

**Chapter 15 & 16 Review Questions + Problem Set**

Directions- On loose-leaf paper, answer the following questions in well-written complete sentences. You do not need to write the question. Number each answer so the number corresponds the question that you have answered. **Only hand-written responses will be accepted. Typed or emailed copies will not be graded.**

**Chapter 15 Review Questions**

1. What is net energy and why is it important for evaluating energy resources?
2. Explain why the nuclear fuel cycle has a low net energy yield and thus must be subsidized to compete in the open marketplace.
3. What is crude oil (petroleum) and how is it extracted from the earth and refined?
4. What is the peak production for an oil well and for the world?
5. What is a petrochemical and why are such chemicals important?
6. What are proven and unproven oil reserves?
7. What are the major advantages and disadvantages of using conventional oil as an energy resource?
8. What is tar sand, or oil sand, and how is it extracted and converted to heavy oil?
9. What are some environmental problems related to the use of this resource?
10. What is shale oil and how is it produced?
11. What are the major advantages and disadvantages of using heavy oils produced from tar sand and shale oil as energy resources?
12. Define natural gas, liquefied petroleum gas (LPG), and liquefied natural gas (LNG)?
13. What are the major advantages and disadvantages of using conventional natural gas as an energy resource?
14. What are three sources of unconventional natural gas and what major problems are related to the use of these resources?
15. What is coal and how is it formed?
16. How does a coal-burning power plant work?
17. Describe the use of coal in China.
18. Describe the problem of coal ash waste.
19. Explain why there is no such thing as clean coal.
20. What are the major advantages and disadvantages of using coal as an energy resource?
21. What is synthetic natural gas (SNG)?
22. What are the major advantages and disadvantages of using liquid and gaseous synfuels produced from coal?
23. How does a nuclear fission reactor work and what are its major safety features?
24. Describe some of the consequences of the Chernobyl nuclear power plant accident.
25. What are the major advantages and disadvantages of relying on the nuclear fuel cycle as a way to produce electricity?
26. Compare the advantages and disadvantages of using the nuclear fuel cycle and coal to produce electricity.
27. How do nuclear power plant operators store highly radioactive spent fuel rods?
28. How can we deal with the highly radioactive wastes produced by the nuclear fuel cycle?
29. What role is nuclear power likely to play in slowing projected global climate disruption caused in part by emissions of carbon dioxide?
30. Describe what happened to conventional nuclear power and possible role of new-generation nuclear power plants in the future.

**Chapter 16 Review Questions**

31. What is energy efficiency?
32. List four widely used energy-wasting technologies.
33. What is cogeneration (combined heat and power or CHP)?
34. What is a smart grid and why is it important?
35. Describe the trends in fuel efficiency in the United States since the 1970s.
36. Explain why the price of gasoline is much higher than what consumers pay at the pump.
37. What is a feebate?
38. Distinguish among hybrid, plug-in hybrid, and fuel-cell motor vehicles.
39. Describe the possible connection between wind farms and plug-in hybrid cars.
40. Summarize the search for better batteries and describe two promising new developments.
41. What is a living roof?
42. Compare the efficiency of incandescent, compact fluorescent, and LED light bulbs.
43. Explain how using compact fluorescent light bulbs can reduce overall air pollution from toxic mercury.
44. What are green buildings and why are they important?
45. List six ways you can save energy where you live.
46. Distinguish between a passive solar heating system and an active solar heating system and discuss the major advantages and disadvantages of such systems for heating buildings.
47. What are three ways to cool houses naturally?
48. Discuss the major advantages and disadvantages of concentrating solar energy to generate high-temperature heat and electricity.
49. What is a solar cell (photovoltaic or PV cell) and what are the major advantages and disadvantages of using such devices to produce electricity?
50. What are the major advantages and disadvantages of using hydropower?
51. What is the potential for using tides and waves to produce electricity?
52. What is a wind turbine and what is a wind farm?
53. What are the major advantages and disadvantages of using wind to produce electricity?
54. What are biofuels and what are the major advantages and disadvantages of using biodiesel and ethanol to power motor vehicles?
55. Evaluate the use of corn, sugarcane, and cellulose plants to produce ethanol.
56. Describe the potential for using algae and bacteria to produce gasoline and diesel fuel.
57. What is geothermal energy and what are three sources of such energy?
58. What are the major advantages and disadvantages of using geothermal energy as a source of heat and to produce electricity?
59. What are the major advantages and disadvantages of using hydrogen as a fuel and to produce electricity and to power motor vehicles?
60. List five major strategies for making the transition to a more sustainable energy future.
61. Describe three roles that governments play in determining which energy resources we use.

