2014 Oregon Science Standards (NGSS)

SCIMATH Performance Tasks & SCI/ELA Formative Assessment Development (Aligned to CCSS)

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NEXT GENERATION SCIENCE STANDARDS

OFFICE OF LEARNING
INSTRUCTION · STANDARDS · ASSESSMENT & ACCOUNTABILITY UNIT
STUDENT ASSESSMENT

COMMON CORE STATE STANDARDS OREGON

AGENDA

- 2014 Oregon Science Standards Update
- NGSS/CCSS-Math & CCSS-ELA Connections
- SCIMATH TASKS (Achieve)
- SCI/ELA TASKS (Socio-Scientific)
- Task Development Brainstorming
- QUESTIONS

2014 Oregon Science Standards (Next Generation Science Standards)

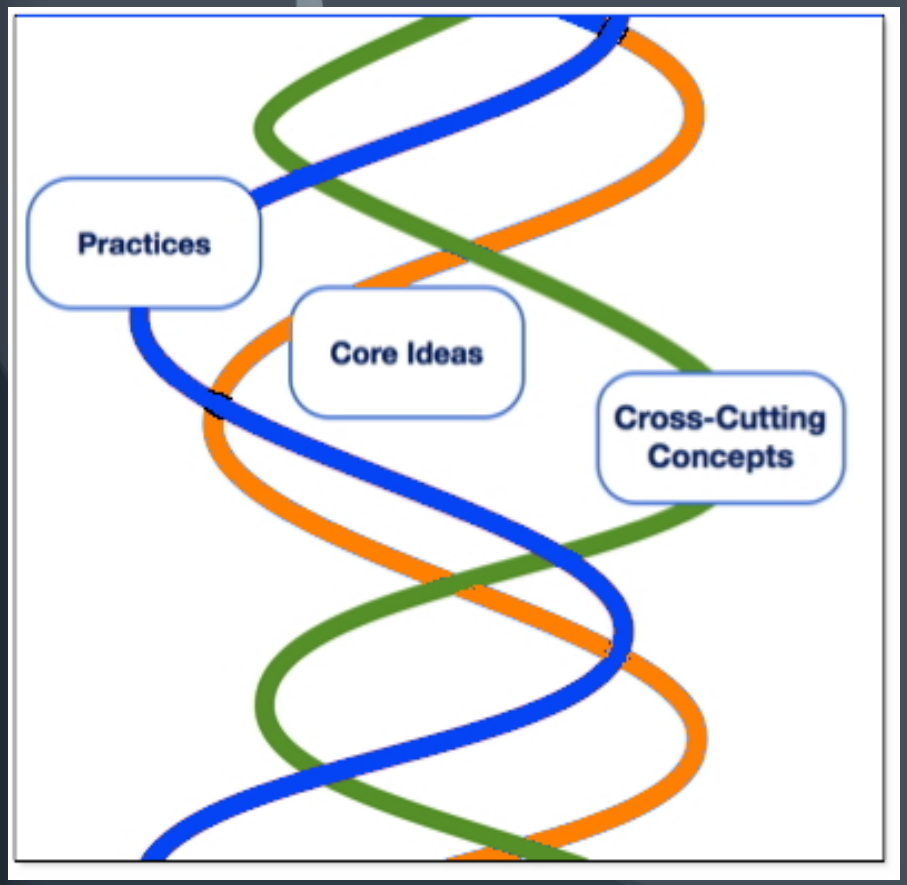
- SBE adopted the 2014 Oregon Science Standards on March 6, 2014
- Adoption includes the grade level middle school science standards sequence (6, 7, and 8)
- Equip Rubric for Lessons and Units for Science is now available*
- 2009 Oregon Science Standards→ 2014 Oregon Science Standards Crosswalks for each grade level are available*
- Continue to use OAKS Science until a new science assessment that aligns to the new standards is developed and becomes operational in 2018-2019*

