

One-on-one Discussion Topics for Environmental Science

You will help create a list of questions that you will prepare to answer and discuss one-on-one with your instructor.

Below is a list of possible questions. **Pick about 20 or so** of the questions on the list and submit them via a Google Doc in Canvas in the “***What I will know by the end of the semester***” assignment.

(You can propose changes to your list later on, after you submit it.

You can also propose your own questions based on other study guide questions or things you have learned about environmental science in this class.)

Your instructor will add questions to your list, so that the list contains at least 30 questions.

If your list consists primarily of questions with short, factual answers, especially true-false or either-or answers, your instructor will add some more challenging questions that ask you to explain why something is true or happens. (If your list is filled with “explain” questions, he will add questions with short, factual answers.)

Your instructor will also add more questions to your list if you focus too much on one or a few areas of knowledge. For example, if you only pick questions about forests, your instructor might add some questions about biodiversity, sustainability, the ocean, and agriculture.

Your instructor will also add more questions to your list if there is significant overlap between the questions that you selected. In other words, if the questions mostly cover the same information, they will be treated as one question and another question added so that you can answer at least 30 different questions about environmental science.

Unit 1: Ecosystem Services

1. Give examples of ecosystem services.

Unit 2: Sustainability and other key concepts in environmental science

2. Given numbers, determine whether or not a situation is sustainable. For example, if fish population 100,000 produces 20,000 new fish each year, what number of fish can be harvested each year sustainably?
3. What is the definition of sustainability that we are using in this class? Apply it to a specific situation to determine whether or not the situation is sustainable.
4. What is the definition of environmental justice that we are using in this class? Apply it to a specific situation to determine whether or not the situation is environmentally just.
5. Given a situation, identify stakeholders.

Unit 3: The Nature of Science

6. What are observations? Identify observations. For example, which of the following are observations?
 - Penguins can swim.
 - Penguins are happy birds.
 - Tides are caused by the Moon.
 - Sea level rises several feet and then sinks back down again several times per day.
 - "I heard her say that she was going to the mall."
 - "He has a lot of dandruff in his hair."
 - "This cake tastes like strawberries."
 - "Telling someone a lie is always wrong."
 - "I prefer green tea to coffee."

- “Yesterday morning I drank a lot of coffee and later in the day I felt pain in my stomach.”
7. According to the reading assignment, can observations change? Why or why not?
 8. According to the reading assignment, why is observational evidence the only kind of evidence that can be used in science to support an idea about the world?
 9. According to the reading assignment, what are hypotheses? What are theories? How is a hypothesis different from a theory?
 10. Can a theory change? Why or why not?
 11. A scientific hypothesis is a hypothesis whose “correctness” can be determined by gathering observational evidence. A hypothesis is an “opinion” if several people looking at the same observation evidence still cannot agree about whether an idea is probably right or probably wrong.

Identify whether or not a statement is a scientific hypothesis, and explain why it is or is not a hypothesis. For example, which of the following are scientific hypotheses? Explain your reasoning. In other words, how would you gather observations that would determine whether the idea is probably right or probably wrong? Or why is it not possible to gather observations that would allow you to determine whether it is right or wrong?

- You can be healthy even if you do not eat meat.
 - Eating animals is wrong.
 - Everything is made out of 4 elements: earth, water, air, and fire.
 - A child’s smile is more beautiful than a sunset.
 - Cars grow on some species of trees.
12. Identify the key elements of the scientific method (hypothesis, test/experiment, observations, interpretation of observations/conclusions). For example, which element of the scientific method each of the following statements represents.

In other words, which ones are hypotheses? Which ones are tests? Which ones are observations? How can you tell which is which?

- The egg floated in salty water, but not in fresh water.
- Life began on land, not in the ocean.
- A scientist weighed a container full of a liquid on a scale and looked at the markings on the side of a beaker to determine the volume of the liquid.
- Students placed 4 pennies into a small film canister and placed it into water to see if it would float.
- There is more life near the coast, because the concentration of nutrients is higher in coastal water.
- The waves in the harbor were smaller than the waves breaking on the sandy beach along the open coast.

Unit 4: Energy

13. What kind of energy is stored in carbohydrates?
14. What do plants and algae need to carry out photosynthesis?
15. Why do living things carry out photosynthesis?
16. After the energy in food molecules is used to power the body of a living thing, what happens to the energy? Does it disappear?
17. Why do living things carry out cellular respiration?
18. What kinds of living things carry out cellular respiration? For example, do algae carry out cellular respiration? animals? bacteria? plants?
19. In addition to food molecules, what substance (matter) do many organisms need to carry out cellular respiration?
20. What is the primary source of energy for the Earth?
21. What is the primary way in which energy leaves the Earth?
22. How are hot molecules different from cold molecules?

23. Do atoms and molecules move slower and slower over time due to friction?
24. Do atoms and molecules ever stop moving?
25. What do you need to spin to make electricity?
What needs to be nearby when you spin it?
26. Is the following statement true or false? "Energy is created by the Sun." Why did you choose true or false? Explain your reasoning.
27. Is the following statement true or false? "Plants create energy." Why did you choose true or false? Explain your reasoning.
28. Is the following statement true or false? "After we use the energy in food to power our bodies, the energy is gone. The energy is used up. The energy no longer exists." Why did you choose true or false? Explain your reasoning.
29. Why are fossil fuels like coal, oil, and natural gas **not** considered to be renewable sources of energy?

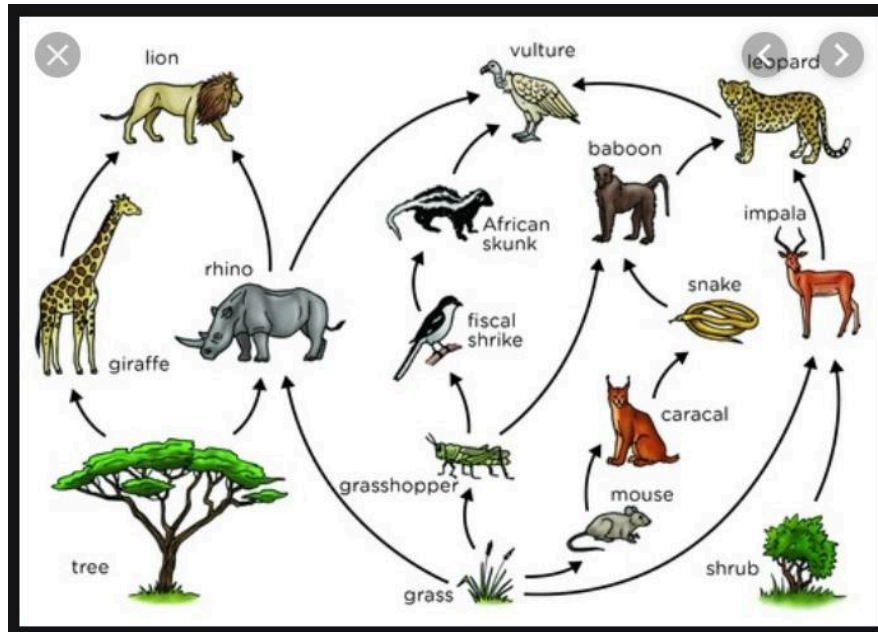
Unit 5: Matter Cycles

30. What do organisms take out of their environment to carry out photosynthesis? What do organisms release into their environment when they carry out photosynthesis?
31. What do organisms take out of their environment to carry out cellular respiration? What do organisms release into their environment when they carry out cellular respiration?
32. What is the atmosphere mostly composed of? Which are the two most abundant (common) gases in the atmosphere?
33. How do plants get the carbon that they need? What sink (reservoir) do they get their carbon from?
34. How do plants get the nitrogen that they need? What sink (reservoir) do they get their nitrogen from?

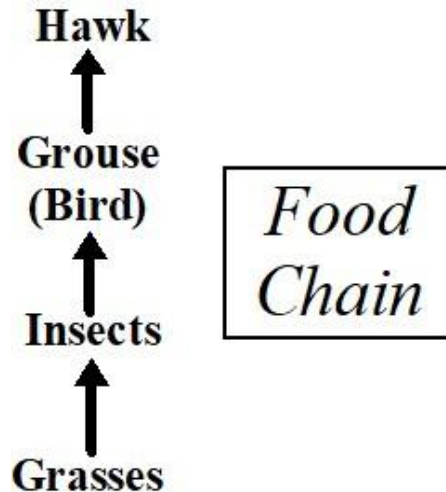
35. What are the two examples of decomposers emphasized in the reading assignment?
36. Which organisms take carbon in soil and release it into the atmosphere as carbon dioxide?
37. Where does most of the nitrogen in soil come from?
38. Which organisms take nitrogen in the air and bring it into soil and bodies of water like lakes and the ocean?
39. Which organisms take nitrogen in the soil and water and release it into the atmosphere?
40. Living things can add the nutrient phosphorus to soil. What is the other major way in which phosphorus is added to soil?
41. How do animals typically add carbon, nitrogen, and phosphorus to soil?
42. How do ocean animals typically add carbon, nitrogen, and phosphorus to the sediments (mud) on the bottom of the ocean?

