Chapter 1
Answers to Critical Thinking and Review End of Chapter Questions:

1. Why does a single child born in the United States have a greater effect on the environment than 12 or more children born in a developing country?

Ans: A single child born in a highly developed country such as the United States causes a greater impact on the environment and on resource depletion than do 12 or more children born in a developing country. Many natural resources are used to provide the automobiles, air conditioners, disposable diapers, cell phones, DVD players, computers, clothes, newspapers, athletic shoes, furniture, boats, and other "comforts" of life in highly developed nations. Consumer goods, such as these, require vast materials and energy for production and distribution. Thus, the disproportionately large consumption of resources by the United States affects natural resources and the environment as much as or more than the population explosion in the developing world.

2. Do you think it is possible for the world to sustain its present population of more than 6.9 billion indefinitely? Why or why not?

Ans: The current global ecological footprint of each person is about 2.7 hectares (6.7 acres), which means humans have overshot our allotment. We can see the short-term results around us—forest destruction, degradation of croplands, loss of biological diversity, declining ocean fisheries, and local water shortages. The long-term outlook, if we do not seriously address our consumption of natural resources, is potentially disastrous. Therefore, it is not likely that we can maintain 6 billion people indefinitely.

3. Is consumption driven more by population than affluence in highly developed countries? Less developed countries? Explain the difference.

Ans: Consumption is the human use of materials and energy. In general the use of resources by consumers in highly developed countries is greatly out of proportion to their numbers. A single child born in a highly developed country may have a greater impact on the environment than 12 children born in developing countries. Many natural resources are required to provide automobiles, air conditioners, disposable diapers, cell phones, DVDs, computers, clothing, etc. in highly developed countries.

4. In this chapter we said the current global ecological footprint is 2.7 hectares (6.7 acres) per person. Do you think it will be higher, lower, or the same in 15 years? Explain your answer.

Ans: Answers will vary

5. How are the concepts of ecological footprint and the IPAT model similar? Which concept do you think is easier for people to grasp?

Ans: An ecological footprint is an average amount of productive land, fresh water, and ocean required on a continuous basis to supply a person food, wood, energy, water, housing, clothing, transportation, and waste disposal. The IPAT model, shows the mathematical relationship between environmental impacts and the forces driving them.

6. Explain the following ancient proverb as it relates to the concept of environmental sustainability: We have not inherited the world from our ancestors; we have borrowed it from our children.

Ans: Environmental sustainability is the ability to meet the current human need for natural resources without compromising the ability of future generations to meet their needs. Sustainability implies that humans can manage natural resources indefinitely without the environment going into a decline from the stresses imposed by human society on natural systems that maintain life. When the environment is used sustainably, humanity's present needs are met without endangering the welfare of future generations.

7. Name an additional example of a common-pool resource other than those mentioned in this chapter.

Ans: Answers will vary

8. Explain why economic well-being, environment, and ethics all contribute to sustainable development.

Ans: Sustainability implies that humans can have economic development and fair allocation of resources without the environment going into decline. When the environment is used sustainably, humanity's present needs are met without endangering the welfare of future generations. The goal of sustainable development is to ensure future economic development while protecting the environment. To ensure sustainability environmentally sound decisions, economically viable decisions, and socially equitable decisions must be thought of as a part of a complex and interlinked system.

9. Give an example of an Earth system?

Ans: At a global level are Earth systems, which include Earth's climate, atmosphere, land, coastal zones, and the ocean. Environmental scientists use a systems approach to try to understand how human activities are altering global environmental parameters such as temperature, carbon dioxide concentration in the atmosphere, land cover, changes in nitrogen levels in coastal waters, and declining fisheries in the ocean.

10. Thomas Henry Huxley once wrote, "The great tragedy of science—the slaying of a beautiful hypothesis by an ugly fact." Explain what he meant, based on what you have learned about the nature of science.

