Questions and Problems

Access to and use of the internet is assumed in answering all questions including general information, statistics, constants, and mathematical formulas required to solve problems. These questions are designed to promote inquiry and thought rather than just finding material in the text. So in some cases there may be several "right" answers. Therefore, if your answer reflects intellectual effort and a search for information from available sources, your answer can be considered to be "right."

1. According to some environmentalists, Earth is now entering the Anthropocene epoch. What is an epoch? In which epoch have humans lived until now? What are some of the past epochs that Earth has been through? Approximately when was the term Anthropocene coined and who is responsible for it?

2. It is noted in this chapter that the narrow layer between the geosphere and atmosphere where plants grow is an important environmental interface. The microclimate in this interface may vary significantly in its characteristics from the microclimate of the atmosphere just above it. What is microclimate? How does the microclimate in the narrow layer just described tend to vary from the climate just above it?

3. Thin layers and interfaces are very important in Earth's environment. Describe some of these layers.

4. The assertion has been made that if Earth were a classroom globe, the layer of soil covering it would be about as thick as the dimensions of a human cell. Assume that a classroom globe is 25 centimeters in diameter. Look up Earth's dimensions and using the assertion made above, calculate the average thickness of soil in cm.

5. What was the London smog disaster? When did it occur? What interaction between the atmosphere and anthrosphere caused it? Approximately how many people died as a result?

6. Approximately when did the steam engine become a practical machine? How did it enable the industrial revolution to occur? What are the analogies with current conditions in which increasingly large and sophisticated farm machinery are enabling an ongoing revolution in agriculture?

7. What was the Love Canal affair and how did it likely influence environmental laws and implementation of environmental regulations in the U.S.?

8. One of the most active areas in energy development in many nations including the U.S. is the development of new sources of natural gas. What is happening in the area of natural gas utilization? Does burning natural gas emit carbon dioxide to the atmosphere? How is it superior in that respect to coal and petroleum? What is meant by the term "bridging fuel" as applied to natural gas?

9. How are desertification and deforestation related to global warming? How do they contribute to each other? How does destruction of a rain forest contribute carbon dioxide to the atmosphere?

10. The process for chemical fixation of atmospheric nitrogen developed by Bosch and Haber in the early 1900s led to the ability to make huge quantities of explosives that subsequently took millions of lives in warfare. However, the initial product, NH_3, is not explosive. Look up the formulas of several common explosives and suggest what is done to use NH_3 to make explosives.

11. Secretary of Energy Steven Chu has suggested three areas in which Nobel-level breakthroughs are needed in the achievement of energy sustainability. Considering conditions on Earth and the rate of depletion of natural capital suggest other areas in the general area of sustainability in which breakthroughs are needed.

12. Of all nations, Brazil has been the most successful in using fuels from biological sources as renewable energy sources. What are the conditions in Brazil that have made that possible?

13. What are the major crops that enabled humans to transition from hunter/gatherer societies to agricultural societies? Where is it believed that this transition first took place and how long ago was it?

14. How does photochemical smog that plagues Los Angeles, Mexico City, and many other urban areas around the world illustrate the law of unintended consequences and revenge effects?

15. A basic premise of Green Science and Technology is that "human welfare must be measured interms of quality of life, not just acquisition of material possessions." Suggest how the dwellings of humans and their living surroundings in general might reflect such a transition.

16. Figure 1.5 reflects various levels of materials use in which the innermost loops are most desirable. The most efficient materials use is product reuse in which a product or component is put directly back into the manufacturing loop. Suggest how a high level of component reuse at the manufacturing site might in fact reflect a less than optimum manufacturing process.

17. Gross domestic product per unit of energy use is a measure of efficiency of the economic systems of various countries and probably reflects the degree to which needed goods and services are provided relative to burden on natural capital. Look up the rank of various nations with respect to this ratio. Are there any surprises in this list? Are there nations on this list with a high rank that are probably not very desirable in terms of living amenities and are there others in which the opposite is true? Suggest two or three nations that have both a high rank and a high quality of life in general?

18. Much concern is being expressed over deteriorating infrastructure in the U.S. What is infrastructure and how may its degeneration contribute to a lack of sustainability?

19. Are paper grocery bags necessarily “green?” After doing some research on paper manufacture suggest ways in which they may not be ideal for sustainability. What is a greener alternative?

20. One recipe for sustainability may be expressed as “electrons, not paper.” Suggest what is meant by this expression and how it may be implemented for sustainability

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