Unit 6: Ecosystems

43. Given a situation, identify different things that are part of the ecosystem. For example, suppose a lion is living on a savanna. What are different things it might encounter that are part of its ecosystem?
44. What is soil? How is it different from sediments (pieces of rock)?
45. Give some examples of sediments. In other words, what are some words that refer to different kinds of sediments?



46. Energy flows through ecosystems. Describe how and why: (i) most energy enters the ecosystem of the food web shown above, (ii) how and why energy will move to several organisms in the food web, and (iii) how and why most energy will leave the ecosystem of the food web. Give specific examples using the living things in the food web. (In other words, do **not** discuss animals, carnivores, consumers, decomposers, herbivores, plants, and producers in general. Instead, discuss the organisms in your assigned food web.)
47. In a matter cycle, matter ends up moving in a circle between different sinks or reservoirs. In other words, suppose matter starts in one sink. The matter then moves from this sink to another sink, and then to another sink, and then to another sink...but eventually the matter ends up back in the sink that the matter started in. Describe how and why carbon, nitrogen, or phosphorus (your choice) might move from one sink to another and end up moving in a cycle in the ecosystem of the food web above. Give specific examples using the living things in the food web. (In other words, do **not** discuss animals, carnivores, consumers, decomposers, herbivores, plants, and producers in general. Instead, discuss the organisms in your assigned food web.)

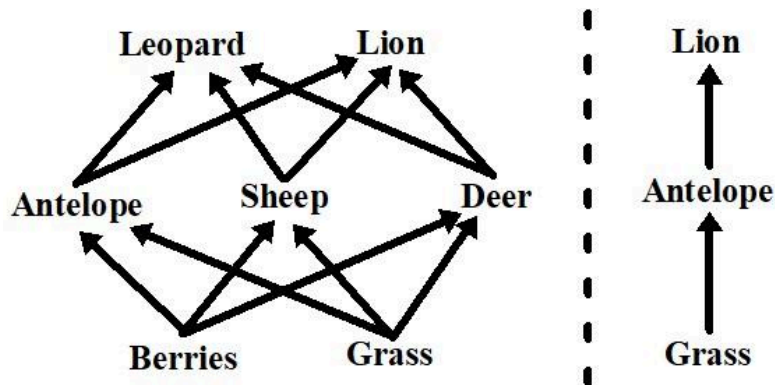


1. Consider the food chain above. Which of these populations of living things has **more** energy than the others? Which has the **least**? Why does one population have **more** energy than the others? Why does one population have **less** energy than the others?
48. Consider the food chain above. Which of these populations of living things has **more** matter (like carbon, nitrogen, and phosphorus) than the others? Which has the **least**? Why does one population have **more** matter than the others? Why does one population have **less** matter than the others?

Unit 7: Populations and Population Growth

49. What is a population? Given a group of living things, determine if it is a population or not. For example, are all the mountain lions in the world a population? Are all insects in a forest a population? Are all the species of birds on a mountain a population? Are the bison, wolves, and prairie dogs living on a prairie all a population?
50. What is the carrying capacity of an environment?
51. What is the ecological footprint of a person?

Unit 8: Biodiversity



52. Given two different food webs (like those above), identify which food web has the higher biodiversity, and explain how you determined which has the higher biodiversity. If a specific organism is removed from the food web, discuss the implications for the population sizes of the other organisms, and how biodiversity benefits the ecosystem.
53. How would you measure the biodiversity of a population? For example, suppose a population of wolves lived in a forest. How would you measure the biodiversity of the population of wolves who live in the forest? What would you do?
54. Describe how or why an ecosystem with a high biodiversity is more likely to provide more benefits or better benefits to humans than an ecosystem with a low biodiversity. Give specific examples illustrating how a high biodiversity ecosystem might provide more or better ecosystem services than a low biodiversity ecosystem.

Unit 9: Evolution and Adaptation

55. Given information about the distribution of a trait within a population at two points in time, determine whether or not evolution has occurred.
56. What is natural selection? In other words, how and why do organisms change to adapt to their environment (evolve)?

57. Evolution by natural selection is often described as "survival of the fittest." What does it mean to be "fittest." Is it the biggest, strongest organism? the one with the most endurance? the fastest one? the smartest one?
58. Do individuals evolve or do populations evolve? Explain your reasoning.
59. What is artificial selection? How is it different from natural selection? Why can artificial selection be bad for a species?
60. Use the concept of natural selection to explain how and why bacteria develop resistance to our antibiotics, and insects and other pests can develop resistance to pesticides (that we use to keep them from eating our crops like food and corn).
61. It is really bad when bacteria develop resistance to our antibiotics: More and more people die until we can develop new ones. Since drug companies do not make much money from antibiotics, it is not a big focus of private research. Based on our knowledge of natural selection, what can we do to minimize or reduce the ability of bacteria to develop resistance to our medicines? How does this help reduce the change that bacteria will evolve resistance to our medications?
62. Consider the statement: "When exposed to pesticides, some Japanese beetles become more pesticide resistant and harder to kill." What is wrong with this statement? How should it be reworded to make it more accurate?
63. What is the big advantage of sexual reproduction (two organisms each contributing half of their genes/DNA to their offspring)?
64. Which population is best able to adapt to a change in their environment like a change in climate or a new predator, one with high genetic diversity or low genetic diversity? Why?
65. Suppose that you exercise a lot (build up your muscles), learn to speak Japanese, develop your computer programming skills, and

take piano classes. Will your offspring (children) have big muscles, have an easy time learning Japanese, and be good at computer programming and playing the piano? Why or why not? (In other words, what is necessary for a trait to be passed on to your offspring?)

Unit 10: Endangered Species and Extinction

66. There has been a dramatic increase in the rate of extinction over the past few hundred years. Which are among the 5 major factors that cause most extinctions?
67. What is the main cause of species endangerment (possible extinction) worldwide? In other words, what kind of human activity leads to the most species going extinct?
68. What is the second leading cause of species endangerment (possible extinction) worldwide?
69. What is an invasive species? How can invasive species harm other organisms in their new ecosystem or harm the ecosystem? Some invasive species harm native species by eating them, but many of the most costly and damaging invasive species do not eat the native species. In what other ways can an invasive species harm a native species?
70. What is the major cause of habitat destruction? In other words, what is the main reason we take over wild lands for our own use?
71. True or false? "Extinctions that unfold slowly usually occur because one species replaces another, leaving the community intact and having little effect on the community at large."
72. "Some species go extinct simply because of changes to their environment. As their environment changes (e.g., change in climate, a new species enters the ecosystem), a population will evolve to adapt to it. Eventually, the population is so different from the original population that it is a new species."

73. True or false? "One of the best ways to save wildlife is to pass laws making harming endangered species illegal and enforce them with harsh punishments."
74. True or false? "Hunters and fishers pay money to hunt and fish in protected areas in the United States, and their fees and taxes help preserve and protect a lot of wilderness areas."
75. True or false? "One of the best ways to save wildlife is to encourage people to build homes in or near wild areas and roads through wild areas. They make it more likely for people to interact with wildlife, and appreciate the wildlife."
76. Which of the environments below is most likely to be the location of a biodiversity hotspot? For example, consider the biomes below.
(There are 3 correct answers.)
- boreal forest
 - coral reef
 - desert
 - forest
 - grasslands
 - island
 - prairie
 - savannah
 - steppe
 - tropical open ocean (far from land)
 - tropical rainforest
 - wetland
77. Many species are safe until people themselves are threatened in some way. People unintentionally harm biodiversity or threaten species with extinction. According to the reading assignments, why do people often hunt endangered species to sell products from endangered species, even if they know it is illegal and the punishments are harsh?

- 78. What is land trust? How do they help preserve ecosystems and wild lands?
- 79. What is conservation easement? How do they help preserve ecosystems and wild lands?

Unit 11: Environmental Health

- 80. What is the difference between infectious diseases and noncommunicable diseases? Which kind of disease kills most people each year?
- 81. What is the most dangerous environmental threat to human health?
- 82. What is the second most dangerous environmental threat to human health?
- 83. What is the third most dangerous environmental threat to human health?
- 84. How are humans typically exposed to high levels of mercury (too much mercury)? What is the most common route of exposure that leads to high levels of mercury in our bodies?
- 85. What are the most common ways for humans to be exposed to unsafe levels of lead?
- 86. How or why do predators typically have more toxic substances in them than animals farther down the food chain?
- 87. True or false? "Any amount of a toxic substance in your body is dangerous. There is no such thing as a safe level or amount."
- 88. True or false? "Exposure to environmental conditions like pollution can trigger or worsen noncommunicable diseases."
- 89. True or false? "The safe amount of a toxic substance can depend on a person's health. The safe amount of a toxic substance might be much lower for a sick person or a person with particular disease."