*http://www.ode.state.or.us/search/page/?id=4141

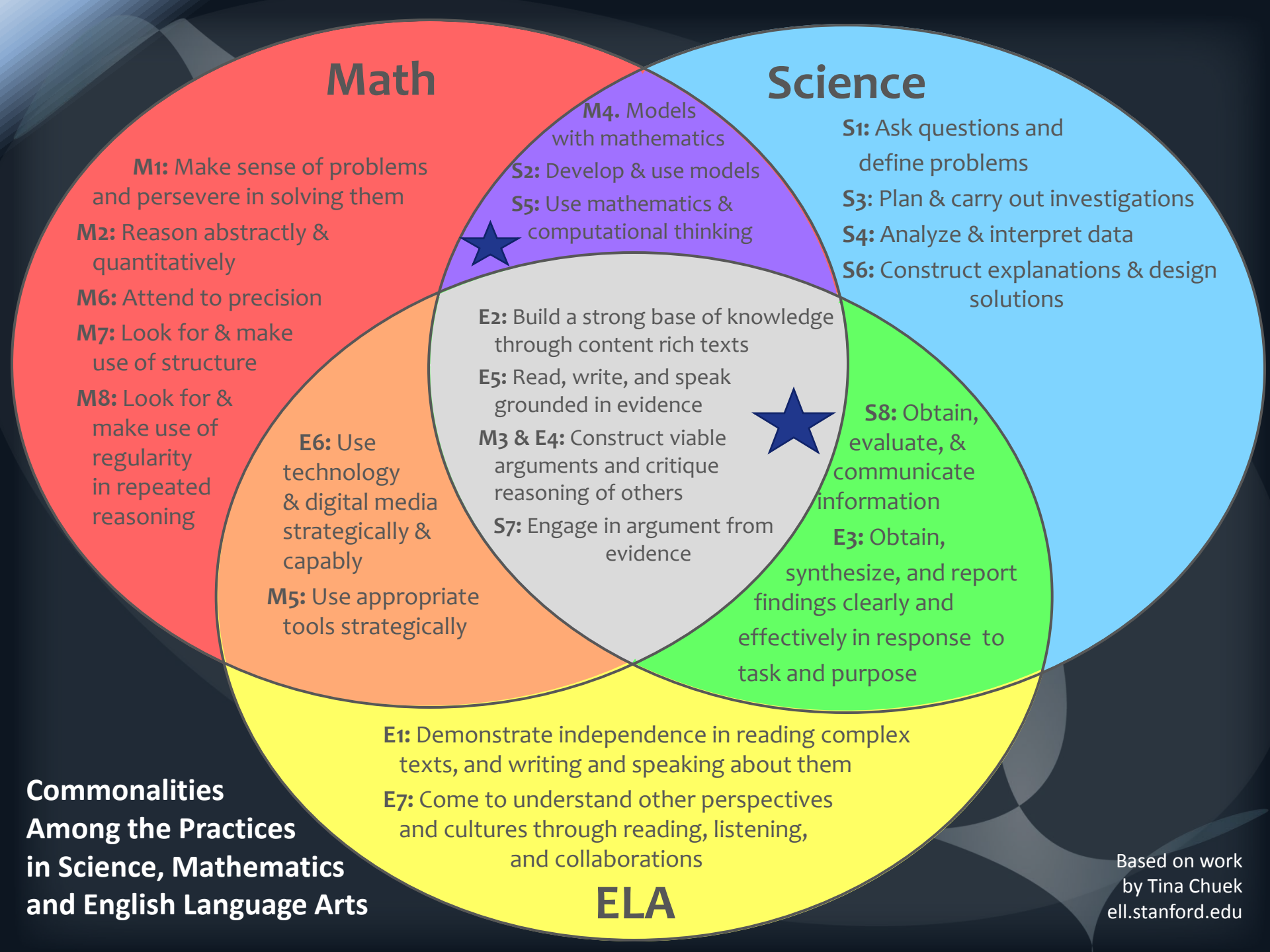
Scientific and Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Developing explanations and designing solutions
- Engaging in argument
- Obtaining, evaluating, and communicating information

NGSS Architecture



- The NGSS are written as Performance Expectations
- NGSS require contextual application of the three dimensions by students.
- Focus is on how and why as well as what



