

# *Chapter 2 – Review Questions*

**Read Chapter 2 and answer the following questions on a separate sheet of paper.**

**ANSWERS MUST BE HANDWRITTEN! Typed responses will not be accepted.**

1. Define science and explain how it works. Distinguish among scientific data, scientific hypothesis, scientific model, scientific theory, and scientific law. Explain why we should take a scientific theory seriously.
2. Describe peer review and reproducibility. Why are they important aspects of science?
3. Give an example of a scientific method. What is a controlled experiment? What is multivariable analysis?
4. Distinguish between inductive reasoning and deductive reasoning, and give an example of each.
5. Distinguish between frontier science and sound science.
6. What is junk science? List four ways to recognize junk science.
7. If scientists cannot establish absolute proof, what do they establish?
8. What is a system? Distinguish among the inputs, flows or throughputs, and outputs of a system.
9. What is a feedback loop? Distinguish between a positive feedback loop and a negative feedback loop, and give an example of each.
10. Define and give an example of a time delay in a system.
11. Define synergy, and give an example of how it can change a system.
12. Define discontinuity and environmental threshold. Describe one environmental threshold that might be crossed to create a discontinuity.
13. Distinguish among matter, elements, and compounds.
14. Distinguish among atoms, ions, and molecules, and give an example of each.
15. What three major types of subatomic particles are found in atoms? Which two of these particles are found in the nucleus, and which is found outside the nucleus?
16. Distinguish between atomic number and mass number. What is an isotope of an atom?
17. What is pH? Distinguish among a neutral solution, an acidic solution, and a basic solution.
18. What is a chemical formula? Distinguish between ionic compounds and covalent compounds, and give the name and chemical formula for an example of each type.
19. Distinguish between organic compounds and inorganic compounds, and give an example of each. Distinguish among hydrocarbons, chlorinated hydrocarbons, simple carbohydrates, polymers, complex carbohydrates, proteins, nucleic acids, and lipids.
20. Distinguish between genes and chromosomes.
21. Distinguish between prokaryotic and eukaryotic organisms.
22. Distinguish between high-quality matter and low-quality matter, and give an example of each. What is material efficiency?
23. Distinguish between a physical change and a chemical change, and give an example of each.
24. What is the law of conservation of matter? Explain why there is no "away" as in "to throw away waste items" or "to put away pollutants."
25. What three factors determine the severity of harm for any pollutant? Distinguish among concentrations of parts per million, parts per billion, and parts per trillion.
26. What does persistence mean in relation to pollutants? Distinguish between degradable (nonpersistent), biodegradable, slowly degradable (persistent), and nondegradable pollutants, and give an example of each type.
27. What is a nuclear change? Distinguish among natural radioactive decay and radioisotopes. What is the half-life of a radioactive isotope? For how many half-lives should radioactive material be stored safely before it decays to an acceptable level of radioactivity?

28. Distinguish between nuclear fission and nuclear fusion. Distinguish between critical mass and a nuclear chain reaction.
29. What is energy? Distinguish between kinetic energy and potential energy, and give an example of each. Define heat in terms of kinetic energy.
30. What is electromagnetic radiation? List three types of electromagnetic radiation. What is a major difference between ionizing radiation and nonionizing radiation?
31. Distinguish between high-quality energy and low-quality energy, and give an example of each.
32. Distinguish between the first law of thermodynamics and the second law of thermodynamics, and give an example of each law in action. Use the second law of thermodynamics to explain why energy cannot be recycled.
33. What is energy efficiency? Why do we have room to improve the efficiency of the energy we use?
34. Distinguish among a high-throughput (high-waste) economy, a matter-recycling-and-reuse economy, and a low-throughput (low-waste) economy. Use the law of conservation of matter and the first and second laws of thermodynamics to explain the benefits of shifting from a high-throughput economy to a matter-recycling-and-reuse economy and eventually to a low-throughput economy.