90. True or false? "The safe amount of a toxic substance in the environment can depend upon a person's age. In other words, small children might be more vulnerable than an adult, or an elderly person might be more vulnerable than a young adult."
91. True or false? "The safe amount of a toxic substance in the environment can depend upon a person's biology, including their sex. Some people have DNA which makes them more susceptible or more resistant than others."
92. True or false? "The safe amount of a toxic substance in the environment can depend upon where a person lives or works. If you live or work in a place where you are exposed more often or to larger amounts, you will take in more of the toxic substance than other people, making it more likely for the level of the toxic substance in your body to exceed the safe level."
93. True or false? "Some routes of exposure to a toxic substance may be more dangerous than others. For example, your body may take in a toxic substance more easily if you breathe in the toxic substance than if you touch something containing the toxic substance with your skin."
94. Use the LD-50 of two chemicals to determine which is more toxic. For example, which chemical is more toxic, one with a LD-50 of 2 ppm or a LD-50 of 200 ppm? Explain your reasoning.
95. What can happen when two chemicals mix together in the environment? Which of the following may be true?
- Their combined effect is **about the same as** the effect of each one added together.
 - Their combined effect is **much less than** the effect of each one added together.
 - Their combined effect is **much more than** the effect of each one added together.

96. Which of the following statements below best describe how we pick the levels at which chemicals are allowed in our bodies and environment?
- Chemical safety standards for typically set **far below** (ten or more times below) the NOAEL (no observable adverse effect level).
 - Chemical safety standards for typically set **near** the NOAEL (no observable adverse effect level).
 - Chemical safety standards for typically set **slightly above** (e.g., 10 or 20% above) the NOAEL (no observable adverse effect level).
 - Chemical safety standards for typically set **slightly below** (e.g., 60 or 80% of) the NOAEL (no observable adverse effect level).

Unit 12: Air Pollution

97. What is the largest source of air pollution due to human activities in the United States?
98. True or false? "Air pollution is a major risk factor for early death (in the top 5). In other words, if you are regularly exposed to air pollution where you live, you are more likely to die at a younger age than people who are not exposed to air pollution."
99. True or false? "Air pollution composed of larger particles causes more harm than air pollution composed of smaller particles."
100. True or false? "If you keep your windows and doors closed all the time, you will prevent air pollution from getting inside and reduce the amount of air pollution inside your home."
101. True or false? "The heating and cooling systems of homes are typically sealed: they do not bring in air from outside the house and do not release air from inside the house outside the house."

102. True or false? "Air that goes through heating and cooling systems of home is filtered to reduce pollution, but homeowners do need to remember to change the filters."
103. "Air that goes through the heating and cooling systems of homes is not filtered to reduce air pollution."
104. True or false? "Sources of air pollution like highways, electrical power plants, incinerators, and so on are typically found or more likely to be found in lower income (poorer) neighborhoods in cities."
105. True or false? "Studies of death and disability rates before and after government regulations on air pollution were implemented clearly showed that reducing air pollution improves human health. In other words, fewer people died and fewer people suffered from disabilities when air pollution was reduced."
106. Who pays the highest external costs from air pollution, children or adults?
107. Which kind or category of air pollution can cause a lot of harm even in very small amounts?
108. Give a few examples of substances, materials, or objects that release VOCs.
109. What is the major source of sulfur dioxide pollution in the atmosphere?
110. How does sulfur dioxide (SO_2) air pollution cause harm? (Mark all that apply.) Give at least two examples.
111. Which produces the largest amount of nitrogen dioxide pollution in the atmosphere?
112. How does nitrogen oxide (NO_x) air pollution cause harm? Give at least two examples.

Unit 13: Environmental Policy

113. Prior to the 1960s, individual states handled environmental regulations. Why wasn't state-by-state good enough? Why is the federal government now involved in environment rules, regulations, and enforcement?
114. Why is agreement between many states and countries necessary to address problems like the hole in the ozone layer? Why wouldn't actions by a few countries to protect the environment be enough?
115. Why did United States environment policy begin to focus more on preventing damage to the environment and harm to people instead of just how to best use resources?
116. Give some examples of command-and-control regulations. Give some examples of economic incentive environmental regulations. Discuss the relative advantages and disadvantages of command-and-control and economic incentive environmental regulations. In other words, discuss some of the pros and cons for each kind of environmental regulation.
117. True or false? "In the United States, our air and water are a **lot** cleaner than they used to be since federal (nationwide) environmental laws were passed beginning in the 1970s."
118. Why is the ozone layer important to people? How does it help us?
119. True or false? "The ozone layer contributes to the greenhouse effect. In other words, it helps warm the planet."
120. True or false? "It is **very** hard to show that pollution caused the harm, because the polluter can (almost) always find some other aspect of your life that might have **possibly** been responsible for or contributed to the damage done to you."
121. True or false? "The Environmental Protection Agency (EPA) writes the environmental laws for the United States."

122. True or false? "Before an action is taken by the government, it has to create an environmental impact statement (EIS) that identifies and tries to quantify the benefits and negative consequences of the policy, rules, or regulations for the environment and people, including businesses."
123. True or false? "The Environmental Protection Agency does **not** help cities, states, companies, and individuals meet the environmental regulations and standards, it simply enforces them."
124. True or false? "Environmental laws are commonly used by neighbors to object to proposed developments (e.g., new building). Building tends to take longer and be more expensive in places like California with stricter environmental laws."

Unit 14: Infectious Diseases

125. How does water **typically** become contaminated? In other words, what is the most common and harmful contaminant? What is the most common source of contamination?
126. What action or intervention would **reduce** the death rate from infectious disease by the largest amount in **developing** countries? In other words, what is the best strategy to save the most lives?
127. Describe how vector-borne diseases are transmitted. As part of your answer, discuss what pathogens and vectors are, and give examples of both.
128. True or false? "There are some people who cannot get some kinds of vaccine shots, typically infants, senior citizens, and people with certain health problems. If everyone who can get a vaccine shot, does get a vaccine shot, then even people who cannot take the vaccine get a lot of protection too."
129. True or false? "Convincing people to change their behavior to prevent disease can be the most challenging part of a public health official's efforts to prevent the spread of a disease."

130. True or false? "If people in the communities at risk from disease do **not** agree to change their behavior to carry out a public health plan to prevent disease transmission, the plan will probably still succeed if the plan is well-funded and resourced (i.e., money, medical professionals, and equipment is provided)."
131. True or false? "Climate change may increase the spread of some infectious diseases by increasing the amount of habitat available to pathogens and vectors (e.g., mosquitos, bacteria that grow better in warm water)."
132. True or false? "Wars and other kinds of armed conflict often lead to environments in which infectious disease spreads more easily."
133. True or false? "People with a high income (wealthier people) suffer **more** from infectious disease than people with a low income (poorer people)."
134. True or false? "People in developing (poorer) countries suffer **more** from infectious disease than people in developed (wealthier) countries."
135. True or false? "Children typically suffer **more** from infectious diseases than middle-aged people."
136. True or false? "Elderly people (senior citizens) typically suffer **more** from infectious disease than middle-aged people."
137. Which of the following steps is **not necessarily** needed to address an infectious disease whose transmission depends upon the environment?
- An understanding of the way the disease is acquired
 - High-tech equipment and medicines to diagnose or treat a disease
 - Identification of ways to decrease the transmission of the disease
 - Public health programs and education that take local culture and traditions into consideration

138. Where do most zoonotic diseases come from? In other words, what is the source or vector for most zoonotic diseases?
139. Give examples of actions we can and should take to reduce the transmission of zoonotic diseases, and explain why they reduce the transmission of zoonotic diseases.
140. Malaria, dengue, and Japanese encephalitis are all transmitted by a mosquito vector. Which action would be **most** helpful in reducing the number of cases of mosquito-borne diseases?
141. What are Neglected Tropical Diseases (NTDs)? Why are they neglected?

Unit 15: Human Population

142. What was the approximate human population in 2023? In other words, how many people were there on the Earth?
143. Which 2 countries have the highest populations? About how many people live in each country? About how many people live in the United States?
144. Where will most of the future growth in the world's population come from? (What continent?)
145. Do scientists who study human population predict that the population of humans on the Earth will keep getting higher and higher if governments and societies do not act to control it? Or do these scientists say that the population of humans on the Earth will eventually stabilize or go down without governmental action? If you said that the population will get higher and higher, what actions do these scientists recommend for reducing population growth and stabilizing the population? If you said that the population will eventually stabilize or even start going down, explain why the population will eventually stabilize or start going down.

