

CreositySpace – Water Watchers Activity Descriptions and Standards Alignment

General Activity Descriptions:

Below you will find brief descriptions of the hands-on science activities associated with the *Water Watchers* Technology Entrepreneurship Curriculum (TEC) module.

Activity 1: Water purification

Objective:

To give students hands on experience on the challenges with water purification

Materials:

Filtration apparatus, filtering components (sand, charcoal, paper, etc.) and contamination components (dirt, oil, garbage, food coloring, etc.)

General Description:

The class will generate some communal mixtures of “dirty water” and then work in small groups to develop a purification strategy. The dirty water will contain a variety of easy to separate components (e.g., leaves, branches, garbage), more difficult to separate components (oil, dirt) and very difficult to separate components (e.g., food coloring, vinegar, etc.).

Activity 2: Design your own water purification plant

Objective:

To introduce students to the key concepts associated with providing clean drinking water to a community including community size, geographical location and resources available.

General Description:

Students will be given a set of conditions and asked to design a water purification plant. They will have a number of components to choose from and will need to decide how to build the plant based on their specific community needs and resources. Students will then present their designs to one another, describing why they chose the specific components they used.

As an optional extension, students can build small models of their purification plants.

Education Standards supported by this module

Common Core ELA Standards

Grade 3

Reading Informational Text:

[CCSS.ELA-LITERACY.RI.3.1](#) Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

[CCSS.ELA-LITERACY.RI.3.2](#) Determine the main idea of a text; recount the key details and explain how they support the main idea.

[CCSS.ELA-LITERACY.RI.3.4](#) Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3 topic or subject area*.

Writing:

[CCSS.ELA-Literacy.W.3.1](#) Write opinion pieces on topics or texts, supporting a point of view with reasons.

[CCSS.ELA-Literacy.W.3.1.a](#) Introduce the topic or text they are writing about, state an opinion, and create an organizational structure that lists reasons.

[CCSS.ELA-Literacy.W.3.1.b](#) Provide reasons that support the opinion.

[CCSS.ELA-Literacy.W.3.1.c](#) Use linking words and phrases (e.g., *because, therefore, since, for example*) to connect opinion and reasons.

[CCSS.ELA-Literacy.W.3.1.d](#) Provide a concluding statement or section.

[CCSS.ELA-Literacy.W.3.2](#) Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[CCSS.ELA-Literacy.W.3.2.a](#) Introduce a topic and group related information together; include illustrations when useful to aiding comprehension.

[CCSS.ELA-Literacy.W.3.2.b](#) Develop the topic with facts, definitions, and details.

[CCSS.ELA-Literacy.W.3.2.c](#) Use linking words and phrases (e.g., *also, another, and, more, but*) to connect ideas within categories of information.

[CCSS.ELA-Literacy.W.3.2.d](#) Provide a concluding statement or section.

[CCSS.ELA-Literacy.W.3.4](#) With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose. (Grade-specific expectations for writing types are defined in standards 1-3 above.)

[CCSS.ELA-Literacy.W.3.5](#) With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.

[CCSS.ELA-Literacy.W.3.6](#) With guidance and support from adults, use technology to produce and publish writing (using keyboarding skills) as well as to interact and collaborate with others.

[CCSS.ELA-Literacy.W.3.7](#) Conduct short research projects that build knowledge about a topic.

[CCSS.ELA-Literacy.W.3.8](#) Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

Speaking & Listening:

[CCSS.ELA-LITERACY.SL.3.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.3.1.A](#) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.3.1.B](#) Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).

[CCSS.ELA-Literacy.SL.3.1.c](#) Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.

[CCSS.ELA-Literacy.SL.3.1.d](#) Explain their own ideas and understanding in light of the discussion.

[CCSS.ELA-Literacy.SL.3.3](#) Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

[CCSS.ELA-Literacy.SL.3.4](#) Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace.

[CCSS.ELA-Literacy.SL.3.6](#) Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

Language:

[CCSS.ELA-LITERACY.L.3.1](#) Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

[CCSS.ELA-LITERACY.L.3.1.A](#) Explain the function of nouns, pronouns, verbs, adjectives, and adverbs in general and their functions in particular sentences.