Ans: A hypothesis is an educated guess, an explanation of a problem. A good hypothesis will make predictions about how the natural world works. These predictions can then be

tested and possibly disproved. Sometimes a seemingly sound hypothesis is disproved by experimental data. Some people have strong beliefs about how the world should work but the scientific facts don't always support those beliefs.

11. In the chapter, the term *model* is defined as a formal statement that describes a situation and can be used to predict the future course of events. On the basis of this definition, is a model the same thing as a hypothesis? Explain your answer.

Ans: A model is not the some thing as a hypothesis. A hypothesis is an educated guess that tries to explain the natural world. It breaks down complex systems into testable processes in order to explain the bigger picture. Many of models are computer simulations that represent the overall effect of competing factors to describe an environmental situation in numerical terms. Models help us understand how a present situation developed from the past or how to predict the future course of events.

12. Some people want scientists to give them precise, definitive answers to environmental problems. Explain why this is not possible.

Ans: Science is a dynamic process, a systematic way to investigate the natural world. Science seeks to reduce the apparent complexity of our world to general scientific laws. Scientific laws are then used to make predictions, solve problems, or provide new insights. There is no absolute certainty or universal agreement about anything in science. Science is an ongoing enterprise, and generally accepted ideas must be reevaluated in light of newly discovered data. Scientists never claim to know the "final answer" about anything because scientific understanding changes. However, this must not prevent us from using current knowledge in environmental science to
make environmental decisions.

13. Explain why it might be difficult to make a decision about whether or not to allow farmers to spray pesticides even if we all agree about negative health effects of the pesticides.

Ans: Answers will vary but should include economic impact on farmer and local community, importance of crop being grown, viability and availability of alternative crops that could be grown, availability and effectiveness of alternative pesticides or use of natural predators.

14. Place the following stages in addressing environmental problems in order and briefly explain each: long-term evaluation, public education and involvement, risk analysis, scientific assessment, political action.

Ans: 1. Scientific assessment involves identifying a potential environmental problem and collecting data to construct a model.
2. Risk analysis evaluates the potential effects of intervention.
3. Public education and involvement occur when the results of scientific assessment and risk analysis are placed in the public arena.

4. Political action is the implementation of a particular risk-management strategy by elected or appointed officials.
5. Long-term evaluation monitors the effects of the action taken.

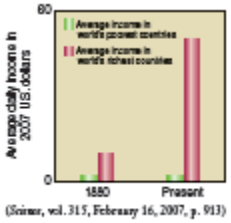
15. What does the term *system* mean in environmental science?

Ans: A system is set of components that interact and function as a whole. A natural system, consisting of a community of organisms and its physical environment, is known as an ecosystem. Ecosystems are organized into larger systems that interact with one another. Natural ecosystems are the foundation for our concept of environmental sustainability.

16. In what ways do decisions about energy use and climate change that we make today limit the possibilities available to the next generation? Explain your answer.

Ans: In order to live in a sustainable way, we must make smart choices about energy use. If we use energy in excess, the environment will be degraded for future generations. In order to not affect future generations, humans must manage natural resources without the environment going into a decline from the stresses imposed by society.

17. Examine the graph, which shows and estimate of the discrepancy between the wealth of the world's poorest countries and that of the richest countries.



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a. How has the distribution of wealth changed from the 1880's to the present? What explains this difference?
b. Based on the trend evident in the graph, predict what the graph might look like in 100 years.
c. Some economists think that our current path of economic growth is unsustainable. Are the data consistent with this idea? Explain your answer.

Ans:

a) Wealth has increase significantly in developed countries and remained essential unchanged in developing countries. The majority of the manufacturing and industrial infrastructure is concentrated in developed countries. Developing countries normally provide the raw materials and not the final product.
b) Significant increases in wealth in developed countries and essentially no net increase in developing countries. The gap between developed and developing countries will increase substantially.
c) Yes – currently highly developed countries represent less than 20% of the world's population, yet they consume significantly more than half of the earth's resources.

If long-term consumption of natural resources is not decreased the outlook could be disastrous.