146. True or false? "Educating girls and women well (e.g., good schools, staying in school longer) tends to lead to **higher** population growth rates (they choose to have **more** children)."
147. True or false? "Making it **easier** for women to work outside the home tends to lead to lower population growth rates (they choose to have **fewer** children)."
148. True or false? "Cultural preferences or religious traditions that lead people to prefer large families can result in high population growth rates even if women and girls receive good educations, have job opportunities, and have access to contraception."
149. True or false? "Not too long ago (and perhaps still today), many parents in China and India preferred to have sons than daughters, especially if they could only have one or a few children. They chose to abort the fetuses of healthy baby girls due to the government's population control policies, so now these countries have significantly more men than women."
150. True or false? "If the infant and child mortality rate is **high** (children are more likely to die young) in a society, then people typically have **fewer** children."
151. True or false? "The number of children the average couple wants to have is usually **pretty close** to the actual number of children each couple has (on average) in a country."
152. True or false? "Countries in which people do **not** have access to contraception (birth control like condoms) typically have **higher** population growth rates than countries in which people have access to contraception."
153. Does technology allow us to increase or decrease the carrying capacity of the Earth? Why? Explain your reasoning.
154. Does technology make us increase or decrease our ecological footprint? Why? Explain your reasoning.

155. Who typically has a **larger** ecological footprint, a person in a developed (wealthier) country or a person in a developing (poorer) country?
156. How can the United States have a larger ecological footprint than China even though the population of China is significantly larger than the population of the United States?

Unit 16: Sustainable Cities

157. According to the reading assignment, what benefits do green spaces like parks provide? Give at least 2 examples that do not involve water quality or the amount of water available.
158. True or false? "Overall, more people on Earth live in cities (urban areas) than in the countryside (rural areas)."
159. True or false? "The number of people living in urban areas (cities and suburbs) is **falling**. In other words, people are moving from cities into rural areas."
160. True or false? "**A significant** amount (more than 30%) of the energy humans use is generated to power our buildings, so making them more energy efficient **would** be helpful in reducing greenhouse gases emissions that cause global warming."
161. Compared to other people in the same country, who has the **highest** ecological footprint, a person who lives in a city (near a city center), a person who lives in the suburbs (outside a city center), or a person who lives in a rural area far from a city? How has the **lowest** ecological footprint? Why are their ecological footprints different? Give a few examples.
162. How and why can green spaces (like parks) in cities help improve the water quality in rivers, lakes, and the ocean in and near cities?
163. How and why can green spaces (like parks) in cities help increase the amount of fresh water available for use by people in the cities?

164. What is the major reason that cities are warmer than rural areas?
165. Growing cities need more space for new homes and businesses. According to the reading assignment, what can we do to avoid sprawl and yet build more homes and businesses?
166. Give 2 different examples of ways to make buildings "greener" (more sustainable). Explain how or why your examples make buildings "greener" (more sustainable).
167. What is mixed-use development? How or in what way do mixed-use developments make cities more sustainable? Give at least one example and explain how or why it makes a city more sustainable.
168. When it comes to building cities, what is "zoning"? What are zoning laws? What kinds of zoning laws can make a city more sustainable? Give at least one example and explain how or why it makes a city more sustainable.

Unit 17: Solid Waste

169. Which of the following produce municipal solid waste (MSW)? (The others produce waste, but it is not classified as MSW.)
- agriculture (farms)
 - homes
 - individual people
 - large businesses, factories, and so forth
 - mining
 - small businesses
170. Approximately what percentage of the waste created in the United States is created by people in their everyday life and small businesses?
171. What happens to most of our household trash? Is it incinerated? recycled? Does it go to a landfill or end up in the ocean?

172. How is trash often disposed of in countries and places where trash is not picked up from homes and they are not allowed to dump it by the side of the road somewhere? In other words, what do people do with their trash if it is not taken away and they cannot dump it somewhere? What is the problem with disposing of trash in this way?
173. True or false? "People in poorer countries create more trash per person (on average) than people in wealthier countries."
174. True or false? "The amount of municipal solid waste (MSW) waste created each year by the United States kept going up until about 15 years ago when it leveled off."
175. True or false? "The amount of municipal solid waste (MSW) created each year by the average person in the United States has **not** gone up for the last 30 years."
176. True or false? "It is **not** safe to put unwanted computers, mobile phones, televisions, and other electronic devices into your household trash. It could damage the environment."
177. True or false? "E-waste does contain valuable minerals, but the cost of recycling them is so high that it is not worthwhile to do so. It is cheaper to mine more of the minerals."
178. True or false? "Workers in other countries who recycle our toxic e-waste often do **not** work under safe working conditions."
179. Consider the 3 possible things to do with our waste listed below. According to the Environmental Protection Agency, which is the order in which we should try to dispose of our waste, from **best** to **worst**? Why is this the best way to do things?
- incinerate with energy capture
 - landfill
 - recycle and compost

180. What is composting? What results from composting? In other words, what can compost be used for? What kinds of household waste materials **can** be included in your compost? Give two examples.
181. How is a landfill better for the environment than an open dump? (How or why does it prevent harm caused by our trash?)
182. In what way is a landfill worse for the environment than an open dump? What conditions in a landfill produce this problem?
183. Give some examples of household hazardous wastes and e-wastes that you might find in a typical home. How should you dispose of household hazardous wastes and e-wastes in the Los Angeles area?
184. How does most plastic pollution get into the ocean?
185. Where is most of the plastic pollution in the ocean, near the coast or far from land?
- True or false? "There are huge islands made of plastic in the middle of the gyres."
186. Where does plastic degrade fastest, on land or in the ocean? How or why?
187. How does plastic pollution harm ocean life? Describe the 3 major ways plastic harms ocean life discussed in the reading assignment.

Unit 18: Sustainable Economy

188. Define external costs, internal costs, and the true cost for a product. Give examples of internal and external costs. Identify examples of external and internal costs.
189. True or false? "It is fairly straightforward and easy to calculate external costs."
190. True or false? "It is easier to calculate internal costs than to calculate external costs."

191. True or false? "Mainstream economics assumes that natural resources are infinite (there is no limit to what nature has or can produce) or that substitutes can be found if needed. This is not always true, depending upon the resource."
192. Does mainstream economics typically consider the value of ecosystem services when determining the most efficient and cost-effective allocation of resources? Why or why not?
193. How can consumers influence businesses to be more environmentally sustainable? Give 2 examples.
194. According to the reading assignment, what is the most effective way to get a company to make products that can be recycled more easily and safely?

Unit 19: Water Resources

195. What are the **two** primary things that we remove from wastewater (sewage) to clean it before releasing it into the environment? In other words, identify the things that would cause the most harm if they remained in the water.
196. True or false? "Most of our drinking water was originally in the ocean." If this is true, how does most of our water get from the ocean to our homes? If this is false, where does most of our water come from?
197. Which of the following describes the water situation in California?
- Most of the fresh water in California is located in the **northern** part of the state. Fortunately, most people live in the **northern** part of the state.
 - Most of the fresh water in California is located in the **northern** part of the state. Unfortunately, most people live in the **southern** part of the state.

- Most of the fresh water in California is located in the **southern** part of the state. Fortunately, most people live in the **southern** part of the state.
- Most of the fresh water in California is located in the **southern** part of the state. Unfortunately, most people live in the **northern** part of the state.

198. In addition to using water in our homes, we need water to grow our food, make products for us (e.g., clothes), and help us generate electricity. Which of these uses is the one which uses the greatest amount of water: homes, agriculture, products, or electricity generation?
199. What organisms do we use in wastewater (sewage) treatment plants to help degrade (break down) the wastes?
200. Which natural ecosystem is the most effective at naturally cleaning wastewater, much like a wastewater treatment plant?
201. In some places, there is enough water for everyone, but not everyone there has enough water. Why not? What is the typical reason people experience water scarcity even when enough fresh, clean water is available?
202. What is the main problem with desalinating ocean water to increase our supplies of fresh water?
203. What is the major problem with building more dams as a way to increase our supplies of fresh water? In what way are dams inefficient or can cause fresh water to be lost to us?
204. True or false? "Most of the water that falls over land eventually flows back into the ocean."
205. True or false? "Most of the water that soaks into the Earth (becomes groundwater) flows through the Earth back into the ocean."
206. True or false? "In addition to water that we use in our homes each day, water is used to make products for us (like clothes) and generate

the electricity we use. Each day, the average person in the United States uses **more** water in their home than is used to make products or generate electricity for them."

207. True or false? "People in some countries use more water in their homes and small businesses than people in other countries. On average, people in most developed countries (wealthier ones) use more water than people in developing countries."
208. True or false? "Most people drink and use treated water that was previously used by someone else (used, treated, and released into the environment). In other words, we are all drinking toilet-to-tap water already."
209. True or false? "Most of the Earth's fresh water is in lakes, rivers, and aquifers (groundwater). In other words, most of the Earth's fresh water is in a liquid form."
210. True or false? "Most of the Earth's fresh water is snow and ice. In other words, most of the Earth's fresh water is a solid, not a liquid."
211. True or false? "Most of the Earth's liquid fresh water is found in aquifers (underground), not in lakes and rivers."
212. True or false? "Most of the Earth's liquid fresh water is found in lakes and rivers, not in soil or aquifers (underground)."
213. If too much water is pumped out of an aquifer along the coast, what can poison the aquifer?
214. True or false? "Water is filtered as it flows through soil and rocks as groundwater (bacteria and contaminants get trapped), making it cleaner."
215. What is the main reason(s) that we do not use a lot more recycled wastewater (purified wastewater) to increase our supplies of fresh water?