[CCSS.ELA-LITERACY.L.3.2](#) Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

[CCSS.ELA-LITERACY.L.3.4](#) Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

Grade 4

Reading Informational Text:

[CCSS.ELA-LITERACY.RI.4.1](#) Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

[CCSS.ELA-LITERACY.RI.4.2](#) Determine the main idea of a text and explain how it is supported by key details; summarize the text.

[CCSS.ELA-LITERACY.RI.4.4](#) Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*.

[CCSS.ELA-LITERACY.RI.4.5](#) Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text.

[CCSS.ELA-LITERACY.RI.4.7](#) Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

Writing:

[CCSS.ELA-LITERACY.W.4.1](#) Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

[CCSS.ELA-LITERACY.W.4.1.A](#) Introduce a topic or text clearly, state an opinion, and create an organizational structure in which related ideas are grouped to support the writer's purpose.

[CCSS.ELA-LITERACY.W.4.1.B](#) Provide reasons that are supported by facts and details.

[CCSS.ELA-LITERACY.W.4.1.C](#) Link opinion and reasons using words and phrases

[CCSS.ELA-LITERACY.W.4.1.D](#) Provide a concluding statement or section related to the opinion presented.

[CCSS.ELA-LITERACY.W.4.2](#) Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[CCSS.ELA-LITERACY.W.4.2.A](#) Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.

[CCSS.ELA-LITERACY.W.4.2.B](#) Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.

[CCSS.ELA-LITERACY.W.4.2.C](#) Link ideas within categories of information using words and phrases.

[CCSS.ELA-LITERACY.W.4.2.D](#) Use precise language and domain-specific vocabulary to inform about or explain the topic.

[CCSS.ELA-LITERACY.W.4.2.E](#) Provide a concluding statement or section related to the information or explanation presented.

[CCSS.ELA-LITERACY.W.4.4](#) Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

[CCSS.ELA-LITERACY.W.4.8](#) Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

Speaking & Listening:

[CCSS.ELA-LITERACY.SL.4.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.4.1.A](#) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.4.1.B](#) Follow agreed-upon rules for discussions and carry out assigned roles.

[CCSS.ELA-LITERACY.SL.4.1.C](#) Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

[CCSS.ELA-LITERACY.SL.4.1.D](#) Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

[CCSS.ELA-LITERACY.SL.4.3](#) Identify the reasons and evidence a speaker provides to support particular points.

Language:

[CCSS.ELA-LITERACY.L.4.1](#) Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

[CCSS.ELA-LITERACY.L.4.1.A](#) Use relative pronouns (*who, whose, whom, which, that*) and relative adverbs (*where, when, why*).

[CCSS.ELA-LITERACY.L.4.2](#) Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

[CCSS.ELA-LITERACY.L.4.3](#) Use knowledge of language and its conventions when writing, speaking, reading, or listening.

[CCSS.ELA-LITERACY.L.4.3.A](#) Choose words and phrases to convey ideas precisely.

[CCSS.ELA-LITERACY.L.4.4](#) Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.

Grade 5

Reading Informational Text:

[CCSS.ELA-LITERACY.RI.5.2](#) Determine two or more main ideas of a text and explain how they are supported by key details; summarize the text.

[CCSS.ELA-LITERACY.RI.5.3](#) Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical text based on specific information in the text.

[CCSS.ELA-LITERACY.RI.5.4](#) Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 5 topic or subject area*.

Writing:

[CCSS.ELA-LITERACY.W.5.1](#) Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

[CCSS.ELA-LITERACY.W.5.1.A](#) Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped to support the writer's purpose.

[CCSS.ELA-LITERACY.W.5.1.B](#) Provide logically ordered reasons that are supported by facts and details.

[CCSS.ELA-LITERACY.W.5.1.C](#) Link opinion and reasons using words, phrases, and clauses

[CCSS.ELA-LITERACY.W.5.1.D](#) Provide a concluding statement or section related to the opinion presented.

[CCSS.ELA-LITERACY.W.5.2](#) Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

[CCSS.ELA-LITERACY.W.5.2.A](#) Introduce a topic clearly, provide a general observation and focus, and group related information logically; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.

[CCSS.ELA-LITERACY.W.5.2.B](#) Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.

[CCSS.ELA-LITERACY.W.5.2.C](#) Link ideas within and across categories of information using words, phrases, and clauses (e.g., *in contrast, especially*).

