

Final Exam Review

Basic Concepts

1. Define "Sustainable Energy" and give some examples of sustainable and non-sustainable energy use.
2. Describe the purpose of the Kyoto Protocol and the US role in the Kyoto process.
3. Identify and describe the main sources of global primary energy.
4. Describe the change in atmospheric CO₂ concentration from 1850 to the present.
5. Describe the change in the average global temperature during the 20th century.
6. State the current level of global primary energy consumption and US primary energy consumption.
7. Define the IPAT Equation and explain its significance.
8. Identify the three major fossil fuels and explain why these fuels are considered to be non-renewable.
9. Identify the gases responsible for depletion of the stratospheric ozone layer, describe the sources of these gases, and explain how the emission of these gases is being reduced.
10. Identify the gases that cause global warming, describe the sources of these gases, and explain how the emission of these gases could be reduced.
11. Identify the gases responsible for acid rain, describe the sources of these gases, and explain how the emission of these gases is being reduced.
12. Identify the gases that lead to the formation of photochemical smog, describe the sources of these gases, and explain how the emission of these gases is being reduced.
13. Describe strategies that governments could use to adapt to global climate change.
14. Describe steps that individuals could take in order to mitigate global climate change.

Electric Power

15. Identify the major fuels used to produce electricity in the US and estimate the approximate fraction of electric power that is produced by power plants using these fuels.
16. Identify and describe the major components of a coal-burning electric power plant.
17. Including both economic and the environmental considerations, compare the advantages and disadvantages of using natural gas instead of coal as the fuel in an electric power plant.
18. Describe the geographical origin of the coal and natural gas used in Connecticut electric power plants.
19. Describe nuclear fission and explain how it differs from radioactive decay.
20. Identify and describe the major components of a nuclear power plant with a pressurized water reactor.
21. Explain why naturally occurring uranium has to be enriched and describe the methods used in this enrichment process.
22. Connecticut's annual electric energy consumption is approximately 31 billion kWh. Describe the role that nuclear power plays in producing this electric energy.
23. Describe the nuclear power industry in the US. How many US nuclear power plants are operating and how many nuclear power plants are currently being built?
24. Identify and describe two important nuclear power accidents.
25. Identify and describe the nuclear waste facility that is being planned in the US.

26. Describe the advantages and disadvantages of generating electricity using wind turbines.
27. Describe the best locations in New England for locating a wind turbine.
28. A 15 watt CFL bulb is on for 10,000 hours before it burns out. Calculate the electricity energy in kWh that it consumes during this time.

Transportation

29. Describe the process by which crude oil is converted into gasoline.
30. Identify the sources of the crude oil used to make gasoline and other fuels in the US.
31. Explain why the global oil reserves in the Persian Gulf region are becoming increasingly important.
32. Describe the concept of Peak Oil and explain why it has global importance.
33. Identify and describe the regulatory strategy used by the US EPA to control emissions from autos.
34. Explain why the *increase* of ozone in the troposphere is an environmental problem, but the *depletion* of ozone in the stratosphere is also an environmental problem.
35. Identify the gas emitted from internal combustion engines that contributes to global warming and explain how increasing CAFE standards would help mitigate this effect.
36. A recent Supreme Court decision allows the EPA to treat CO₂ as a pollutant. Explain how this decision could impact US automobile efficiency standards.
37. Identify and describe the two major biofuels that are currently being used in some automobiles.
38. Explain why the CO₂ emitted as a result of biofuel combustion does not contribute to the increasing atmospheric concentration of CO₂.
39. Describe a hybrid electric vehicle such as the Toyota Prius and explain what steps are needed to convert it into a plug in hybrid.
40. Explain the differences between a hybrid electric vehicle such as Toyota's Prius and an electric vehicle such as GM's EV1.
41. Describe the advantages and disadvantages of fuel cell vehicles.
42. A car drives 240 miles each week. She drives an HEV that gets 40 mpg. Assuming gasoline costs \$3.00 per gallon, how much does she pay for gasoline each week?

Conservation and Renewable Energy

43. Describe the advantages and disadvantages of replacing electric resistance baseboard heating with a ground-source heat pump.
44. Describe the advantages of replacing incandescent light bulbs by compact fluorescent bulbs.
45. Define R-value and explain why replacing increasing the R-value of wall and ceiling insulation will decrease the energy consumption of a residence.
46. Describe the components of a solar hot water heating system.
47. Describe the structure of a solar collector used in a solar hot water heating system.
48. A solar hot water system has the following characteristics: the collector area equals 5.0 m², the system efficiency equals 50%, and the annual average daily insolation incident on the collector equals 5.0 kWh/m²/day. Calculate the amount of energy produced by this system during a year.
49. Describe the components of a solar electric power system.
50. The total cost of a 5.0 kW solar electric power system to a Connecticut homeowner equals \$18,000 and the electricity produced by this system in a year is worth \$1,800. Calculate the payback period for this system.