

Cross-Curricular Discussion

After students have had a chance to review the “News in Brief” section and answer the article-based observation questions, lead a classroom discussion that encourages students to think about research details not fully explained in each brief. Students can also generate other potential research ideas and questions related to each brief. To complete this discussion, you may want to break students into four groups to answer the questions for a particular news brief, then have students discuss their answers with the larger group.

[“Extreme gas loss dried out Mars”](#)

Discussion Questions:

- 1. What are some important questions that are raised but not fully explained by the information in the news brief? Research possible answers to those questions. List and explain at least three examples. [Students may have other answers, but some examples appear below.]**
 - a. How does the current atmosphere of Mars compare with that of Earth? [Mars’ atmosphere is less than 1% of the density of Earth’s atmosphere at the surface of the planets. . The atmosphere of Mars is approximately 96% carbon dioxide, 1.9% argon, 1.9% nitrogen and trace amounts of other gases. The atmosphere of Earth is approximately 77.8% nitrogen, 20.9% oxygen, 0.9% argon, 0.4% water vapor, 0.04% carbon dioxide and trace amounts of other gases.]**
 - b. Why does Mars not have a magnetic field? [Earth’s magnetic field is created by a hot, partially liquid, spinning iron core. The core of Mars appears to be solid iron sulfide (fool’s gold), presently incapable of generating much magnetic field, although it may have done so earlier in the planet’s history.]**
 - c. What are common argon isotopes, and why do argon isotopes help to measure atmosphere loss on Mars? [Isotopes have the same number of protons (and electrons) but different numbers of neutrons; they have the similar chemical properties but slightly different physical properties. Heavier isotopes require more energy to evaporate, boil off or diffuse, so processes such as the bombardment of Mars’ atmosphere by solar charged particles can change the argon isotope ratios at high altitude vs. low altitude. The dominant argon isotope is ^{40}Ar , which is produced by the slow decay of slightly radioactive potassium ^{40}K (1.25 billion year half-life), a common element in rocks on Mars and Earth. Argon is chemically inert, so instead of reacting, it just floats around the atmosphere. The mass of an argon atom (approximately 40 atomic mass units or amu) is also close to that of CO_2 (approximately 44 amu). Carbon dioxide is nonpolar, so it does not have strong intermolecular forces. Therefore, argon and carbon dioxide should behave in somewhat similar ways in terms of atmosphere loss.]**

Extension Prompts:

2. Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions? *[Students may have other answers, but some examples appear below.]*

a. How long ago did Mars have an atmosphere warm enough for water and possibly life? *[Measure atmospheric traces or magnetic field effects in Mars rocks of different ages.]*

b. When could Earth lose its habitable atmosphere? *[Determine how long until the Earth's core fizzles out, and how long it would take to lose the atmosphere after that.]*

c. How much atmosphere would you have to produce to terraform Mars (transform it to support human life)? *[How much oxygen and other gas would be required to give Mars an Earth-like atmosphere? How much gas would have to be added to the atmosphere each year to keep up with losses from the solar wind? Would this be possible?]*

[Students may have other answers.]

“Extreme gas loss dried out Mars” Question Bank

What are some important questions that are raised but not fully explained by the information in the news brief? Research possible answers to those questions. List and explain at least three examples.

Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions?

“Thinning ice creates undersea greenhouses in the Arctic”

Discussion Questions:

1. What are some important questions that are raised but not fully explained by the information in the news brief? Research possible answers to those questions. List and explain at least three examples.

a. What is a phytoplankton bloom, and what causes them? *[Phytoplankton are organisms that live suspended just below the water's surface and use their characteristic pigments to absorb sunlight, providing the energy required to make their own food through photosynthesis. Phytoplankton need nutrients such as nitrogen and phosphorus, as well as small quantities of iron, zinc and manganese to grow and reproduce. Blooms often take place when there is a sudden increase in an essential nutrient concentration, or there are excess nutrients and environmental conditions change to become optimal. Phytoplankton reproduce at a rapid rate until at least one of the nutrients is depleted.]*

b. Where do blooms happen besides under thinning sea ice? *[Blooms can happen where phosphorus- and nitrogen-rich fertilizer runoff occurs when it rains.]*

c. How thin must the ice be for enough sunlight to penetrate to nourish phytoplankton? *[Consult the original source article or try an experiment!]*

d. Would thinning ice accelerate or reverse climate change? *[Ice thinning increases light exposure under ice, which would increase the phytoplankton blooms. The blooms absorb some carbon dioxide through photosynthesis. On the other hand, thinning creates more dark areas that absorb more solar heat, which accelerates ice melting, and leads to greater release of greenhouse gases trapped in Arctic ice and more access to fossil fuels buried in the Arctic. Overall, scientists say that thinning ice acts as a “positive feedback,” meaning that it accelerates climate change, as discussed in the Science News article “[Runaway Heat?](#)”]*

d. If satellites can’t see below the sun-blocking Arctic ice, how did they discover the bloom below it in July 2011? *[As described in the Science News article “[Microbes flourish under Arctic sea ice,](#)” a ship was used to crack open the ice in multiple places, and underwater cameras viewed the phytoplankton blooms below.]*

