Solutions for Principles of Environmental Science 9th Edition by Cunningham

CLICK HERE TO ACCESS COMPLETE Solutions

Solutions

Cunningham 9e Answers to Practice Quizzes

Chapter 1

1. Global populations are rising, but in the future they should stabilize, although at what level and when depends on fertility changes. Fertility rates are falling everywhere, and the global average has declined from 5 to less than 2.5 children per woman.
2. Ecological services include many factors and resources we rely on. Often they're described in terms of provisioning, regulating, supporting, and cultural services. Climate regulation, water filtration, and food provision are a few examples.
3. A hypothesis is a testable, provisional explanation. A scientific theory is an explanation supported by a large body of empirical evidence and regarded by a majority of scientists as likely to be correct.
4. The scientific method involves 1) identifying a question, 2) forming a testable hypothesis, 3) collecting data, 4) interpreting results, 5) reporting results for peer review, 6) publishing findings. See figure 1.4.
5. Probability is a measure of how likely something is to occur. An example is flipping a coin. Each toss has a 50% probability of landing on a particular side.
6. Scientists try to reserve judgment because they know that better evidence could emerge from future tests or evidences. Thus they try to be skeptical of evidence and to look for solid, unbiased evidence. This is also why tests require replication: one test result could be an accident or an outlier. Many tests are better than a few.
7. The first step in critical thinking is to ask, "What is the purpose of my thinking?"
8. Utilitarian conservation is pragmatic, efficient resource use for the greatest good for the greatest number for the longest time. Gifford Pinchot and Teddy Roosevelt were leaders in this movement. Biocentric preservation emphasizes the right of other organisms—and nature as a whole—to exist regardless of their usefulness to us. John Muir was a leading proponent of this philosophy.
9. Water is a critical resource because 1.1 billion people lack access to clean water, 15 million people die annually from diseases linked to polluted water or inadequate sanitation, and by 2025, the U.N. warns, three-quarters of all humans may live in water-stressed countries.
10. In figure 1.5, the most dramatic warming occurs at high latitudes, especially northern Canada, Siberia, and parts of the Arctic Ocean.
11. The ratio of per capita income is about 52:35 (or a little less than 5:3) for North America: East Asia. For North America:South Asia, the ratio is about 52:2 (or about 25:1).
12. The poorest people are often both the victims and agents of environmental degradation. Forced to meet short-term survival needs at the cost of long-term sustainability, they suffer most from environmental damage because they have few other options.
13. Sustainability is a search for ecological stability and human progress that can last over the long term. Sustainable development is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."

Chapter 2

1. Two primary nutrients that cause eutrophication are nitrogen (N), and phosphorus (P).
2. Systems are networks of interactions among interdependent units or compartments as well as processes or flows that link those components. A positive feedback loop enhances or accelerates a process and a state variable. A negative feedback inhibits or reverses a process or reduces a state variable.
3. Carbon atoms, like all matter, are constantly cycled in living organisms. Given the huge number of carbon atoms in your body, it's almost certain that some of them were also part of some prehistoric organisms.
4. Water molecules are polar, which makes water a superb solvent. Water is the only inorganic liquid that exists at normal ambient temperatures. This provides a liquid medium for life processes. Water molecules are highly cohesive. This results in capillary action. Water expands when it crystallizes so that ice floats. Water has a high heat of vaporization, so we can remove a large amount of heat through evaporation. Water has a high specific heat, making it an ideal medium for storing heat and moderating the earth's temperature.
5. DNA (deoxyribonucleic acid) is an extremely complex, double helix-shaped molecule that contains the genetic material that defines an organism's traits. DNA exists in the nucleus of cells (for all cell-based organisms). It is made up of nucleotides linked together in long chains. The specific sequence of nucleotides in a DNA molecule carries the genetic information that codes for protein structure and gives each organism its unique inheritable characteristics.
6. Heat is stored energy, but if it is stored in a diffuse form, it is usually hard to convert from one form to another. We use the term "low-quality energy" to refer to diffused, dispersed, low temperature energy that is difficult to gather or use for productive work. "High-quality energy," in contrast, is intense, concentrated, high-temperature, and useful for work.
7. Materials cycle endlessly in the biosphere, or between biosphere, geosphere, hydrosphere, and atmosphere, because of the law of conservation of matter. Energy follows a linear path because it continually degrades to lower-quality forms as it is re-used, and ultimately energy dissipates to space as heat. This is the second law of thermodynamics—in every energy exchange, some of the energy is converted from higher quality to lower quality. Thus, to keep living processes going, there has to be a constant energy input and a sink to which surplus waste energy (such as heat) can dissipate.
8. Our eyes are sensitive only to visible light (0.4 to 0.7 um), which happens to be the most common wavelengths in solar radiation. Short ultraviolet wavelengths (microwaves (10 nm or 10×10^{-9} m) are 1 million (1×10^{6}) times shorter than microwaves (1 mm or 1×10^{-3} m).
9. Extremophiles live in extreme conditions at the bottom of the ocean, in hot springs, or deep in the earth's crust. They get the energy they need to live by chemosynthesis: reactions that use chemicals, such as hydrogen sulfide or hydrogen gas as an energy source.
10. For most organisms on the earth's surface, the ultimate source of energy is the sun, and the sink for waste energy is outer space.