Unit 20: Water Pollution

216. What is the number 1 (most common and worst) cause of water pollution? In other words, what is the contaminant?
217. What is the number 2 (second most common and second worst) cause of water pollution? In other words, what is the contaminant?
218. What are the 2 major sources of unnaturally large amounts of nutrients in rivers, lakes, and the ocean in the United States?
219. What are the 2 major sources of the harmful bacteria in rivers, lakes, and the ocean?
220. How or why does most nonpoint source pollution enter bodies of water like rivers, lakes, and the ocean?
221. Define point source and nonpoint source pollution. Give examples of point source and nonpoint source pollution. Identify examples of point source and nonpoint source pollution.
222. How do toxic algae and cyanobacteria typically become toxic? How do humans typically cause toxic algae and cyanobacteria to grow in rivers, lakes, and the ocean? How do toxic algae and cyanobacteria in rivers and lakes typically harm humans and other animals when large numbers of algae and cyanobacteria are in the water?
223. What are red tides? How do humans typically cause red tides? How and why do red tides harm and even kill humans and other living things?
224. What are “dead zones” in the ocean? How do humans typically cause “dead zones” in the ocean? How and why do “dead zones” harm humans and other living things?
225. True or false? "Bodies of water like rivers, lakes, and the ocean in the United States are much less polluted than they used to be before the Clean Water Act was passed and enforced."

226. According to the reading assignment, what animals are really good at taking in plankton and bacteria, and making the water clearer (less turbid) and cleaner?

Unit 21: The Ocean

227. What are our 3 major uses of the ocean?
228. Approximately what percentage of the world's population lives "close" to (within about 120 miles of) the ocean?
229. "Most of the oxygen on the Earth is made in the ocean by ocean life, not by plants on land."
230. What is an EEZ (exclusive economic zone)?
How does it differ from a territorial sea?

Which of the following statements about EEZs are true?

- "According to the Law of the Sea, a country has the right to stop, board, and inspect any ship that is travelling through its EEZ."
 - "According to the Law of the Sea, a country can refuse to let military ships from other countries pass through its EEZ."
 - "According to the Law of the Sea, a country owns all of the oil and natural gas deposits in its EEZ."
 - "According to the Law of the Sea, a country can fish in another country's EEZ."
 - "According to the Law of the Sea, a country can dump wastes (pollute the water) in another country's EEZ."
 - "The United States has extensively explored its EEZ and has detailed knowledge of the resources that it contains."
231. Fishers (people who catch fish) catch many fish that no one eats.
What is the other major use for the worldwide catch?
232. Give examples of the living resources that humans take from the ocean aside from petroleum or organisms for food. (In other words, you cannot say "oil," "fish," "food," etc.) In other words, in what other

ways are living organisms useful to us? (Be specific. Give details. For example, describe the kind of organism and what it does, has, or makes that is useful.)

233. What is a fishery? How is a fishery different from aquaculture?
234. What percentage of large fish (e.g., sharks, swordfish) have been removed from the ocean?
235. About what percentage of the world's fisheries are **not** overfished or close to it?
236. Why has overfishing become a problem? (What is the major reason?) In other words, why wasn't overfishing such a big problem in the past?
237. Describe a harmful fishing practice.
How or why is it an especially harmful fishing practice?
238. What percentage of our seafood comes from aquaculture?
239. How and why can aquaculture harm and reduce wild fish populations? Give at least 2 examples.
240. How can we do aquaculture more sustainably? How or why will these methods reduce harm to the local ocean environment? What is the biggest challenge to overcome to make aquaculture more sustainable?
241. What is a marine reserve? Do the fish (and other organisms) in a marine reserve benefit fishers in the long-term? In other words, do fishers eventually begin to catch more fish? Why? Explain.
242. What is an estuary?
What are common words that indicate that a place is an estuary?
243. What is a wetland? What do they look like? What are the two main kinds of coastal wetlands? What makes coastal wetlands wet each day?

244. How can you tell the difference between an estuary and wetland just by looking at them? What can you look for that will tell you if you're looking at an estuary or a wetland?
245. Where is there more life, in an estuary or in the coastal ocean outside the estuary? Why?
246. How do estuaries benefit people? Give at least 2 examples. Why are estuaries good places for these activities? What produces the conditions that make estuaries good places for these activities?
247. Where is there more life, in a wetland or in the ocean outside the wetland? Why?
248. How do wetlands benefit people? Give at least 2 examples. What do wetland plants do that lead to these benefits?
249. What is a coral reef? How do corals create a coral reef? Why do coral reefs grow in warm places? Why do corals grow a reef? In other words, how does creating a reef help the corals?
250. What do most of the animals that live in coral reefs eat?
251. Why is there so much more life (per square foot) in a tropical coral reef than in the tropical open ocean?
252. True or false? "There are coral reefs that live in the cold water of the deep ocean, more than a mile below the surface."
253. How do deep-sea corals get most of their food?
254. According to the reading assignment, what benefits do coral reefs provide to humans? Discuss at least 2 different benefits. Explain how and why corals and coral reefs provide these benefits.
255. What can cause corals to bleach? How do humans cause coral bleaching? Why does a bleached coral look "white"? Why do bleached corals often die?

256. Tourists touching a reef and boats running into a reef can harm corals, but the damage is usually limited. According to the reading assignment, what is a human activity can harm a large reef area? Describe the human activity and why we carry out the activity (how humans benefit from the activity). Explain how or why the activity harms coral reefs.
257. What are phytoplankton? How would you describe what they are and look like to someone who has not taken this class? For example, how big are they? What color are they? What would you tell this person about how phytoplankton affect their lives?
258. How do humans use harvested kelp? Discuss why kelp is used in each product. In other words, how does kelp improve the product? How do kelp forests benefit the people who live near them? Give at least 2 examples. Discuss the forest itself, not kelp that can be harvested from the kelp forest.
259. Sometimes kelp forests die or are destroyed. How have humans destroyed some kelp forests (in California and elsewhere)? What is the most common way?

Units 22: Forests

260. Which economic benefit provided by forests is worth the most money in the current economy?
261. Describe at least 3 ecosystem services that forests provide to humans. Be specific about what the forests do and why they do it. Be specific about how the lives of people are better than thanks to forests. (Note: Discuss at least one example of forests, not just trees or wood.)
262. What is the primary reason that forests are being cut down in developing countries?

263. Despite the problems with palm oil, it is probably still a better (more sustainable choice) than other edible oils we could use like soybean oil. Why?
264. Conserving biodiversity and sustaining ecosystem services in Southeast Asian forests requires sustainable palm oil production. What can consumers do to encourage sustainable production of palm oil?
265. How or why can sending fire fighters stop a forest fire sometimes result in more deforestation than if we let the forest burn?
266. Which kind of forest occupies the smallest amount of land because it **has been** cut down already: boreal, temperate, or tropical?
267. Which kind of forest is growing back fastest, occupying more and more land: boreal, temperate, or tropical?
268. Which kind of forest is being cut down fastest **now**: boreal, temperate, or tropical?
269. True or false? "The global deforestation rate is **higher** than in the past. In other words, **more** trees are cut down each year than in the past."
270. True or false? "Deforestation rates are higher in developed (wealthier) countries. In other words, forests are being cut down faster in developed countries than in developing countries."
271. True or false? "Deforestation rates are increasing in some developing (poorer) tropical countries. In other words, trees are being cut down even faster than in the past."
272. True or false? "Most developed countries cut down much of their forests before or when they industrialized (when they began to use fossil fuel powered machines throughout their economies)."
273. True or false? "Nowadays developed countries typically protect their remaining forests. If they need more wood than they can sustainably

take from their own smaller forests, they can buy the wood from developing countries, contributing to unsustainable harvesting of wood (deforestation) in developing countries."

274. How can we reduce deforestation and protect forests? What policies and actions are advocated in the reading assignment?

Unit 23: Grasslands

275. Describe at least 3 ecosystem services that grasslands provide to humans. Be specific about what the grasslands do and why they do it. Be specific about how the lives of people are better than thanks to grasslands. (Note: Discuss at least one example of grasslands, not just grass.)
276. What are the major ways in which grasslands are being destroyed by humans? In other words, why are there fewer and fewer grasslands? Identify the 3 main reasons for grasslands becoming deserts (desertification)?
277. True or false? "To help protect or restore grasslands, the United States government pays some farmers **not** to farm, and some ranchers **not** to ranch."
278. True or false? "Desertification occurs when grassland becomes deserts, and human actions can sometimes cause this to happen. Fortunately, a desert can be restored to a grassland with proper care."
279. True or false? "Some grasslands do **not** have soil that is good for growing food. However, often this land can produce food for us, because we can sustainably graze livestock like cattle, sheep, and goats on the land."
280. True or false? "Grasslands need grazers. If there are not a lot of herbivores grazing, grasslands will degrade and will not support as much life in the future."