**Problem Set → Show All Work Do Not Use A Calculator**

62. Suppose a 1,450-watt microwave is used for 30 minutes each day. How many kWh per year does the microwave use?
63. 1 kWh of electricity is equal to 3,413 Btu. One cubic foot of natural gas supplies approximately 1,031 Btu of energy. How much natural gas would be needed to power the 1,450-watt microwave for one year?
64. A typical coal-burning power plant uses 4,500 tons of coal per day. Each pound of coal produces 5,000 Btu's of electrical energy. How many Btu's are produced each day from such a typical plant?
65. How much energy, in kWh, does a 100-Watt computer running for 5 hours use?
66. If your home uses twenty 100-watt incandescent light bulbs for four hours per day, how many kilowatt-hours of electricity are needed to power the bulbs for one year of use?
67. Compact fluorescent light bulbs (CFLs) are 75 more efficient than incandescent bulbs. How many kilowatt-hours per year can you save by replacing twenty incandescent bulbs with CFLs?
68. A compact hybrid gets 51 miles per gallon of gasoline in highway driving. A luxury sedan averages only 25 miles per gallon on the highway. If gas costs \$3.00 per gallon, how much money will a person who drives 10,000 miles per year save by choosing to purchase the hybrid?

**Free Response Questions**

69. The environmental impact of washing a load of clothes in an electric washing machine is different than washing the same clothes by hand. Use the information below to answer the questions that follow. Show your calculations.

**Assume the following:**

- All of the clothes can be washed in one load in the washing machine.
- The water entering the water heater is 60°F.
- The water leaving the water heater is 130°F.
- The electric washing machine uses 20 gallons of water. It uses 110 volts of electricity at an average of 1,500 watts for 30 minutes.
- Washing the clothes by hand requires 35 gallons of hot water.

1 gallon of water = 8 pounds  
1 Btu = amount of energy required to raise the  
temperature of 1 pound of water by 1°F  
1 kilowatt-hour = 3,400 Btu's

- (a) Calculate the total amount of energy (in Btu's) to wash the clothes in the washing machine.
- (b) Calculate the total amount of energy (in Btu's) to wash the clothes by hand.
- (c) Overall, which method do you think has a greater environmental impact?

70. Battery electric vehicles (BEVs) have been introduced to consumers as an alternative way to reduce the environmental effects caused by use of internal-combustion engine (ICE) vehicles. A comparison of both vehicle types can help determine whether the use of BEVs would be beneficial in the future. Where calculations are required, show your work.
- Identify THREE strategies that the federal government could implement to encourage the use of BEVs.
  - Assume that the fuel efficiency of the ICE vehicle is 25 miles per gallon (mpg) and that gasoline costs \$3.75 per gallon (gal). Calculate the cost of gasoline per mile.
  - The charger supplies energy to the BEV battery at an average rate of 4.0 kilowatts (kW) and fully charges the BEV battery in 7.0 hours. The car will run for 100 miles on a full charge. The cost of electricity is \$0.11 per kilowatt-hour (kWh).
    - Calculate the cost of the electricity to fully charge the battery. Assume that the battery is not charged to begin with.
    - Calculate the cost of electricity per mile to drive the BEV.
- When it is driven 100 miles, the ICE vehicle contributes 72.8 pounds (lb) of CO<sub>2</sub> from the burning of the gasoline. The drilling, refining, and transportation costs of getting the gasoline to the gas station add an additional 17.7 lb of CO<sub>2</sub> per 100 miles. The BEV does not emit any CO<sub>2</sub> itself, but the extraction, transportation, and combustion of the coal that produced the electricity at the power plant add 63.6 lb of CO<sub>2</sub> for the same 100 miles.
- Calculate the difference in the amount of CO<sub>2</sub> that would enter the atmosphere if both cars were driven 100 miles.
  - Describe TWO economic impacts (excluding costs related to climate change resulting from CO<sub>2</sub> emissions or the cost of gasoline at the pump) that result from an increased number of BEVs on the road.