11. Green plants capture solar energy through photosynthesis, a series of chemical reactions that occur in chloroplasts. The energy captured in this process is used to create chemical bonds in organic molecules. These molecules serve both as an energy source and building material for all plants and animals.
12. A species is made of all the organisms of the same kind that are able to breed under natural conditions and produce live, fertile offspring. A population consists of all the members of a species living in a given area at the same time. A biological community is made up of all the populations of different species living and interacting in a given area at a specific time.
13. Big, fierce animals (such as grizzly bears, tigers, and great white sharks) are usually the top carnivores in their ecosystem. They need to be large and fierce to catch their prey. Because they are at the top of the ecological pyramid, it takes many organisms at lower trophic levels (and therefore, large home ranges) to support these big carnivores. Thus, there are never very many of them in a given area. Their adaptations as top predators make them dangerous to humans. They also often compete with us for food, so we tend to eliminate them either directly by hunting, or indirectly by reducing their food supplies or eliminating their habitat.
14. An example of an inverted ecological numbers pyramid might be a single large tree supporting many herbivorous insects, or a single coyote supporting many parasites.
15. Humans release about 7 GT of carbon annually compared to 100 GT released by respiration from land-based plants, animals, and microbes.

Chapter 3

1. Tolerance limits restrict the distribution and abundance of species by forcing them to live in a specific environment. Saguaro cactus cannot withstand extended freezing temperatures, so their distribution is strictly limited by elevations at which freezing nights occur regularly. Similarly, young desert pupfish only live in hot water (20-36°C), forcing them to remain near hot springs in the desert. By contrast, at all ages the common carp and European starling survive in a broad range of temperatures, and through human introduction now occupy every continent in the world except Antarctica.
2. Allopatric speciation is the evolution of separate species in *different locations*. This occurs when an ancestor population has been separated. Sympatric speciation is the evolution of separate species in the *same location*. This might occur when subsets of a population come to occupy different niches or use different resources.
3. Selective pressure is the case in which certain traits, such as a heavy beak in a place with thick-coated seeds, allow some individuals somewhat greater reproductive success than other individuals. Eventually those traits become common in the population, while other traits become rare. Selective pressures in your locality could include temperature, water, wind, predation, food, fire, or a number of other environmental factors.
4. In the Type I curve, most individuals survive to a relatively mature age, then die at an old age. Type II describes a population that is equally likely to die at any age. Type III represents a population in which most individuals die very young, but a small proportion of individuals survive to reach maturity.
5. Symbiotic relationships involve two species living together. Mutualism refers to a relationship in which both species benefit, as in the case of algae or ox pickers on an

Cunningham 9e CRITICAL THINKING ANSWERS

Chapter 1

1. As girls gain an education, they have more income value for their family beyond child production, so there may be less pressure to marry young and have many children; they may also gain more ability to argue for their own employment priorities.
2. There are many existential questions, such as, what is the meaning of life? Is there life after death? or Do we have a right to kill others? That science can't answer. Many of these are questions evaluated with empirical evidence, but rather have to do with values and life experience.
3. You can maintain objectivity in several ways. Keeping the identity of survey respondents secret from those who evaluate responses helps to maintain impartiality and objectivity. You can do blind or even double-blind experiments. You can carefully follow the ordered steps of the scientific method in order to be sure you are properly testing you hypothesis.
4. Our vulnerability to environmental degradation varies with wealth, class, location, and other factors. Often, low-income communities have higher exposure to pollution or other hazards; they also have fewer resources such as health care or health and safety infrastructure to protect them. Often income aligns with race, so that people of color frequently face greater environmental risks.
5. In studying the environmental impacts of a rich versus poor country, you ought to examine not only the local environment of each country, but also evaluate the impacts of extracting, shipping, and using resources from remote locations. In other words, what are the environmental impacts of wealthy lifestyles and political/economic systems on the countries that produce the goods and services they use?

Chapter 2

1. The boundaries of an ecosystem are often defined in terms of the general characteristics of the plants and animals that live in an area—for example the boundaries of a desert ecosystem might be where moisture increases and vegetation becomes more abundant. All ecosystems are open with regard to energy source (usually the sun), but consider the sources of water, air, food, building material, and other resources. Where do they come from?
2. Entropy means disorder or disorganization or reduced structure. Entropy in everyday life includes death, decay, rusting metal, and water running down hill, or even disarray in your room the day after you have cleaned it. Does the principal of entropy explain why it's impossible to build a perpetual motion machine? Constant energy is needed to maintain order and cleanliness, in most cases.
3. If all chemical bonds were extremely strong, your cells would not be able to break them apart in order to release energy or form new compounds. Substances with strong bonds are solid, not moveable and fluid. If all chemical bonds were extremely week, no structures could exist, and your cells could not form stable structures or compounds to keep you alive. Life would be impossible in either case. Variation in the nature and strength of chemical bonds makes life possible.
4. You would need to find a way to collect and measure the biomass weight of the different plants, animals, microbes (and the accumulated organic material they produce that's