

# CHAPTER 16--ENERGY EFFICIENCY AND RENEWABLE ENERGY

*Student:* \_\_\_\_\_

1. The heating bill for the office-home of Amory Lovins in Snowmass, Colorado is
  - A. \$300 a month
  - B. \$300 per year
  - C. less than \$500 per year
  - D. less than \$100 per year
  - E. less than \$50 per year
2. Lovins home-office in Snowmass, Colorado recovered the investment in energy efficient devices and solar cells in what length of time?
  - A. 6 months
  - B. 10 months
  - C. 1 year
  - D. 3 years
  - E. 10 years
3. The best way to reduce our unnecessary waste of energy is to improve
  - A. solar cells
  - B. hydroelectric power
  - C. coal mining techniques
  - D. energy efficiency
  - E. hydrogen cells
4. Unnecessary energy waste costs the United States an average of
  - A. \$570,000 per minute
  - B. \$475,000 per hour
  - C. \$1,000,000 per day
  - D. \$1,000,000,000 per month
  - E. \$10,000,000,000 per year
5. What percentage of the commercial energy used in the United States is wasted?
  - A. 54%
  - B. 64%
  - C. 74%
  - D. 84%
  - E. 94%

6. What percentage of the commercial energy used in the United States is wasted unnecessarily?
- A. 11%
  - B. 23%
  - C. 33%
  - D. 43%
  - E. 51%
7. Reducing unnecessary energy waste does all of the following *except*
- A. prolongs fossil fuels
  - B. increases the cost
  - C. creates local jobs
  - D. reduces pollution and environmental degradation
  - E. has a very high net energy yield
8. Which of the following *does not* waste large amounts of energy and money when used?
- A. incandescent light bulbs
  - B. internal combustion engine
  - C. nuclear power plants
  - D. coal-fired power plants
  - E. mass transit
9. Industries can cut energy waste by all of the following means, *except*
- A. using combined heat and power systems
  - B. replacing energy-wasting electric motors
  - C. switching from coal-burning power plants to nuclear power plants
  - D. recycling materials
  - E. switching from incandescent lighting to fluorescent lighting and LED lighting
10. Switching the United States to a smart electric grid would save the U.S. economy what amount per year?
- A. \$1 trillion
  - B. \$800 billion
  - C. \$500 billion
  - D. \$100 billion
  - E. \$1 billion
11. The average fuel efficiency of U.S. cars has improved by how much since 1908?
- A. 3 mpg
  - B. 10 mpg
  - C. 15 mpg
  - D. 18 mpg
  - E. 21 mpg

12. The hidden costs of gasoline amounts to how much per gallon?
- A. \$3.18
  - B. \$5.50
  - C. \$9
  - D. \$12
  - E. \$36
13. The hidden costs of a gallon of gasoline includes all of the following *except*
- A. government subsidies for oil companies
  - B. tax breaks for car manufacturers and road builders
  - C. research and development for hybrid cars
  - D. cost of pollution control and cleanup
  - E. costs of military protection of oil supplies in the Middle East
14. Ways to save energy in transportation includes all of the following, *except*
- A. gasoline taxes
  - B. switching from electrified rail systems to diesel powered systems
  - C. tax breaks on fuel efficient automobiles
  - D. encourage bicycle use by building bike lanes along highways and city streets
  - E. building accessible mass transit systems
15. Which country is already mass producing the Build Your Dreams plug-in hybrid automobile?
- A. China
  - B. Japan
  - C. South Korea
  - D. Russia
  - E. United States
16. An electric car costs about \_\_\_\_\_ as much per kilometer as using a gasoline powered car.
- A. one-half
  - B. one-third
  - C. one-quarter
  - D. one-fifth
  - E. one-tenth
17. Forty-five percent of new passenger-car sales in Europe is made up of
- A. energy-efficient diesel cars
  - B. hybrid cars
  - C. plug-in hybrid cars
  - D. hydrogen fuel cell cars
  - E. conventional gasoline cars

