Ch.11-Q4W2-Chemical reactions and energy-Qs. Bank

Multiple Choice
Identify the choice that best completes the statement or answers the question.

_____ 1. The burning of gasoline in an automobile engine is an example of a(n) _____.
   a. photosynthesis reaction   c. exothermic reaction
   b. endothermic reaction   d. reversible reaction

_____ 2. The most common form of energy encountered in chemical reactions is _____.
   a. electrical energy   c. light energy
   b. nuclear energy   d. heat

_____ 3. In a chemical change, energy can be _____.
   a. created, but not destroyed   c. either created or destroyed
   b. destroyed, but not created   d. neither created nor destroyed

_____ 4. An example of a process in which entropy decreases is _____.
   a. melting   c. boiling
   b. freezing   d. vaporization

_____ 5. The two terms below that are identical in meaning are _____.
   a. calorie and Calorie   c. Calorie and joule
   b. calorie and joule   d. kilocalorie and Calorie

_____ 6. The main source of energy for living things on Earth is _____.
   a. combustion of fossil fuels   c. solar energy
   b. oxidation of dead organisms   d. geothermal energy

_____ 7. The major product formed during the process of photosynthesis is _____.
   a. carbon dioxide   c. sugar
   b. water   d. DNA

_____ 8. In a(n) _____ reaction, the products are at a higher energy level than are the reactants.
   a. activation   c. endothermic
   b. catalytic   d. exothermic

_____ 9. Even in an exothermic reaction, _____ is needed to get the reaction started.
   a. activation energy   c. an endothermic reaction
   b. a catalyst   d. an inhibitor

_____ 10. A cake is placed in a heated oven and baked. The reactions that take place during this process are _____.
   a. catalyzed   c. exothermic
   b. endothermic   d. inhibited

_____ 11. The energy involved in endothermic and exothermic reactions is _____.
   a. chemical   c. light
   b. heat   d. electrical

_____ 12. The energy released in the formation of a compound from its elements is always _____ the energy required to decompose that compound into its elements.
   a. greater than   c. less than
   b. identical to   d. similar to

_____ 13. If the heat of reaction is negative, the reaction is _____.
   a. endothermic   c. negative
   b. exothermic   d. positive

_____ 14. If the energy graphs of a reaction, catalyzed and uncatalyzed, are examined, the peak representing activation energy is _____ for the catalyzed reaction.
    a.   equal   c.   lower
    b.   higher   d.   unchanged

_____ 15. Spontaneous reactions occur if energy _____ and disorder _____.
    a.   decreases, decreases   c.   increases, decreases
    b.   decreases, increases   d.   increases, increases

_____ 16. When bowling pins at the end of an alley are hit by a bowling ball, the entropy of the pins _____.
    a.   decreases   c.   is spontaneous
    b.   increases   d.   stays the same

_____ 17. If a reaction results in increased energy and increased entropy, will the reaction be spontaneous?
    a.   no   c.   yes, if the temperature is high
    b.   yes   d.   yes, if the temperature is low

_____ 18. A _____ is the heat required to raise the temperature of 1 g of liquid water by 1ºC.
    a.   calorie   c.   kilocalorie
    b.   Calorie   d.   joule

_____ 19. The energy value of foods is measured in units of _____.
    a.   calories   c.   joules
    b.   Calories   d.   nutrients

_____ 20. If 16 cans are produced from aluminum made from ore, how many cans can be made from recycled aluminum for the same cost?
    a.   8   c.   32
    b.   16   d.   48

_____ 21. In processes that produce electricity, some of the energy used is wasted as _____ energy.
    a.   chemical   c.   kinetic
    b.   heat   d.   light

_____ 22. The process that uses carbon dioxide and water, in the presence of sunlight and chlorophyll, to form simple sugar and oxygen is _____.
    a.   capillary action   c.   photosynthesis
    b.   digestion   d.   respiration

_____ 23. The ultimate source of energy in the food web is _____.
    a.   the sun   c.   light reactions
    b.   photosynthesis   d.   the Calvin cycle

_____ 24. When photosynthesis is compared to the burning of fossil fuels, photosynthesis is a(n) _____ efficient process.
    a.   less
    b.   more
    c.   equally

_____ 25. Why is the natural process of photosynthesis far more efficient than electricity production by industrial processes?
    a.   Industrial processes that produce electricity increase entropy through the combustion of carbon dioxide and water.
    b.   Industrial processes that produce electricity convert energy from one form to another yet maintain low-entropy systems.
    c.   Photosynthesis builds complex high-energy molecules in a process in which entropy decreases.
    d.   Photosynthesis releases waste heat and increases the entropy of the environment.