281. How should we graze cattle so that they graze like wild grazers?
How does grazing them in this way benefit and improve grasslands?
How would grazing them in other ways harm grasslands?
282. How can we reduce desertification and protect grasslands?
What policies and actions are advocated in the reading assignment?

Unit 24: Agriculture

283. According to the United Nations, spending about \$18 billion a year would allow us to eliminate hunger and extreme poverty. Is this economically feasible?
284. True or false? "Humans do **not** grow enough food to feed everyone on the planet."
285. Modern industrial agriculture produces a lot more food at a lower cost than earlier methods of agriculture. How does it achieve this according to the reading assignment? Describe two common ways in which modern industrial agriculture produces more food than earlier methods of agriculture or produces food at a lower cost than earlier methods of agriculture.
286. Modern industrial agriculture produces a lot more food at a lower cost than earlier methods of agriculture. However, there are costs. Discuss at least 2 non-pesticide examples of different external costs that often result from growing crops using modern industrial agriculture according to the reading assignment. (In other words, do **not** discuss pesticides as one of your examples.) As part of your answer, describe how modern industrial agriculture is done and show how it leads to the external costs. Be specific about how humans are harmed.
287. What are the **two** main components of the Green Revolution of the 1960s?

288. How were new kinds of wheat and rice that produce more food per acre (high yield varieties) created by the 1960s as part of the Green Revolution?
289. Which place got the **least** help during the Green Revolution: Africa, Asia, or South America?
290. Why was Asia targeted during the Green Revolution? In other words, why did Asia get the most help?
291. True or false? "The Green Revolution succeeded in increasing food supplies by a lot and reducing the number of hungry people in the world."
292. True or false? "If a product is labeled as eco-friendly, then you can be sure it was made sustainably, that it is made in a way that did not harm nearby ecosystems."
293. True or false? "It costs farmers a **lot** of time and money to get the food they produce certified as organic."
294. True or false? "One of the benefits of buying food from local farmers is that food is not transported from far away, and thus has a lower carbon footprint (less gas is burned to bring it to you, so fewer greenhouse gases are emitted)."
295. True or false? "One of the benefits of buying food from local farmers is that the food is fresher, and thus typically healthier."
296. True or false? "One of the disadvantages of organic food is that it is typically more expensive than food produced using industrial agriculture."
297. True or false? "Organic food has been shown to be healthier than food produced using industrial agriculture."
298. True or false? "Organic food is typically produced in a more sustainable way than food produced using industrial agriculture, and thus is better for local ecosystems near farms where it is produced."

299. True or false? "Transportation from the farms to our cities is the major way in which our food contributes to greenhouse gas emissions and global warming."
300. True or false? "You should always wash vegetables and fruit before eating them or cooking them, even if they are organic."
301. True or false? "We have been making progress on fighting hunger: there are fewer and fewer hungry people in the world."
302. True or false? "The vast majority of people who do **not** have enough nutritious food live in developing countries."
303. True or false? "Poor people in developing countries spend a **large** part of their income on food. Thus, if food prices increase, the cost of food could be far more than they can afford to pay."
304. True or false? "It is more expensive to produce and deliver food to a young child (under) than to provide medical care for malnutrition."
305. True or false? "A person **can** experience undernutrition even if they are eating food with the recommended number of calories each day."
306. True or false? "A lot of food in the United States is made from genetically modified crops."
307. True or false? "Genetic engineering is sometimes used to transfer a gene (DNA) from one animal or plant to another one of the same or similar species. This could have been done using breeding (choosing who reproduces with who) but is faster and more precise. This kind of GMO is **not** considered a GMO for the purpose of regulation in the United States. In other words, testing and careful study for safety are not required."
308. "Genetic engineering is sometimes used to transfer a gene (DNA) from one organism to another one of a completely different species. This kind of GMO is **not** considered GMO for the purpose of regulation in the United States. In other words, testing and careful study for safety are not required."

309. True or false? "Genetic engineering is sometimes used to "turn off" a gene in an animal or plant (so the gene does not work). This kind of GMO is **not** considered a GMO for the purpose of regulation in the United States. In other words, testing and careful study for safety are not required."
310. True or false? "Based on the evidence accumulated so far, genetically modified foods are safe to eat."
311. True or false? "There is strong evidence to suggest that eating some genetically modified foods is dangerous."
312. True or false? "One concern about GMOs is that their new genes could be passed on to wild species whose new abilities could then harm ecosystems."
313. According to the reading assignment, what are the main reasons that lots of people do not have enough food in some parts of the world today?
314. Describe a problem with how agriculture is often being done or how the food supply works in developing countries according to the reading assignment. Describe what we might do to change this to make sure everyone in the world has enough to eat.
315. True or false? "Scientists can use all the new techniques and technologies to analyze the genes of animals and plants, and use the information to create new organisms (varieties) using traditional breeding practices, but much **faster** than in the past **and** without genetically modifying them."
316. True or false? "Different strategies for growing more food probably will work best in different places. There is not one best strategy that we can apply to growing more food everywhere. In other words, in some places, industrial agriculture may be appropriate and even sustainable. In some places, sustainable agriculture is a much better choice."

317. True or false? "Research into technologies, crops, and techniques needs to be done for specific environments. There is not one set of practices that will work well in all places."

Unit 25: CAFOs and meat production

318. Where do the harmful bacteria in meat from cattle typically come from? How or where does the meat become contaminated?
319. Suppose that we stopped consuming meat (everyone became vegetarian). Could we feed the world's population if it goes from the current 7+ billion people to the projected 10 or 11 billion people with our existing farmland? Would it be possible with enough habitat destruction to create more farmland?
320. True or false? "Cooking meat to a high enough temperature will kill bacteria in meat like ground hamburger, and prevent you from getting sick from consuming the meat."
321. True or false? "Hamburger is more dangerous than steak, because grinding the meat spreads the bacteria to the inside of the meat which is not in direct contact with the hot grill."
322. True or false? "Meat contains essential proteins that our bodies need to be healthy. However, we can also get these proteins by eating the right plant-based foods."
323. True or false? "People who eat more of some kinds of meat (beef, pork, lamb) than other people are more likely to die than the people who eat less of these kinds of meat."
324. True or false? "Only eating animals raised on grasslands in pastures would allow us to grow more food for people to eat."
325. True or false? "Eating more meat and fewer plant-based foods would allow us to grow more food for people to eat."
326. True or false? "Eating more meat and fewer plant-based foods would improve our health."

- 327. True or false? "Eating more meat and fewer plant-based foods would reduce our ecological footprint."
- 328. True or false? "Only eating animals raised on grasslands in pastures would reduce our ecological footprint."
- 329. What is the big advantage that raising animals in CAFOs has over raising animals in pastures?
- 330. Describe one way in which government policy in the United States helps support raising animals in CAFOs according to the reading assignment.
- 331. Discuss at least 1 non-air pollution example of an external cost that often results from raising animals in CAFOs according to the reading assignment. (In other words, do **not** discuss bad smells and other forms of air pollution.) As part of your answer, describe the practices and conditions in CAFOs that lead to the external cost. Be specific about how humans are harmed.
- 332. Suppose that you could eat the plants fed to an animal (like a cow) or you could eat the animal. Would you get more energy by eating the plants or by eating the animal? Why?

Unit 26: Mining

- 333. True or false? "Our homes are filled with things made from minerals that are mined from the Earth."
- 334. True or false? "Few everyday items and substances are made from minerals that are mined from the Earth, mostly electronics and other forms of technology."
- 335. True or false? "Many everyday items and substances are made from minerals that are mined from the Earth."
- 336. What are some examples of everyday objects and substances in our homes or that we use every day in our lives that contain minerals and result from mining? Give some examples. (If your example contains

some parts which are not minerals, discuss what part contains the minerals.)

337. How can we reduce the amount of minerals we use and thus the amount of mining we do? Give examples of at least 2 different strategies, and explain how or why they help reduce the amount of minerals that we use and thus mining that we do.
338. True or false? "Recycling most metals is more expensive than mining metals from the Earth. (This is currently true but may change in the future.)"
339. True or false? "To get most metals, mining is less expensive than recycling. (This is currently true but may change in the future.)"
340. True or false? "Mining causes less environmental damage than recycling. In other words, mining some amount of metal uses less water and energy and creates less pollution than recycling the same amount of metal. (This is currently true but may change in the future.)"
341. Give an example of how miners extract valuable minerals from ore that illustrates how or why mining produces a lot of waste and pollution.
342. True or false? "Mining produces a lot of waste rock. To get one pound of valuable metals or minerals could require digging up and processing (literally) a **ton** of rock."
343. True or false? "Mining requires a **lot** of energy and burning a **lot** of fossil fuels like oil and coal to power heavy machinery, trucks, and processing plants."
344. True or false? "One of the few good things about mining is that we typically dig down into the Earth, so mining typically does not take up a lot of land (it does **not** result in much habitat destruction). The waste rock is just put right back in the deep hole!"