18. Anela Belcher, materials scientist at MIT, is working on a novel new type of battery based on which of the following?
- A. water
  - B. salt
  - C. seaweed
  - D. alcohol
  - E. viruses
19. The weakness of electric cars is their
- A. noise level
  - B. maintenance cost
  - C. batteries
  - D. slow acceleration
  - E. price
20. Fuel efficiency for all types of cars would nearly double if
- A. all cars were diesels
  - B. all cars used wind power
  - C. all cars had smaller engines
  - D. all cars were made from ultrastrong, ultralight composite materials
  - E. everyone sold their car
21. Orienting a building to face the sun in order that solar energy is used to help heat the building, would save what percentage of its heating costs?
- A. 20%
  - B. 30%
  - C. 40%
  - D. 50%
  - E. 60%
22. The energy efficiency of buildings can be improved by all of the following strategies, *except*
- A. use of energy-efficient appliances
  - B. use of energy-efficient compact fluorescent light bulbs
  - C. plugging leaks
  - D. building big windows into the northern side of new housing
  - E. use energy-efficient windows

23. Cutting down on energy waste has many benefits, yet few people take advantage of the cost savings. All of the following are reasons why this occurs, *except*
- A. the government gives tax breaks and subsidies to keep costs low
  - B. the market price for energy does not include environmental and health costs
  - C. there are very few incentives for consumers to use energy-efficient products
  - D. the government has done a great job encouraging car fuel efficiency
  - E. people tend to resist change even if it saves them money
24. Which country is adding 100,000 new jobs per year in the renewable energy industry and is rapidly becoming the world leader in making and selling wind turbines and solar cells to other countries?
- A. United States
  - B. China
  - C. Germany
  - D. Sweden
  - E. Korea
25. Which country gets 95% of its energy from renewable sources?
- A. Denmark
  - B. Brazil
  - C. Iceland
  - D. Costa Rica
  - E. China
26. Which of the following is *not* a means to cool a building naturally?
- A. orient the building to catch the sun
  - B. a living roof
  - C. open windows to catch the breeze
  - D. light-colored roof
  - E. awnings, window overhangs
27. Which of the following is not true of heating a house with passive or active solar energy?
- A. Net energy is moderate to high
  - B. very low carbon dioxide emissions
  - C. very low land disturbance
  - D. low installation and maintenance costs for active systems
  - E. moderate cost for passive systems

28. A 2009 environmental and industry group study estimated solar thermal power plants could meet what percentage of the world's projected electricity needs by 2050?
- A. 25%
  - B. 36%
  - C. 47%
  - D. 58%
  - E. 69%
29. What is the factor that may limit the production of electricity from solar thermal power plants?
- A. money
  - B. water
  - C. available space
  - D. technology
  - E. needed chemicals
30. The chief ingredient of most solar cells is
- A. silicon
  - B. sodium
  - C. chromium
  - D. arsenic
  - E. calcium
31. The advantages of solar cells include all of the following, *except*
- A. moderate net energy yield
  - B. little or no direct emissions of carbon dioxide
  - C. electricity storage systems readily available
  - D. easy to install and expand as needed
  - E. competitive costs for newer cells
32. The world's fastest growing way to produce electricity is
- A. hydroelectric
  - B. solar cells
  - C. geothermal
  - D. nuclear
  - E. hydrogen cells
33. The world's leading renewable energy source used to produce electricity is
- A. hydrogen
  - B. biomass
  - C. ethanol
  - D. hydropower
  - E. coal

34. Which one of the following countries is not one of the top five producers of hydropower?
- A. Canada
  - B. China
  - C. Brazil
  - D. Germany
  - E. United States
35. The world's single largest human-caused source of methane is
- A. cattle belching
  - B. flatulence
  - C. pig manure
  - D. melting tundra
  - E. world's largest dams
36. Which of the following countries produces the greatest proportion of its electricity by hydroelectric plants?
- A. Austria
  - B. Switzerland
  - C. Norway
  - D. Italy
  - E. Russia
37. Which of the following is a disadvantage of hydroelectric plants?
- A. low net energy
  - B. large land disturbance
  - C. little untapped potential
  - D. high-cost electricity
  - E. high emissions of carbon dioxide
38. Which of the following cannot (at least now) be used to generate electricity directly?
- A. ocean tides
  - B. ocean waves
  - C. heavy rains
  - D. water behind dams
  - E. flowing river water
39. The world's second-fastest-growing energy resource is
- A. hydroelectric dams
  - B. wind power
  - C. nuclear power
  - D. coal-fired power plants
  - E. tidal energy