Commonalities Among the Practices in Science, Mathematics and English Language Arts

Based on work by Tina Chuek
ell.stanford.edu

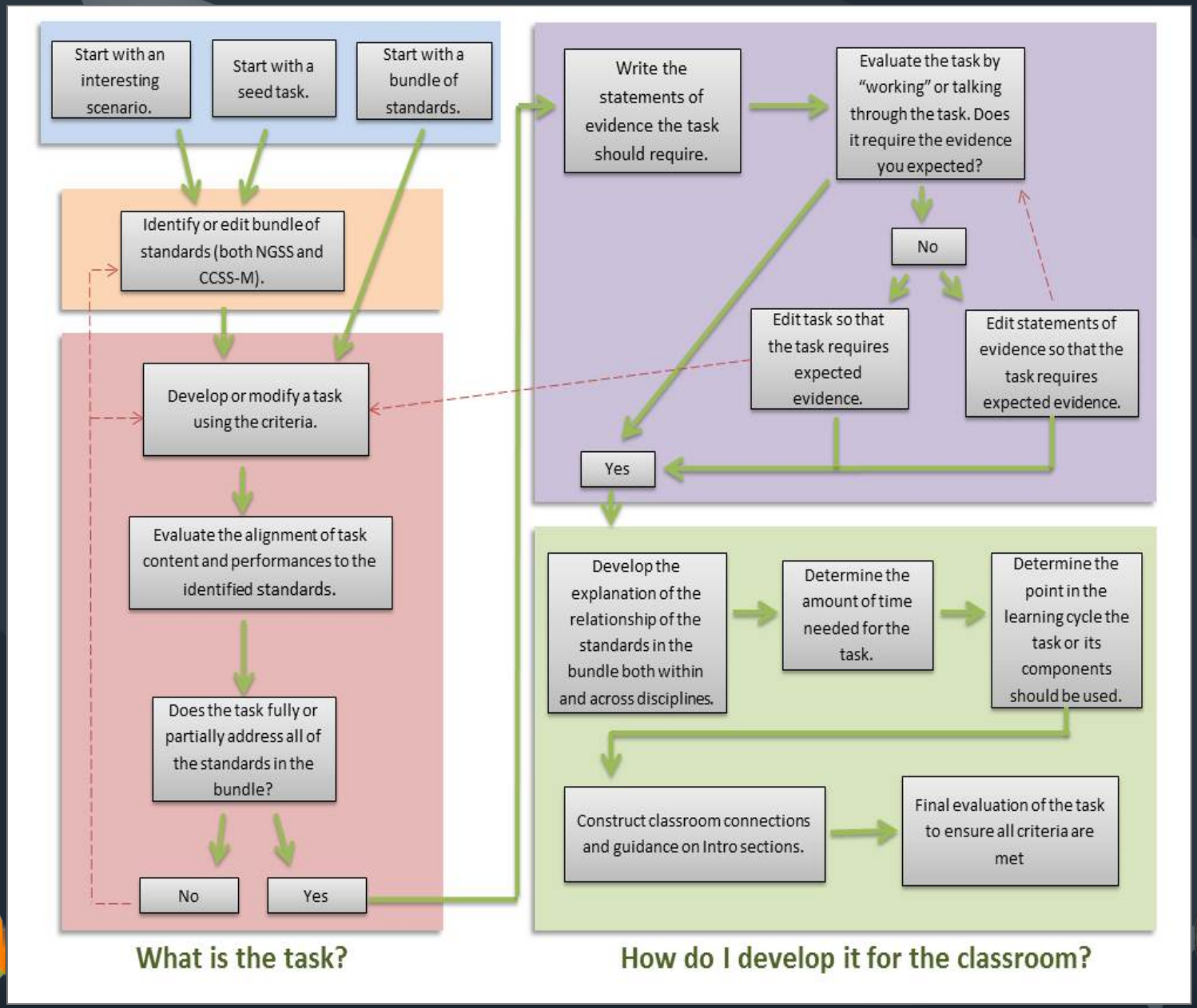
SCIMATH TASKS

ASSESSMENT GUIDANCE

Criteria	
1. Clear Purpose	Why am I assessing?
2. Clear Learning Target(s)	What am I assessing?
3. Quality Assessment	How can I assess it well?
4. Proper Test Administration	How will I ensure test conditions do not interfere with a student's ability to perform well on a test?
5. Effective Communication of Results	How will I share results for maximum impact?