345. True or false? "Mining to get the metals (to make products for us) uses a **lot** of water, more water than is used for drinking, cooking, and cleaning in our homes."
346. True or false? "Some places have higher concentrations of some minerals than other places. So, if we want to keep costs low and reduce environmental damage, we should get some minerals from other countries."
347. True or false? "In developing countries, mine workers often work in unsafe conditions."
348. True or false? "The products we buy are often made from metals mined in other countries. Local people get jobs but their environment and health are often damaged."
349. Will we run out of the minerals we need? Why or why not?
350. What are tailings? Why are tailings made? In other words, why are they necessary to get the minerals we want out of ore? Are tailings more dangerous or less dangerous than other kinds of rock waste? Why?
351. What are tailings? Why are tailings made? In other words, why are they necessary to get the minerals we want out of ore? What is a tailings dam and tailings pond? Why are they built? In other words, what is their purpose? How do they accomplish their purpose? What kinds of disasters can result from constructing tailings dams and ponds?
352. Are minerals a renewable resource? Why or why not?

Unit 27: Fossil Fuels

353. Are fossil fuels renewable sources of energy? Why or why not?
354. Which fossil fuel is used to power most of our vehicles like cars, trucks, and ships?

- 355. Which fossil fuels are used to generate most of our electricity?
- 356. Which is the cheapest fossil fuel?
- 357. Which kind of fossil fuel is the cleanest to burn? In other words, which produces the least pollution and the least bad pollution?
- 358. Which kind of fossil fuel is the dirtiest to burn? In other words, which produces the most pollution and the worst pollution?
- 359. True or false? "Hydraulic fracturing has reduced the United States' reliance on supplies of oil from other countries. It has increased our energy independence (energy sovereignty)."
- 360. True or false? "New oil and natural gas drilling techniques that make it much cheaper and easier to drill for oil and natural gas have made the United States one of countries with large supplies of oil and natural gas."
- 361. True or false? "Generally, obtaining oil and natural gas using non-traditional techniques like hydraulic fracturing is more expensive than using traditional techniques, so the price of oil and natural gas determines if and when people use them."
- 362. True or false? "We have already extracted the easiest to drill oil and natural gas from the Earth. In general, this makes it harder and more expensive to drill for oil and natural gas than in the past."
- 363. True or false? "People who live near places where oil is extracted or refined do **not** have higher rates of health problems like birth defects and cancer."
- 364. True or false? "Hydraulic fracturing (fracking) requires the use of **less** water to extract oil and natural gas than traditional drilling techniques."
- 365. True or false? "In some places wastewater from hydraulic fracturing is buried in holes lined with concrete (so that the wastewater will not contaminate groundwater supplies)."

366. True or false? "Wastewater from hydraulic fracturing can be cleaned and is cleaned in some places."
367. "A **lot** of water is used to get oil and natural gas out of the Earth. The water becomes contaminated as a result."
368. True or false? "We **cannot** clean water that was used for drilling for oil and natural gas. It is permanently contaminated."
369. True or false? "Hydraulic fracturing brings long-term, sustainable wealth (booming economy, more jobs) to communities where it is occurring."
370. True or false? "Hydraulic fracturing brings wealth to the whole community near where it is being done. Everyone benefits economically: paid lots of money for their land, increased property values, and more jobs with better wages."
371. Is oil biodegradable? If so, what kinds of organisms can degrade it? If not, why not?
372. True or false? "The toxic ash from coal fired power plants is buried in landfills (or put in ponds) where it can contaminate our supplies of fresh water."
373. True or false? "Cancer rates near mountain top removal coal mining sites are higher than those near other mining sites or areas where there is no mining."
374. True or false? "Mining and generating electricity from coal uses a **lot** of water. Using coal to generate electricity for us uses more water than is used for drinking, cooking, and cleaning in our homes."
375. True or false? "Mining coal and using coal to generate electricity does **not** produce much waste rock."
376. True or false? "Mining coal uses a lot of land (the mined area, processing facilities, piles of waste rock and tailings ponds) and thus causes significant amounts of habitat destruction."

377. True or false? "Coal mining in the Appalachian Mountains has become more destructive and environmentally damaging than in the past, because techniques like MTR (mountain top removal) are now used."
378. True or false? "We can make "clean coal," but cleaning coal is expensive, so it makes coal an expensive source of energy instead of a cheap one."
379. True or false? "Clean coal" releases a lot of carbon dioxide (a greenhouse gas) when it is burned."
380. True or false? "After companies are done mining coal, they are supposed to restore the land. They cover rock waste with top soil, and plant grass, perhaps some trees. Ditches are dug to create new streams."
381. True or false? "We **can** clean water that was used for mining coal, but it is expensive."
382. True or false? "Coal is mainly found in certain places and few countries have a lot of coal. Some countries have so much coal that they can cause prices to go up a lot by producing a lot less (or cause prices to go down a lot by producing a lot more)."
383. True or false? "A lot more oil is found in some places than other places. Some countries have so much oil that they can cause prices to go up a lot by producing a lot less (or cause prices to go down a lot by producing a lot more)."
384. True or false? "Supplying our energy needs from many different places (e.g., different countries) makes our energy supply more reliable and stable."
385. True or false? "Supplying our energy needs from many different sources (e.g., fossil fuels, wind, solar, nuclear) makes our energy supply more reliable and stable."

386. True or false? "We will **not** run out of oil and natural gas within the next 100 years."
387. True or false? "Fossil fuels are forming right now inside the Earth."
388. Which fossil fuel produces the most small particle air pollution when it is burned to generate electricity?
389. Which fossil fuel produces toxic ash after it is burned?
390. Which fossil fuel releases the most chemicals which can cause acid rain when it is burned to generate electricity?
391. Which fossil fuel releases the most radioactive materials when it is burned to generate electricity?
392. In what way might fossil fuels be considered a kind of solar energy?
393. What are the most significant dangers experienced by coal miners, especially those in subsurface mines (coal miners who go down into the Earth)? (Mark all that apply.)
394. What is the **most common** cause of death for coal miners?
395. Why are there fewer coal miners nowadays? What is the main or major reason according to the reading assignment?
396. Why are we using more natural gas and less coal to generate electricity? (What is the most important reason?)
397. Which powerful greenhouse gas is accidentally released during hydraulic fracturing drilling operations?
398. What harmful chemical is released into the environment when coal is burned and ends up in seafood?
399. Which kind of fossil fuel forms from ancient swamps?
400. Which kind of fossil fuels form on the bottom of the ocean?
401. Which is the **easiest** fossil fuel to transport? In other words, which can be moved from place to place fastest and at the lowest cost?

402. Which is the hardest and **most dangerous** fossil fuel to transport?
403. Where is better for an oil spill to occur, on land or in the ocean?
Which environment heals faster?
404. The estimated value of the EROEI of coal is around 11:1. When you take into account the external costs of coal like costs to human health, what might be a reasonable value of its EROEI?
- 1:1 (not worth using)
 - 3:1 (worst of our choices)
 - 6:1 (only a little worse than natural gas)
 - 10:1 (just about as good as if we do not include the external costs)
405. Petroleum (oil) is not just burned as fuel. For example, oil is needed to lubricate machines. However, there are lots of different chemicals in petroleum (oil). In addition to using oil as a fossil fuel, what else are chemicals in it used for? List a product or material from the reading assignment that is made from the chemicals in oil.
406. Natural gas is not only burned as a fuel. Chemicals in it can be used to make materials and products. List a product or material from the reading assignment that is made from the chemicals in natural gas.

Unit 28: Climate Change

407. Who benefits from the current way in which we burn fossil fuels and emit greenhouse gases? How do they benefit? Give a few examples. Include examples of people who benefit from the production of fossil fuels and examples of people who benefit from the consumption of fossil fuels.
408. What are the likely external costs of climate change? Which groups of people (stakeholders) are most at risk from them? Give a few examples.
409. Who will be hurt the most by climate change, people who live in developed (wealthier) countries or people who live in developing

(poorer) countries?

Who have added most of the excess carbon dioxide and other greenhouse gases to the atmosphere thus far, people who live or lived in developed (wealthier) countries or people who live or lived in developing (poorer) countries?

- 410. How is climate different from weather? How and why is people's experience with weather and weather prediction often a poor way to think about climate and climate prediction?
- 411. What kind of "light" do hot objects like the Sun and lamps primarily emit?

What kind of "light" do not-very-hot objects like objects at ordinary temperatures found at the surface of the Earth primarily emit?