40. Which of the following countries intends to be the world's largest manufacturer and seller of wind turbines by 2020?
- A. China
  - B. United States
  - C. France
  - D. Germany
  - E. Denmark
41. Which of the following countries is the world's most energy-efficient country?
- A. China
  - B. United States
  - C. France
  - D. Germany
  - E. Denmark
42. A 2009 Harvard University student estimates that wind power has the potential to produce \_\_\_\_\_ times the world's current use of electricity.
- A. 20
  - B. 30
  - C. 40
  - D. 50
  - E. 60
43. Which of the following *is not* an advantage of locating wind farms offshore?
- A. eliminates land use negotiations
  - B. takes advantage of stronger offshore winds
  - C. avoids complaints about noise
  - D. avoids complaints about their being unpleasant to look at
  - E. less costly to install
44. The following are numbers of birds killed each year by various hazards. Which is the number of birds killed by wind turbines?
- A. 440 thousand
  - B. 67 million
  - C. 80 million
  - D. 100 million
  - E. 100+ million



45. The U.S. Department of Energy calls four of the following states the “Saudi Arabia of wind power.” Which of these is not one of the four?
- A. Wyoming
  - B. North Dakota
  - C. South Dakota
  - D. Kansas
  - E. Texas
46. A 2009 U.S. Department of the Interior study indicates that wind farms off the Atlantic and Gulf coasts could generate enough electricity to do which of the following?
- A. eliminate all solar energy
  - B. eliminate all hydroelectric power
  - C. eliminate all coal-burning power plants
  - D. eliminate all nuclear power plants
  - E. eliminate all geothermal plants
47. Which of the following *is not* considered biomass?
- A. wood
  - B. crop residues
  - C. charcoal
  - D. animal manure
  - E. coal
48. Growing biomass in plantation settings has all of the following disadvantages, *except*
- A. depletion of soil nutrients
  - B. clearing forests for plantations degrades biodiversity
  - C. non-native species planted in plantations can spread to nearby ecosystems
  - D. plantation grown biomass is very expensive to burn
  - E. clearing forests for plantations reduces carbon dioxide capture
49. Solid biomass has all of the following advantages, *except*
- A. widely available
  - B. moderate costs
  - C. no net carbon dioxide increase if properly managed
  - D. plantations can help restore degraded lands
  - E. very high efficiency
50. The largest producers of liquid biofuels include all of the following, *except*
- A. United States
  - B. Brazil
  - C. European Union
  - D. China
  - E. Australia

51. Biofuels have all of the following advantages, *except*
- A. increases biodiversity and soil nutrients
  - B. biofuel crops can be grown anywhere, rather than concentrated as is petroleum
  - C. if managed correctly, no net increase in carbon dioxide emissions
  - D. can be distributed through existing fuel networks
  - E. can be used in motor vehicles at little or no additional cost
52. What percentage of Brazil's motor vehicles currently run on ethanol or ethanol-gasoline mixtures?
- A. 15%
  - B. 25%
  - C. 35%
  - D. 45%
  - E. 55%
53. In Europe, more than half of all cars run on diesel, primarily because
- A. it produces less smoke
  - B. it burns more slowly
  - C. diesel engines are 40% more efficient
  - D. diesel engines are less heavy
  - E. diesel is less expensive
54. The United States government heavily subsidizes ethanol production from corn, because
- A. farmers demand it
  - B. a very low net energy yield
  - C. lower carbon dioxide emissions
  - D. higher gas mileage
  - E. there is too much corn in the U.S.
55. If all of the corn grown in the U.S. was processed into ethanol each year the resulting ethanol would meet how much of the U.S. current demand for gasoline?
- A. 6 months
  - B. 2 months
  - C. 7 months
  - D. 30 days
  - E. 5 weeks
56. Which of the following *is not* one of the challenges in using algae to produce biofuels similar to gasoline and biodiesel?
- A. cutting the cost of production
  - B. discovering which algae would be best to use
  - C. learning where is best to grow the algae
  - D. finding a way to economically get the oil from the algae
  - E. scaling up to large scale production systems