http://www.ode.state.or.us/go/LocalAssessmentGuidance

THE SCIMATH TASK DEVELOPMENT PROCESS



NGSS/CCSS-Math Task Template

Introduction

This section includes a short "abstract" describing the task background information and the unifying theme/question for the task. This section also includes reference to the materials from which the assessment task was developed.

Standards Bundle

This section lists the Next Generation Science Standards (performance expectations), CCSS-M practices and grade level standards, and CCSS-ELA/Literacy standards that are partially or fully assessed by the task components. Standards completely highlighted in bold are fully assessed by the task, including an integration of the dimensions from the foundation boxes associated with each NGSS performance expectation as reflected in the evidence statements and as outlined in the standards alignment and connections section below.

Information for Classroom Use

Connections to Instruction: This section provides recommendations for how this assessment task might be used in the classroom, including type of class and where within the instructional unit it might be used, whether it could be used as a formative or summative assessment, and suggestions for how it might be subdivided.

Approximate Duration for the Assessment Task: This section will provide information on the amount of time needed to complete the assessment task and how it might be broken up to fit within limited-time class periods at different points in time over the course of an instructional unit. Note that this section does not include instructional time leading up to each task component(s).

Assumptions: A description of the foundational knowledge and abilities required of the teacher and/or students in order to use this assessment task.

Materials Needed: A description of the resources needed to complete the task components.

NGSS/CCSS-Math Task Template

Assessment Task

This section represents the portion of the task that would be given to students.

Context: An introduction to the task that defines the setting of the task or that gives the task components a unifying theme or question.

Task Components: All of the activities and questions that make up the assessment task, divided into specific components.

Alignment and Connections of Task Components to the Standards Bundle

This section describes how each task component specifically would assess proficiency of part of the standards bundle, including all-related standards and parts of standards (since most individual task components don't assess a full standard) and how they integrate math, science, and engineering aspects of the task. This section also includes a statement describing which task component(s) together fully assess an NGSS performance expectation, including an integration of the associated dimensions.

Evidence Statements

This section includes a list of statements that will specifically and clearly state the evidence for student proficiency on a task component as it meets the requirements of all dimensions of the associated standards included in the standards bundle and the intent for assessment.

Rubrics (coming soon)

In future versions of these classroom sample assessment tasks, this section will provide example scoring guidelines for the task components that reflect levels of student performance as below basic, basic, proficient, and advanced.

SAMPLE DRAFT SCIMATH TASKS

- MIDDLE SCHOOL:

-Natural Selection and the Development of Antibiotic Resistance

- HIGH SCHOOL:

-Giant African Land Snail (Demo)

-Analyzing Floods: Understanding Past Flood Events and Considering Future Flood Events in a Changing Climate

-Solar Cookers

*More to be released by Achieve by late FALL 2014

Giant African Land Snail

SCIMATH TASK

Bundling Math and Science

Modeling; Reasoning Abstractly and Quantitatively

Cause and Effect

Systems and System Models

Construct and compare linear, quadratic, and exponential models and solve problems.

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

For exponential models, express as a logarithm the solution to $ab^{ct}=d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

NGSS LS2: Ecosystems

1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

NGSS LS4: Biological Evolution

2. Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

Giant African Land Snail

In 1966, a Miami boy smuggled three Giant African Land Snails into the country. His grandmother eventually released them into the garden, and in seven years there were approximately 18,000 of them. The snails are very destructive and had to be eradicated. They consume over 500 different types of plants, lay over 1200 eggs per year, and have been shown to cause indigenous snails' populations to decrease over time. According to the USDA, it took 10 years and cost $1 million to eradicate them. Now, Dade County, Florida faces the same infestation.

