measuring tape</td>
</tr>
<tr>
<td>- estimation</td>
</tr>
<tr>
<td>- beakers</td>
</tr>
<tr>
<td>- pixel measuring</td>
</tr>
<tr>
<td>- tablespoons</td>
</tr>
<tr>
<td>- teaspoons</td>
</tr>
<tr>
<td>- handfuls</td>
</tr>
<tr>
<td>- pounds</td>
</tr>
<tr>
<td>- height</td>
</tr>
<tr>
<td>- compare piles</td>
</tr>
<tr>
<td>- pints</td>
</tr>
<tr>
<td>- ounces</td>
</tr>
<tr>
<td>- quarts</td>
</tr>
<tr>
<td>- grams</td>
</tr>
<tr>
<td>- tons</td>
</tr>
<tr>
<td>- round</td>
</tr>
<tr>
<td>- width</td>
</tr>
<tr>
<td>- miles</td>
</tr>
<tr>
<td>- yard stick</td>
</tr>
<tr>
<td>- centimeters</td>
</tr>
<tr>
<td>- kilograms</td>
</tr>
<tr>
<td>- feet</td>
</tr>
<tr>
<td>- inches</td>
</tr>
<tr>
<td>- count each grain</td>
</tr>
</tbody>
</table>
Classroom Activities

- Signposts for comprehension
- Card sorts
- Brainframes
- Writing prompts
Do you know when you're digesting food?

Unless you have an upset stomach, digestion usually happens without you even noticing. You know when you chew up your food, but most of the digestive process takes place without you even knowing it. Even when you are not eating, food is still passing through your stomach and small intestine. It may take over a day for a meal to pass all the way through your digestive system.

Function of the Digestive System

Nutrients in the foods you eat are needed by the cells of your body.

The digestive system is the body system that breaks down food and absorbs nutrients. It also gets rid of solid food waste. The digestive system is mainly a long tube from the mouth to the anus. The main organs of the digestive system include the esophagus, stomach and the intestine. The intestine is divided into the small and large intestine.

*Modified from Heinemann and Beers*
Sort these cards based on the type of energy demonstrated.
Pull each card out of this stack and sort it according to its domain.
Place the phylum cards in the correct position based on how they evolved over time. Place the sub groups underneath. Use your notes to help you.
1. Place card labeled “TC” on the bottom space (number 1). Fossils T and C are the oldest fossils in this activity.
2. Find a card that either has one or more of these letters (T or C). Since it has a letter in common with the first card, it should go above it. This layer of rock is newer or younger than the red layer below it.
3. Continue moving cards into your rock layer. When you finish you will have a vertical stack of cards with the “TC” card representing the oldest rock layer and the card on the orange 8 representing the youngest rock layer.
4. Answer the questions for the Letter Fossil Sort before you move on to the next slide.

PLEASE LEAVE ALL CARDS SORTED ON THE SLIDES FOR A GRADE.
1. Each card represents a rock layer.

2. Find card “K” and move it toward the bottom of your slide. This is your oldest rock layer.

3. Find a card with at least one of the same fossils as card K and put it on the orange rectangle just above and to the right of it. Pay close attention to how many fossils have been found in each rock layer.
Sort these cards into the three categories: Living, Non-Living and Undecided.
Brain Frames

- Brain frames are part of our structured writing program, EmPower, Architects for Learning®
- Used for organizing ideas, studying and taking notes
- **SHOWING RELATIONSHIPS**
  - Relationship
  - Idea
  - Idea
  - Idea
  - Idea

- **SEQUENCING**
  - Event
  - Event
  - Event
  - Detail
  - Detail

- **TELLING**
  - Topic
  - Idea
  - Idea
  - Idea
  - Idea
  - Idea
  - Idea

- **CATEGORIZING**
  - Category
  - Idea
  - Idea
  - Idea
  - Idea

- **COMPARING/CONTRASTING**
  - Topic
  - Idea
  - Idea
  - Idea
  - Idea

- **SHOWING CAUSES/EFFECTS**
  - Cause
  - Event or Opinion
  - Effect
  - Effect
  - Effect

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**Cell organelles: complete the showing relationship brainframe**

- **Function**
  - nucleus: controls cell
  - cell membrane: surrounds cell, gives structure and support
  - cell wall: does photosynthesis
  - chloroplast: in plant cells only, gives cell energy
  - mitochondria: produces energy

**Jobs**
- nucleus
- cell membrane
- chloroplast
- mitochondria
The circulatory system moves waste to the organs of the excretory system.
How do organisms get energy?

- **Type of organism**
  - Plants
  - Bacteria
  - Animals

- **Energy**
  - Glucose
  - Sunlight

- **Photosynthesis**

- **Cellular Respiration**

- **Eat Food**

- **Hunt**
Energy from hot water particles → Particles of the plastic vial → Cold water particles → Particles of the thermometer → Particles of the thermometer alcohol

Steam, thermometer, felt it was hot → Spread out and move faster → Spread out and move faster → Spread out and move faster → Spread out and move faster, the red alcohol rose up
Complete the sequencing brain frame, following the path of a signal in your body.

1. Touching a Wet Dog
2. Send signal to **spinal cord**
3. Send signal to **brain**
4. Send signal to **spinal cord**
5. Send signal to **muscle**
6. Hand moves away
3. Complete the following sequencing brainframe:

- Change in
- Production of a
- Change in
- Production of a
Amphibians
- No legs at larval stages
- Porous eggs
- Moist skin
- Lay eggs in water
- Metamorphosis

- Heterotrophic
- Eukaryotes
- Chordates
- Four legs
- Cloaca
- Ectothermic
- Vertebrates

- Reptiles
  - Have scales
  - More land based
  - Dry skin
  - Amniotic eggs
  - Shed
Weather Report Writing Prompt

Choose a city anywhere in the world. Describe the weather for your city using temperature, precipitation, humidity, and wind. Tell the people in your city how to prepare for that day’s weather.

Steps:

1. Pick a city, and answer the question on Google classroom
2. Use the weather print out to complete the sequencing brainframe on Google Classroom
3. Type your draft weather report on Google classroom
4. Read your weather report to a classmate to check for mistakes
5. Have a teacher BOLD your weather report
6. Make all corrections
7. Turn in the writing prompt assignment on Google classroom
Phase Change Writing Prompt

Explain how heat energy affects a substance. In your explanation, be sure to include:

- The temperatures at which a substance changes states of matter
- What is happening at the molecular level at each state
- The names for the process of changing states

**Step 1:** collect and label your graph

**Step 2:** complete the paragraph template on Google Classroom

**Step 3:** type your paragraph

**Step 4:** BOLD with a classmate and/or teacher
References

- EmPOWER Process™, Architects for Learning
- Architects for Learning®
- Teacher resources: SEPUP, FOSS, Holt, CK12
- “Supporting Emergent Multilingual Learners in Science” Molly Weinburgh, Cecilia Silva, Kathy Horak Smith