[CCSS.ELA-LITERACY.W.5.2.D](#) Use precise language and domain-specific vocabulary to inform about or explain the topic.

[CCSS.ELA-LITERACY.W.5.2.E](#) Provide a concluding statement or section related to the information or explanation presented.

[CCSS.ELA-LITERACY.W.5.4](#) Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

[CCSS.ELA-LITERACY.W.5.8](#) Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

Speaking & Listening:

[CCSS.ELA-LITERACY.SL.5.1](#) Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 5 topics and texts*, building on others' ideas and expressing their own clearly.

[CCSS.ELA-LITERACY.SL.5.1.A](#) Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

[CCSS.ELA-LITERACY.SL.5.1.B](#) Follow agreed-upon rules for discussions and carry out assigned roles.

[CCSS.ELA-LITERACY.SL.5.1.C](#) Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

[CCSS.ELA-LITERACY.SL.5.1.D](#) Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

[CCSS.ELA-LITERACY.SL.5.3](#) Summarize the points a speaker makes and explain how each claim is supported by reasons and evidence.

Language:

[CCSS.ELA-LITERACY.L.5.1](#) Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

[CCSS.ELA-LITERACY.L.5.1.A](#) Explain the function of conjunctions, prepositions, and interjections in general and their function in particular sentences.

[CCSS.ELA-LITERACY.L.5.2](#) Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.

[CCSS.ELA-LITERACY.L.5.3](#) Use knowledge of language and its conventions when writing, speaking, reading, or listening.

[CCSS.ELA-LITERACY.L.5.4](#) Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 5 reading and content, choosing flexibly from a range of strategies.

Common Core Math Standards (Grades 3–5)

Grade 3

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.4 Model with Mathematics

3.OA.1-3 Represent and solve problems involving multiplication and division.

3.OA.7 Multiply and divide within 100.

3.NBT.1-3 Use place value understanding and properties of operations to perform multi-digit arithmetic.

3.MD.2 Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).

3.MD.5-7 Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

Grade 4

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.4 Model with Mathematics

4.OA.1-3 Use the four operations with whole numbers to solve problems.

4.NBT.1 Generalize place value understanding for multi-digit whole numbers.

4.NBT.4-5 Use place value understanding and properties of operations to perform multi-digit arithmetic.

4.MD.1-3 Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.

Grade 5

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.4 Model with Mathematics

5.MD.4-5 Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

Next Generation Science Standards/NY State Science Learning Standards 3–5

Performance Expectations

3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, & electric currents.

4-ESS3-1. Obtain & combine information to describe that energy & fuels are derived from natural resources & their uses affect the environment

5-ESS2-2. Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect Earth’s resources and environment.

Example NGSS “Big Idea” and Topic Bundle: How is water present in our world and how do we depend on it in its various forms? As our global community grows, what strains do we put on our water resources, what problems are we creating and where can we look for solutions? The discussion will also extend to examining how those needs, strains and solutions may be different for different communities, both within the US and globally, based on their needs and resources.

Science and Engineering Practices

Asking questions / defining problems

Developing and using models

Hands-on activities encourage students to ask questions and model real-world solutions to water quality challenges.

Planning and carrying out investigations/ analyzing and interpreting data

Water filtration activity has students planning their investigations and analyzing the results.

Using math & computational thinking

Water purification plant activity along with additional math word problems give students a chance to think about how math is used in S&E.

Constructing explanations/designing solutions; Engaging in argument from evidence; Obtaining, evaluating, and communicating information

Challenge extensions, writing prompts, reading comprehension activities, and innovation prompts in the *Book of Ideas* - Young Inventors Journal enable students to design and support their solutions to a variety of challenges.

Connections to Nature of Science

Scientific investigations use a variety of methods; Scientific knowledge is based on empirical evidence

Entrepreneur story/presentation and hands-on activities illustrate how scientific investigations are conducted and how that information is put to use.

Science models, laws, mechanisms, and theories explain natural phenomena

Filtration activity models how the soil filters ground water.

Disciplinary Core Ideas

ESS2.A Earth materials and systems

ESS2.C The roles of water in Earth’s surface processes

ESS2.D Weather and climate

Discussions of water availability, usage and conservation support the above standards.