Giant African Land Snail

a. Assuming the snail population grows exponentially, write an expression for the population, *P*, in terms of the number, *t*, of years since their release in 1966.

b. How long does it take for the population to double?

c. Assuming the cost of eradicating the snails is proportional to the population, how much would it have cost to eradicate them if

   i. The Florida Department of Agriculture (FDA) had started the eradication program a year earlier?

   ii. The FDA had let the population grow unchecked for another year?

Giant African Land Snail

d. Using information from online sources develop a model of a possible food web for current day Dade County. The web should include at least one indigenous snail, the wolf snail and at least three indigenous plants. Be sure to include mathematical or computational representations about the current carrying capacity of the ecosystem as well as the energy dissipation as energy is transferred from organism to organism.

e. Given the population growth and the nature of the Land Snails, insert the Land snails into the previously constructed food web. Using your previous representation, construct an argument based on the competitive relationships and the mathematical comparisons between a normally functioning ecosystem versus one with the Land Snails. The argument should also include the Land Snails effect on other organisms within the food web.

Giant African Land Snail

f. Given the data on current day Dade County before the introduction of the Land Snails and after, construct an explanation of the effect of Land Snails on the ecosystem. The explanation should include a mathematical representation of the Land Snails effect on biodiversity and populations of the wolf snail.

g. Apply concepts of statistics and probability to develop evidence that the Land Snail has an advantageous heritable trait and tend to increase in proportion to wolf snails.

Evidence Statements

The student's model of food webs accurately reflects the flow of matter and energy in Miami Dade County by showing evidence of the following:

- Arrows accurately describing the movement of matter and energy from organism to organism.
- Arrows accurately describe the relationships between different levels of organisms.
- The model properly represents the disruption to the natural web with the insertion of the Land Snail.

Evidence Statements

- The argument of the model includes mathematical representations of dissipation of energy from organism to organism.
- The argument for the model includes evidence of understanding that energy has a source and it is not created or destroyed, but transferred from organism to organism.

Essential Skills Math Work Sample

The snail population grows exponentially and could be represented by an exponential function $y = ab^x$.

Date	t	P
1966	0	3
1973	7	18,000
1983	17	0

Since the model will be exponential I coded 1966 as year zero so that I easily solve for a (since $b^0 = 1$)

$P = ab^t$ (Where P is population of snails, and t is time in years)

$3 = ab^0$ $a = 3$

$18{,}000 = 3(b^7)$

$6000 = b^7$

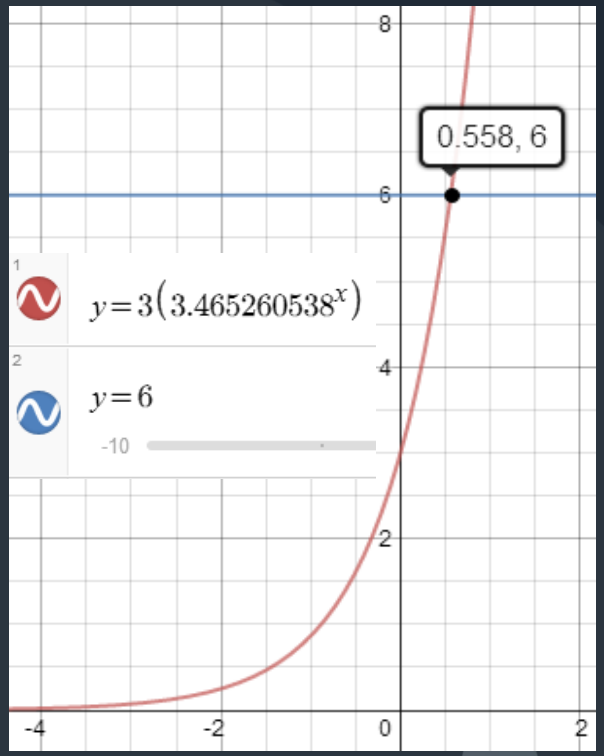
$b = 6000^{1/7}$ $b = 3.465260538\ldots$

$b \approx 3.47$ $P = 3(3.47^t)$

I stored the actual value of b on my calculator to use in future computations. As the base of an exponent I don't want to create excessive round off error.