57. The country that is the world's largest producer of geothermal electricity is
- A. Finland
  - B. China
  - C. Iceland
  - D. the Philippines
  - E. the United States
58. Tapping just 2% of the hot, dry rock geothermal energy in the U.S. could produce how much of the energy needed by the U.S.?
- A. 50% of the energy for electricity
  - B. three-fourths of all energy
  - C. all the energy necessary for electricity
  - D. 10 times the energy needed from coal burning power plants
  - E. 2,000 times the current annual use of electricity
59. Hydrogen gas can be produced in all of the following ways, *except*
- A. passing electricity through water
  - B. stripping it from methane
  - C. a chemical reaction involving coal, oxygen, and steam
  - D. removing it from the atmosphere
  - E. taking off the gasoline molecule
60. Which of the following is true about hydrogen?
- A. it is fairly rare in the universe
  - B. it is abundant in the atmosphere as a free gas
  - C. it has a high net energy yield
  - D. hydrogen gas is a fuel produced by using other forms of energy
  - E. hydrogen is a fuel resource like gasoline
61. Which of the following statements about hydrogen is *false*?
- A. no direct carbon dioxide emissions if produced from water
  - B. good substitute for oil
  - C. very high net energy yield
  - D. can be produced from plentiful water at some sites
  - E. None of these statements is false.
62. Which of the following statements about storing hydrogen gas is *false*?
- A. it can be stored as a liquid
  - B. it can be stored in solid metal hydride or sodium borohydride
  - C. it can be stored in carbon nanotubes
  - D. it can be stored in the hollow tubes of chicken feathers
  - E. storage in all these forms is highly explosive

63. Experts suggest in the next few decades we will probably shift from our current model of producing electricity to which of the following?
- A. de-centralized micropower system
  - B. a highly centralized macropower system
  - C. a highly de-centralized macropower system
  - D. some new, unforeseen system
  - E. a central, megasystem
64. One of the general conclusions of experts about future energy systems is that greatly improved energy efficiency and the temporary use of which of the following, is the way we will proceed.
- A. coal
  - B. fuel oil
  - C. nuclear power
  - D. natural gas
  - E. nuclear power
65. One of the most important steps governments can take to encourage a different energy future is to do which of the following?
- A. put taxes on fossil fuels
  - B. cap and trade systems for reducing carbon dioxide
  - C. run public service announcements encouraging a new direction in energy
  - D. phase out subsidies and taxbreaks for fossil fuels and nuclear energy
  - E. increase the CAFE standards
66. In order to keep the prices of selected energy resources artificially low to encourage the use of those resources, governments could do all of the following *except*
- A. providing research and development subsidies on select resources
  - B. providing tax breaks on select resources
  - C. provide loan guarantees to encourage development of select resources
  - D. restricting the sale of unfavorable systems
  - E. enact legislation favoring select energy resources
67. Which of the following would not improve energy efficiency?
- A. continue subsidies for centralized macropower systems
  - B. greatly increase energy efficiency research and development
  - C. increase fuel-efficiency standards for vehicles, buildings, and appliances
  - D. reward utilities for reducing demand for electricity
  - E. provide large tax credits for buying efficient cars, houses, and appliances
68. The Rocky Mountain Institute building in Snowmass, Colorado, pays less than \$50 per year for heating.
- True   False

69. The United States wastes almost none of its energy.  
True False
70. Of all commercial energy used in the United States, roughly 35% is wasted.  
True False
71. Coal fired power plants waste about two-thirds of the energy released by burning the coal.  
True False
72. Cogeneration in Denmark produces a majority of its electricity.  
True False
73. Turning thermostats up in winter and down in summer will decrease energy use and waste.  
True False
74. Since 1985 the CAFE standards increased dramatically.  
True False
75. Fuel economy standards for new vehicles in China are much higher than those in the U.S.  
True False
76. U. S. battery makers are far behind Asian countries in developing and producing batteries for cars and other uses.  
True False
77. Green building certification now exists in more than 100 countries around the world.  
True False
78. Photovoltaic cells do not produce any of the greenhouse or acid gas emissions associated with electricity generated by the combustion of fossil fuels.  
True False
79. Molten salt systems allow solar thermal power plants to produce electricity around the clock.  
True False
80. Solar energy is used both directly and indirectly to make up the majority of commercial energy.  
True False

81. In 2006, construction began on six underwater turbines to tap the tidal flow of the East River in New York City.
- True False
82. By the end of this century solar cells will be the world's number one source of electricity according to the chief engineer for General Electric.
- True False
83. According to the United Nations, about 60% of all the world's potential for hydropower has been developed.
- True False
84. Small hydropower projects emit more carbon dioxide and are therefore less desirable than larger projects.
- True False
85. Wind power is the second fastest growing source of energy worldwide.
- True False
86. If all costs are included for all sources, wind power is the cheapest way to produce electricity.
- True False
87. More than one-third of the world's people, in 77 less developed countries, are facing a fuelwood crisis, requiring them to cut down wood faster than it can be replaced.
- True False
88. Producing ethanol using switchgrass produces more than 5 times as much energy as it takes to grow it, far more than corn based ethanol.
- True False
89. Geothermal heat pumps and geothermal exchange may be used to tap the geothermal energy stored in the earth's mantle.
- True False
90. Hydrogen as an energy source only makes sense if the hydrogen gas is made using low-polluting renewable sources that emit little or no carbon dioxide.
- True False

91. Because of their abundance and artificially low prices, fossil fuels will continue to be used in large consequences in the future.

