Teacher's Guide for MUSE

"How S.T.E.M. is Saving the World"

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Teacher's Note:
This guide contains project ideas, short answer, extended response, fill-in, and true/false with correction. The variation is designed to have the students think critically, as well as to test their comprehension. An answer key to the short answer sections can be found at the end of the guide.

Extended Response: Comprehension & Critical Thinking
The questions below can be used as written, simply answered in complete sentences, or easily transformed into longer essay (ELA) style questions, or even research topics. In any case, have the students support their answers with details from the text or use critical thinking skills to create a thorough and interesting answer. The questions, essays and projects have been aligned with the **Common Core Standards**. Consider the level of your students when deciding how to use the questions.

"Guardian Dogs to the Rescue" p. 9-12

1. List the characteristics of the fairy penguin.
2. How did foxes affect the fairy penguin population?
3. Who is Oddball?
4. What is the traditional job of the maremma dog breed?
5. How do maremmas cause predators to stay away?
6. How has the maremmas' caring nature been a boon for the free-range poultry farmers?
7. With the introduction of Oddball, did the populations of penguins increase? Why/why not?
8. Why do you think the story of guardian dogs is so inspiring to many people?
9. What are giant African pouched rats trained to sniff out?
10. How are goat squads used?

"Tech in Translation" p. 13-15

1. Why do very few deaf children in Morocco go to school?
2. Explain how a unique computer technology is filling the education gap in Morocco.
3. How does this special translation computer program work?
4. What are some of the learning tools that the computer program provides for the hearing impaired students?
5. How are government agencies stepping up to embrace this technology?
6. What is the U.S. connection between Soudi's research group and the American company IDRT?
7. What does IDRT specialize in?
8. What does IDRT provide Soudi's research group with?
9. What is the long-term goal of technology partnership?
10. Explain why you think that different countries and regions have different sign languages.

Essay: *Write a persuasive essay to a government agency insisting that this translation program become part of the educational system. Use proper form and include all the necessary elements for a persuasive essay.*

"Nano 101" p. 16-20

Read the article in its entirety and then fill in the blanks. Refer back to the text if necessary.

1. Nano is a prefix meaning _____.
2. On the scale of numbers, the nano falls between a mircro (one-millionth) and a _____ (one-trillionth).
3. Since atoms are measured in billionths of meters, nanotechnology works on an _____ scale.
4. In 2006, American tech entrepreneur Mark Sims' designed a _____ made of 15,342 atoms.
5. In 2014, Swiss scientists invented the first nano _____.
6. Scientists have created a 'nanosubmarine' that can enter the _____ and transport medicine to specific locations in the body.
7. _____ will be used to seek life on Mars, scrub pollutants called chlorofluorocarbons from the air, and eat up oil spills.
8. Nanoscientists have found that, when reduced to their smallest size, certain elements like silver, gold and _____ take on 'superpowers'.

Essay: *What so you think is the most exciting aspect of nanotechnology? Use examples from the text or research your own. Provide details.*

"Jack Andraka" p. 22-23

1. What was Jack Andraka's suggestion for detecting the presence of pancreatic cancer?
2. Explain Andrakas' path to success.
3. How did Andrakas cope with bullying at school?
4. Do you agree with Andrakas' advice to "look forward in the face of difficult times"? Why/why not?
5. What is addressed in Andrakas' book, Breakthrough?

"The Art of Saving Energy" p. 26-28

1. Why is Art Rosenfeld sometimes called the "Godfather of Energy Efficiency'?
2. What does the phrase 'to save a Rosenfeld' mean?
3. Why did Rosenfeld's focus of study change in 1973?
4. Explain the politicians' mixed reactions to more expensive energy.
5. While a physics professor at European laboratories, what did Rosenfeld learn about the Europeans' oil usage?
6. Why was the California Energy Commission formed in 1974?
7. Describe some of the energy-saving technologies that have been incorporated into homes and buildings.
8. What did Rosenfeld think was the best approach to ending our ever-increasing need for fossil fuels?

Personal Essay: *What are some ways that* ***you*** *can save energy? Be specific. Are you willing to make a commitment for this important cause?*

"Fueling Up" p. 29-31

1. What are biofuels?
2. What are some of the sources we currently have for renewable electricity?
3. How does using food crops to make energy effect land usage?
4. Why are biofuels more efficient than petroleum-based fuels?
5. What does Patrick Keaney and his company Green Grease Monkey do?

"iSeahorse" p. 32-33

1. How do seahorse mates greet each other?
2. Why can it be difficult to spot different species of seahorses?
3. Why are seahorses rapidly disappearing from our oceans?
4. What is the objective of Project Seahorse?
5. How can kids help this cause?

"Clean Water for a Dirty World" p. 35-37

1. Why is there a lack of clean tap water around the world?
2. How many children die each year from drinking dirty water?
3. Why does untreated water cause sickness and death?
4. Why do richer countries have safer water than poorer countries?
5. How did trees provide clues for engineers? Has this method been successful?
6. How have scientists used sunlight to clean water? What modification is made for muddy water?
7. Explain how the 'speedy filter' works.
8. Do you think we take our clean water for granted in the U.S.? How can **you** be less wasteful with this precious resource?

"Let There Be Light" p. 42-45

1. Why have people sought to conquer darkness throughout history?
2. What accompanied the complexity and demand for lighting?
3. When and by whom were electric lights invented?
4. What does a generator do? Give examples from the article.
5. What were the sources of electricity generated in the U.S. in 2013, according to the U.S. Energy Information Administration?
6. Explain the construction and purpose of the photovoltaic cell.
7. Why were solar cells only common on spacecraft in the past?
8. What ideas are scientists examining for improving solar cells?
9. What do critics often say in regard to solar energy systems?
10. How are power companies in Vermont generating electricity?

Research: *Read the final paragraph of this article explaining 'A Liter of Light'. Do some research to discover at least two other ways that we can provide simply energy/lighting.*

ANSWER KEY

"Nano 101"

1. one-billionth
2. pico
3. atomic
4. gear-train
5. assembly line
6. bloodstream
7. nanobot
8. pencil lead