The population began with 3 snails and would double when it reached 6 snails. How long will it take?

Date	X	Y
1966	0	3
??	??	6
1973	7	18,000
1983	17	0



$P = 3(3.47^t)$

$6 = 3(3.47^t)$

$2 = (3.47^t)$

$\log 2 = t \log 3.47$

$t = \log 2/\log 3.47$

$t \approx .56$ years to double

The problem could also be solved graphically be finding the intersection point of the linear function $y = 6$ and the exponential function $y = 3(3.47^x)$. The intersection point also indicates that it takes about .56 years for the population of snails to double.

CCSS F-LE.2, F-LE.4

SCI/ELA TASKS

Developing socio-scientific arguments is complex; students must not only build sound arguments, but they must also draw on content knowledge and evidence from both science and ethics.

"Beyond My Opinion Versus Yours"-
The Science Teacher, January 2014

Socio-scientific argumentation and its connections to the *Next Generation Science Standards* and the Nature of Science.

Connections to the *NGSS*

- Scientific and Engineering Practice: Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.
  - Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g., economic, societal, environmental, ethical considerations).

Connections to the Nature of Science

- Science Is a Human Endeavor
  - Science is a result of human endeavors, imagination, and creativity.
- Science Addresses Questions About the Natural and Material World
  - Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions.
  - Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge.
  - Many decisions are not made using science alone but rely on social and cultural contexts to resolve issues.

"Beyond My Opinion Versus Yours"- The Science Teacher, January 2014

Why teach socio-scientific issues?

Teaching socio-scientific issues (SSIs) helps us not only meet the goals of equity and diversity described in *A Framework for K–12 Science Education* (NRC 2012) but also allows us to explicitly "bridge [our] diverse students' background knowledge and experiences to scientific knowledge and practices," as required by the *Next Generation Science Standards* (NGSS Lead States 2013, p. 6).

As demonstrated in this table, SSI lessons help us provide more equal opportunities for learning, allowing us to meet a number of often overlooked learning goals for *all* students.

Goals for all students	**Helping equalize opportunities to learn**
Address science-related choices students make now or in the near future.	Meaningfully relates science to "circumstances of [students'] own lives." (NRC 2012, p. 285)
Make interdisciplinary connections that situate science in the real world.	Cultivates students' participation as scientifically literate members of society.
Develop skills of investigation, argumentation, and critical thinking.	Encourages students to see themselves as "competent learners of science." (NRC 2012, p. 286)
Support thoughtful interpretations of others' ideas about science.	Provides a space to explore how students' cultures shape their ideas about nature.
Practice communication skills needed to learn science content in productive ways.	Recognizes diverse communication styles students use to make sense of science.
Encourage students to see the crucial roles that reading and writing play in science.	Promotes the iterative development of ideas characteristic of scientific work.

"Personalizing Science: Strategies for Engaging Diverse Students with Socio-Scientific Issues", The Science Teacher, January 2014

FIGURE 3

Elements of a strong socio-scientific justification.

Makings of a strong justification	Which means...
Decision	A position (claim) is clearly stated. The decision relates directly to the ethical question.
Facts	The facts and science content can be confirmed or refuted regardless of personal or cultural views. These can be used as evidence to support the claim.
Ethical considerations	Ethical considerations may include respect for persons, maximizing benefits and minimizing harm, and justice. These can serve as evidence to support the claim.
Stakeholder views	There are a variety of views and interests in the decision, and more than one individual or group will be affected by the outcome.
Alternative options and rebuttals	No one decision will satisfy all parties. A thorough justification considers strengths and weaknesses of various positions.
Reasoning and logic	A logical explanation that connects the evidence to the claim is provided.