ESS3.A Natural resources

ESS3.C Human impacts on Earth systems

LS1.A Structure and function

Activities and videos reinforce the interconnectedness between humans and all aspects of their environment.

PS1.A Structure of matter

PS1.B Chemical reactions

PS2.B Types of interactions

Discussions around water quality and the types of things that can influence water quality address the structure matter and various physical and chemical interactions.

PS3.A Definitions of energy

PS3.B Conservation of energy and energy transfer

PS3.D Energy in chemical processes and everyday life

PS4.B Electromagnetic radiation

The discussion of solar energy and its connection to water purification provides examples of the above.

ETS1.A: Defining and Delimiting Engineering Problems

ETS1.B: Developing Possible Solutions

ETS1.C: Optimizing the Design Solution

Hands-on activities, science and technology based writing prompts, challenge questions and group activities support the three phases of Engineering Design.

Cross Cutting Concepts

Cause and effect; Scale, proportion and quantity; Stability and change

The activities and videos emphasize environmental cause and effect as well as the concept of balancing availability and demand of resources.

Systems and system models; Energy and matter: Flows, cycles, and conservation

The activity highlights model systems based on resource balance and optimal usage.

Structure and function

Entrepreneurs highlight how the structure and properties of materials can be used to perform specific functions.

Connections to Nature of Science

Science is a way of knowing; Science addresses questions about the natural and material world

Videos and introduction text support these connections.

Science is a human endeavor

Entrepreneur story and historical timeline highlight the human aspect of science and engineering.

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology; Influence of Engineering, Technology and Science on Society and the Natural World

Introduction text, historical timeline, entrepreneur story and activities highlight above interactions and interdependencies.

Connections to Common Core State Standards

See previous Common Core Standards section for ELA and Math standards addressed by these activities.

Texas Essential Knowledge and Skills:

General

(2) Scientific investigation and reasoning. The student uses scientific inquiry methods during laboratory and outdoor investigations. The student is expected to:

- (A) plan and implement descriptive investigations, including asking and answering questions, making inferences, and selecting and using equipment or technology needed, to solve a specific problem in the natural world;
- (C) construct maps, graphic organizers, simple tables, charts, and bar graphs using tools and current technology to organize, examine, and evaluate measured data;
- (D) analyze and interpret patterns in data to construct reasonable explanations based on evidence from investigations;
- (F) communicate valid conclusions supported by data in writing, by drawing pictures, and through verbal discussion.

(3) Scientific investigation and reasoning. The student knows that information, critical thinking, scientific problem solving, and the contributions of scientists are used in making decisions. The student is expected to:

- (A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;
- (D) connect grade-level appropriate science concepts with the history of science, science careers, and contributions of scientists.

Grade 3

(6) Force, motion, and energy. The student knows that forces cause change and that energy exists in many forms. The student is expected to:

- (A) explore different forms of energy, including mechanical, light, sound, and heat/thermal in everyday life;

(9) Organisms and environments. The student knows that organisms have characteristics that help them survive and can describe patterns, cycles, systems, and relationships within the environments. The student is expected to:

- (A) observe and describe the physical characteristics of environments and how they support populations and communities within an ecosystem;

Grade 4

(5) Matter and energy. The student knows that matter has measurable physical properties and those properties determine how matter is classified, changed, and used. The student is expected to:

- (C) compare and contrast a variety of mixtures and solutions such as rocks in sand, sand in water, or sugar in water

(6) Force, motion, and energy. The student knows that energy exists in many forms and can be observed in cycles, patterns, and systems. The student is expected to:

- (A) differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal;

(7) Earth and space. The students know that Earth consists of useful resources and its surface is constantly changing. The student is expected to:

- (C) identify and classify Earth's renewable resources, including air, plants, water, and animals; and nonrenewable resources, including coal, oil, and natural gas; and the importance of conservation.

Grade 5

(6) Force, motion, and energy. The student knows that energy occurs in many forms and can be observed in cycles, patterns, and systems. The student is expected to:

- (A) explore the uses of energy, including mechanical, light, thermal, electrical, and sound energy;

(7) Earth and space. The student knows Earth's surface is constantly changing and consists of useful resources. The student is expected to:

- (C) identify alternative energy resources such as wind, solar, hydroelectric, geothermal, and biofuels; and