True   False

92. The cost of using energy efficient computers and other electrical devices, along with solar cells to generate electricity, was repaid in only \_\_\_\_\_.

\_\_\_\_\_

93. An \_\_\_\_\_ uses only 5% of the electricity it draws to produce light, the other 95% is wasted as heat.

\_\_\_\_\_

94. Between 1973 and 1985, the average fuel efficiency rose sharply for motor vehicles sold in the United States primarily because of government-mandated \_\_\_\_\_ standards.

\_\_\_\_\_

95. An \_\_\_\_\_ solar heating system captures energy from the sun by pumping a heat absorbing fluid through special collectors.

\_\_\_\_\_

96. Photovoltaic systems that track the sun during daylight hours collect about \_\_\_\_\_ more energy than stationary panels can.

\_\_\_\_\_

97. One or more groups of suitcase sized \_\_\_\_\_ can be placed in any stream or river without altering its course and be used to produce electricity around the clock.

\_\_\_\_\_

98. Analysts expect an increased number of \_\_\_\_\_ wind farms because of steadier air flow.

\_\_\_\_\_

99. A better alternative to using corn for the production of ethanol is \_\_\_\_\_ ethanol, produced from the inedible biomass of most plants.

\_\_\_\_\_

100. Our earth's interior <sup>3</sup>/<sub>4</sub> like the sun <sup>3</sup>/<sub>4</sub> provides heat energy from nature called \_\_\_\_\_ energy that can be used without polluting the environment.

\_\_\_\_\_

101. A \_\_\_\_\_ uses the temperature differential between the surface and 3-6 meters underground to heat and cool a house.

\_\_\_\_\_

102. \_\_\_\_\_ can be used in stationary applications like generating electricity or heating buildings, and for powering vehicles, buses, and trains.

\_\_\_\_\_

103. Typically it takes at least \_\_\_\_\_ years to phase in a new energy alternatives.

\_\_\_\_\_



## CHAPTER 16--ENERGY EFFICIENCY AND RENEWABLE ENERGY **Key**

1. E
2. B
3. D
4. A
5. D
6. D
7. B
8. E
9. C
10. D
11. A
12. D
13. C
14. B
15. A
16. D
17. A
18. E
19. C
20. D
21. A
22. D
23. D
24. B
25. D
26. A
27. D
28. A
29. B

- 30. A
- 31. C
- 32. B
- 33. D
- 34. D
- 35. E
- 36. C
- 37. B
- 38. C
- 39. B
- 40. A
- 41. E
- 42. C
- 43. E
- 44. A
- 45. A
- 46. C
- 47. E
- 48. D
- 49. E
- 50. E
- 51. A
- 52. D
- 53. C
- 54. B
- 55. D
- 56. B
- 57. E
- 58. E
- 59. D
- 60. D
- 61. C
- 62. E
- 63. A

- 64. D
- 65. D
- 66. D
- 67. A
- 68. TRUE
- 69. FALSE
- 70. FALSE
- 71. TRUE
- 72. TRUE
- 73. FALSE
- 74. FALSE
- 75. TRUE
- 76. TRUE
- 77. FALSE
- 78. TRUE
- 79. TRUE
- 80. FALSE
- 81. TRUE
- 82. TRUE
- 83. FALSE
- 84. FALSE
- 85. FALSE
- 86. TRUE
- 87. TRUE
- 88. TRUE
- 89. TRUE
- 90. TRUE
- 91. FALSE
- 92. 10 months
- 93. incandescent light bulb
- 94. Corporate Average Fuel Economy *or* CAFE
- 95. active
- 96. 30-40%
- 97. micro-hydropower generators

98. offshore

99. cellulosic

100. geothermal

101. geothermal heat pump

102. Fuel cells

103. 50 *or* fifty