"Beyond My Opinion Versus Yours"- The Science Teacher, January 2014

SCI/ELA TASK (Socio-Scientific)

Bioethics Concepts and Skills: Steroid and Performance Enhancing Drug Abuse In Athletics

Modeled after Smarter Balanced ELA Performance Tasks

Performance Task Template (Part 1)

- Classroom Component:
- Three Videos
- Q/A Session
- Source #1:Steroid Background Information
- Source #2: Tour in Tatters: Team Ousts the Race Leader
- Source #3: Olympic Champion Acknowledges Use of Steroids
- Source #4: The Olympics would be better if athletes were allowed to take drugs
- 3 Questions Pertaining to the Sources

Part 2: Student Instructions and Assignment

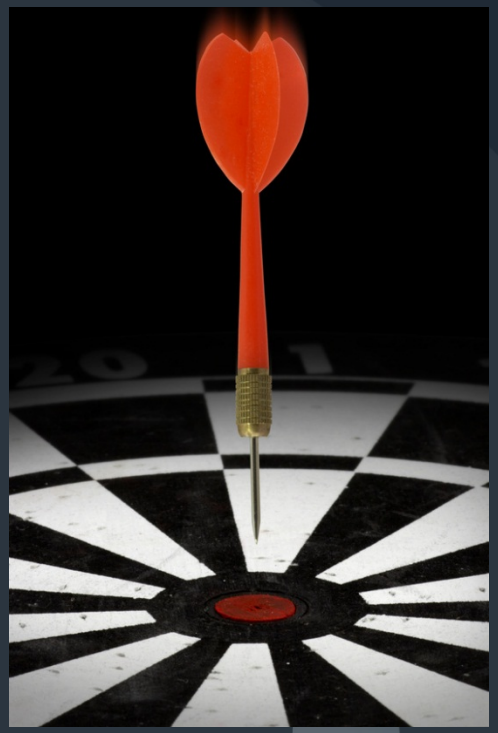
Your Assignment

Based on the articles that you have researched and read, determine whether or not the United States should continue to ban the use of steroids and performance enhancing drug use in professional athletics. Write an argumentative essay that takes a clear position, using material from the articles you have read as support. Be sure that your recommendation acknowledges both sides of the issue so that people know that you have considered this recommendation carefully. You do not need to use all the sources, only the ones that most effectively and credibly support your position and your consideration of the opposing view.

Smarter Balanced Rubrics: Full Writes

Three Attributes

- **Purpose/Organization**
  (4-point scale)
- **Evidence/Elaboration**
  (4-point scale)
- **Conventions**
  (2-point scale)



*Individual attribute scores **contribute** to the overall score on the summative assessment.*

SCIMATH & SCI/ELA TASK DEVELOPMENT BRAINSTORMING

Questions

Resources

Next Generation Science Standards (Achieve):
http://www.nextgenscience.org

Next Generation Science Standards (Achieve) Resources:
http://www.nextgenscience.org/resources

2014 Oregon Science Standards Webpage:
http://www.ode.state.or.us/search/page/?id=4141

Smarter Balanced Assessment Consortium:
http://www.smarterbalanced.org/

Smarter Balanced Practice Tests (Math and ELA Performance Tasks + Rubrics):
http://sbac.portal.airast.org/practice-test/resources/

National Institutes of Health (NIH)- Teaching Exploring Bioethics
(Free Curriculum Supplement):
http://science.education.nih.gov/supplements/nih9/bioethics/guide/teaching.htm

Smarter Balanced Achievement Level Setting Opportunity

- Educators, parents, business leaders, and other interested parties are invited to participate online.
- Participants will take selected English or Math tests and recommend achievement level scores.
- Register at http://www.smarterbalanced.org/onlinepanel by September 19th, 2014 to participate.
- Visit the Smarter Balanced website at www.smarterbalanced.org to learn more about the online panel.
- Please spread the word! We want as many Oregonians involved as possible!

Contacts

For 2009/2014 Oregon Science Standards(NGSS) related questions, please contact Jamie Rumage (jamie.rumage@state.or.us)

For OAKS Science and local performance assessment related questions, please contact Rachel Aazzerah (rachel.aazzerah@state.or.us)

For Math assessment and work sample related questions, please contact Bryan Toller (bryan.toller@state.or.us)

For ELA assessment and work sample related questions, please contact Ken Hermens (ken.hermens@state.or.us)