- 412. What happens to visible light when it hits nitrogen & oxygen gas (which make up most of the atmosphere): is it absorbed, reflected, or does it go through?

What happens to infrared light when it hits nitrogen and oxygen gas (which make up most of the atmosphere)?

What happens to visible light when it hits greenhouse gases?
What happens to infrared light when it hits greenhouse gases?

- 413. Explain how the atmosphere's greenhouse effect works.
- 414. Describe 1 observation made by scientists that does not involve thermometers and suggests that the Earth is getting warmer. Explain why it indicates the Earth is getting warmer. Describe another (different) observation made by scientists that does not involve thermometers and suggests that the Earth is getting warmer. Explain why it indicates the Earth is getting warmer.

415. If more carbon dioxide is added to the atmosphere, will the greenhouse effect get stronger or weaker? Will more carbon dioxide in the atmosphere make the world warmer or cooler?
416. True or false? "If there were no atmospheric greenhouse effect, the entire Earth would be covered by ice."
417. True or false? "Carbon dioxide in ocean water contributes to the greenhouse effect and warms the Earth."
418. True or false? "Carbon dioxide is the greenhouse gas emitted by human activities which warms the Earth the most. In other words, the carbon dioxide in the atmosphere due to humans is responsible for more of the warming of the Earth than any other greenhouse gas."
419. True or false? "Carbon dioxide is the strongest greenhouse gas. In other words, if equal amounts of carbon dioxide and another greenhouse gas are in the air, the carbon dioxide will cause more warming."
420. Give at least 2 examples of fossil fuels. Why do we burn each one? In what way do you benefit from the burning of these fossil fuels in your everyday life?
421. What is the primary way in which humans increase the amount of greenhouse gases like carbon dioxide in the atmosphere? What are some of the other major ways in which humans increase the amount of greenhouse gases in the atmosphere?
422. What are the primary ways in which humans increase the amount of methane in the atmosphere?
423. What are the primary ways in which humans increase the amount of carbon dioxide in the atmosphere?
424. What are the primary ways in which humans increase the amount of nitrous oxide in the atmosphere?

425. How do trees, grasses, and other plants on land help reduce our carbon dioxide pollution? Identify the thing that plants do with carbon that helps the most to reduce carbon dioxide pollution. Under what circumstances will the carbon in trees, grasses, and other plants probably get back into the atmosphere? Under what circumstances will the carbon in trees, grasses, and other plants stay "trapped" in another sink and **not** get back into the atmosphere? Which sinks will they go into instead and why won't the carbon go back into the atmosphere?
426. Removing carbon dioxide from ocean water can help clean up our carbon dioxide pollution. Why do these organisms remove carbon dioxide from ocean water? What use of the carbon is most likely to keep the carbon from getting back into ocean water and the atmosphere? How or why might the carbon in ocean life go back into ocean water and possibly the atmosphere? Under what circumstances will the carbon in ocean life stay "trapped" in another sink and **not** get back into ocean water and possibly the atmosphere? Which sink will the carbon go into instead and why won't it go back into ocean water?
427. About half of our carbon dioxide has been absorbed by the ocean. How does lots of carbon dioxide entering ocean water affect the ocean water? Which ocean organisms are most strongly affected by the extra carbon dioxide in ocean water? How does it affect them?
428. If global warming continues and the water at the surface of the ocean gets warmer and warmer, will there be more phytoplankton or fewer phytoplankton in the oceans? Why?
429. If global warming continues and the water at the surface of the ocean gets warmer and warmer, will there be more fish or fewer fish in the ocean? Why or why not? Explain your reasoning.
430. How do clouds affect the Earth's climate? Explain how or why clouds can warm and/or cool the surface of the Earth.

- 431. Humans' most significant impact on the Earth's climate is enhancing the greenhouse effect. What human activity has the second-largest impact on the Earth's climate?
- 432. The Earth is mainly covered by water. What is the primary way that all this water in the ocean affects the overall temperature of the Earth?
- 433. There is a lot more carbon dioxide in the atmosphere than in the past. Why has the amount of global warming been so small so far? Why has the Earth warmed up so slowly?

Unit 29: Renewable Energy

- 434. How or why can heating water generate electricity?
- 435. How or why can flowing air (wind) or water (currents) be used to generate electricity?
- 436. Of course, hydropower is renewable energy. Describe another advantage that hydropower has over other sources of energy according to the reading assignment. Describe one of the significant problems with relying on hydropower for electricity discussed in the reading assignment.
- 437. Of course, solar power is renewable energy. Describe another advantage that solar power has over other sources of energy according to the reading assignment. Describe one of the significant problems with relying on solar energy for electricity discussed in the reading assignment.
- 438. Of course, geothermal power is renewable energy. Describe another advantage that geothermal power has over other sources of energy according to the reading assignment. Describe one of the significant problems with relying on geothermal energy for electricity discussed in the reading assignment.
- 439. Of course, wind power is renewable energy. Describe another advantage that wind power has over other sources of energy according to the reading assignment. Describe one of the significant

problems with relying on wind energy for electricity discussed in the reading assignment.

440. For us to rely upon renewable energy like solar and wind instead of fossil fuels, we probably need people to buy a lot of powerful batteries to store the renewable energy for later use. What kind of consumer product containing such powerful batteries is becoming more and more common for ordinary people to own?
441. Sustainable energy generation is supposed to cause little or no harm to local ecosystems. What is the biggest way in which wind power harms local ecosystems?
442. What are the top **two** biggest external costs associated with solar power?
443. Which are the **two** kinds of renewable energy that we use the most in the United States?
444. Which renewable source(s) of energy are already or soon will be producing as much electricity as they can for us? In other words, which ones will **not** be producing much more energy in the future than they already are?
445. Which kind of renewable energy is projected to give the United States more and more energy over time? (It has a lot more room to grow than any other one.)
446. In geothermal heat pumps (ground source heat pumps), water is pumped down into the ground below a house. The water exchanges heat with the Earth, and then is brought up. Can this water be used to warm the house in winter? Can this water be used to cool the house in summer?
447. True or false? "Geothermal heat pumps can be installed just about anywhere."

448. True or false? "A smart grid improves the reliability of the electricity system, so power outages are less likely, shorter, and less damaging."
449. True or false? "A smart grid makes it easier for renewable supplies of energy like wind and solar to be part of our electricity generation system."
450. True or false? "A smart grid allows us to direct electricity to essential services like hospitals, firefighters, and the police to make sure they have power during disasters."
451. True or false? "A smart grid allows power companies to control aspects of our homes (e.g., thermostat and air conditioning) remotely."
452. True or false? "One of the major reasons fossil fuels like coal, oil, and natural gas are **cheaper** sources of energy than renewable sources of energy like solar and wind is that the damage mining and burning fossil fuels does to human health and ecosystem services is **not** included in their price."
453. True or false? "We currently tax fossil fuels to take into account the damage they do to human health and the environment to make sure affected communities get some compensation. The level of taxation reasonably approximates the damage they do so that the compensation is sufficient to pay for damage done."
454. True or false? "We **need** fossil fuels to supply our energy needs and maintain our standard of living. We cannot afford to switch over to only renewable sources of energy right now."

Unit 30: Biofuels

455. What is the main reason that people burn biomass in developing countries in their homes? What is the main problem with burning biomass in homes?

456. What is the major advantage that biofuels have over other kinds of sustainable energy?
457. What are a few of the limitations or problems with relying on biofuels to power our vehicles?
458. Describe one major advantage of making biofuels from algae instead of crops according to the reading assignment.
459. Is there probably some biofuel in most or all gas-powered cars on the roads of Los Angeles? If so, why is it in our fuel? If not, why isn't biofuel more widely available?
460. True or false? "We will no longer have any need for oil or to drill for oil if biofuels become good enough. In other words, biofuels can replace or substitute for oil."
461. Which requires more mining and thus results in more environmental damage due to mining, a car that burns fossil fuels or an electric vehicle?
462. True or false? "Growing crops for biofuels does **not** reduce our food supply."
463. True or false? "If we harvest wild grasses to make biofuels, we will **not** reduce our food supply."
464. True or false? "Biofuels are carbon neutral, because the carbon dioxide emitted when they are burned was originally taken from the atmosphere when the plants used to make the biofuels were grown. In other words, using biofuels to power vehicles does **not** increase the overall amount of greenhouse gases in the atmosphere."
465. True or false? "Growing biofuels and using them to power our vehicles reduces the amount of carbon dioxide (a greenhouse gas) in the atmosphere."

466. True or false? "Right now, biofuels like ethanol and biodiesel in our vehicles are **not** very efficient. In other words, we get as much energy from them as we use to make them; their EROEI is close to 1:1."
467. True or false? "A liter of a biofuel contains **less** energy than a liter of the equivalent fossil fuel. For example, a liter of ethanol contains less energy than a liter of gasoline. A liter of biodiesel contains less energy than a liter of diesel."