Extension Prompts:

2. Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions?
 - a. Could you fight climate change by engineering giant algae mats on land or sea? *[How much algae would be required? How would you keep decaying algae from releasing carbon dioxide into the atmosphere?]*
 - b. Could Arctic algae be useful in other environments? *[Do these algae have genes that could make crops more cold-resistant? What types of life might exist on Mars, Europa or elsewhere in space? Is there hardy algae that could be used to terraform Mars?]*
 - c. Aside from breaking the Arctic ice apart and using an underwater camera to view the water below, what other techniques could be used to potentially detect blooms below the ice? *[Blooms could potentially alter the composition of the surrounding Arctic ice. Potentially, ice core samples could be taken and their chemical characteristics compared to detect blooms.]*

“Thinning ice creates undersea greenhouses in the Arctic” Question Bank

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Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions?

“[Food odors entice tired brains](#)”

Discussion Questions:

1. What are some important questions that are raised but not fully explained in the brief? Research possible answers for those questions. List and explain at least three examples.

- a. **Why might the brain pay more attention to food smells when sleep-deprived?** *[The brain might burn more calories, causing us to crave more food, if it has to sustain activity for longer than usual each day.]*
- b. **How does functional MRI localize brain activity?** *[It uses strong magnetic fields to detect differences in oxygen-rich blood and oxygen-poor blood. Blood flow serves as a proxy for which areas are more active.]*
- c. **Why does the brain react differently to food odors than non-food odors?** *[Organisms can gain a competitive advantage for survival if they have a better ability to identify food sources.]*

Extension Prompts:

2. **Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions?**
 - a. **Are sleep-deprived people more or less interested in the smells of different kinds of foods than well-rested people?** *[Maybe higher-energy foods? Try it and see!]*
 - b. **Why does the brain need sleep?** *[That is a very big and very important question, and the answer is not well understood. The Science News article [“Snooze patterns vary across cultures, opening eyes to evolution of sleep”](#) explores this question with sleep-pattern data across cultures.]*
 - c. **Are there ways to counteract overeating in sleep-deprived people?** *[An experiment could administer varying doses of caffeine and diet drinks, increasing exercise or using non-food smells to distract from thoughts of food.]*

“Food odors entice tired brains” Question Bank

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Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions?

[“More brain differences seen between girls, boys with ADHD”](#)

Discussion Questions:

1. **What are some important questions that are raised but not fully explained in the brief? Research possible answers to those questions. List and explain at least three examples.**
 - a. **Where is the cerebellum and what does it do?** *[The cerebellum is located at the lower rear of the brain. Maintenance of balance and posture, coordination and voluntary movements, motor learning and cognitive ability are all functions involving the cerebellum.]*
 - b. **What are the most important regions of the brain that are affected by ADHD?** *[The prefrontal*

cortex is involved in impulse control, executive functions, good judgment and high-level decision making. That is the last part to fully develop as you grow up.]

c. Why might boys and girls be affected differently by ADHD? *[As the study in the article shows, girls with ADHD and girls without ADHD have statistically significant differences in cerebellum volume. Differences in brain volume may help to explain why ADHD affects girls and boys differently, but brain function is not necessarily related to brain size. Many other factors, such as the hormonal differences between girls and boys, may play a more significant role in the effect that ADHD has on the different sexes.]*

Extension Prompts:

2. Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might someone conduct theoretical or experimental analyses to answer these questions?

a. Do sex-specific hormones have an effect on ADHD? *[Test levels of various hormones in a large number of people of both genders on the spectrum from no ADHD to severe ADHD, and look for correlations.]*

b. How well do ADHD medications work? *[Study functional MRI and cognitive tests of treated vs. untreated people.]*

c. Do factors such as amount of sleep, time of day or food intake affect brain activity in girls and boys diagnosed with ADHD? *[Study functional MRI scans for girls and boys with ADHD who are trying to perform a task after four or eight hours of sleep.]*

“More brain differences seen between girls, boys with ADHD” Question Bank

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Based on the research outlined in the brief, what other questions for future research might be explored by these scientists, you or someone else? Write at least three possible questions. How might one conduct theoretical or experimental analyses to answer these questions?