_____ 26. How can industrial processes be as efficient as photosynthesis?
   a.   decrease entropy by an increase of waste heat
   b.   decrease entropy by a decrease of waste heat
   c.   increase entropy by an increase of waste heat
   d.   increase entropy by a decrease of waste heat

Completion
Complete each statement.

27. Energy changes typically involve a flow of energy from an object at high temperature to one at low temperature, an energy transfer known as _____.

28. In energy transfer, the total amount of energy at the end is always the same as that at the beginning, a generalization that is called the _____.

29. An important feature of energy changes is the degree of disorder, which is called _____.

30. A unit widely used in practical situations is equal to 0.239 J and is called the _____.

31. One thousand calories is called a(n) _____.

32. The most important source of useful energy today is a group of materials called _____.

33. Some organisms convert the inorganic compounds, water and carbon dioxide, into carbohydrates, a process known as _____.

34. The amount of heat generated in a chemical reaction is measured by a(n) _____.

Short Answer

35. The heats of reaction during the exothermic formation of Al_2O_3 and CO_2 are -1676 kJ/mol and -394 kJ/mol, respectively. On the basis of this information, which of the two compounds is likely to be more stable?

36. Although electricity is often the most convenient form of energy to use, it is almost never the most efficient overall. Why?

37. When energy is wasted during an industrial process, what actually happens to that energy?

38. Write the overall chemical reaction for photosynthesis. What are the names of the two series of reactions that occur during photosynthesis?

39. Explain why industrial processes can never be 100 percent efficient, in spite of the fact that energy is conserved in all processes.

The graph in Figure 20-1 shows the absorption of light by a chlorophyll molecule at various wavelengths. Answer the following questions about this graph.
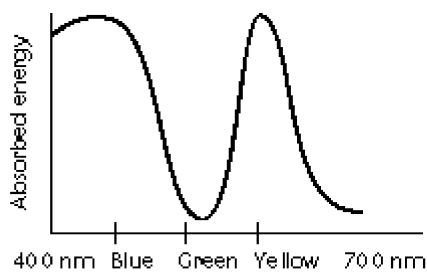

Figure 20-1

40. At what regions of wavelength does the chlorophyll molecule absorb light energy most strongly? Least strongly?

41. How does this graph explain the color of chlorophyll?

42. An electron ejected from a chlorophyll molecule by light energy is said to be "activated." What do you think that term means?

43. Suppose the equation Chl → $Chl^+ + e^-$ represents the reaction that occurs when light energy ejects an electron from the chlorophyll molecule (Chl). What happens to the electron produced in this reaction?

44. What happens to the positively charged chlorophyll ion (Chl^+) in this reaction?

45. The vertical axis on the graph is labeled "energy absorbed." Why is the amount of oxygen produced during photosynthesis at each wavelength roughly proportional to the energy absorbed at each wavelength?

The graph in Figure 20-2 shows energy changes that take place when hydrogen and iodine react to form hydrogen iodide. Answer the following questions by referring to this graph.
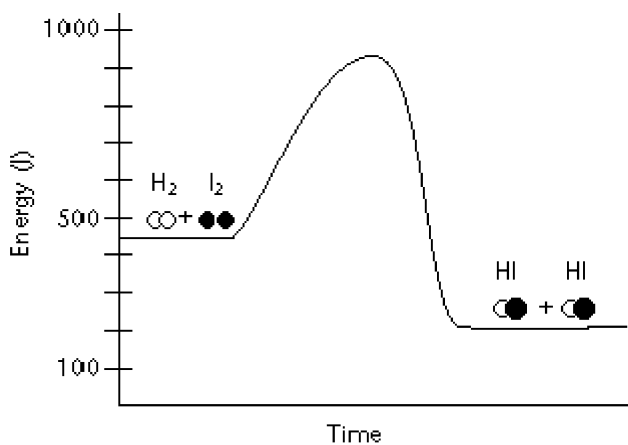

Figure 20-2

46. Estimate the energy possessed by the original reactants in this reaction.

47. Estimate the energy possessed by the products of the reaction.

48. Estimate the activation energy required for the reaction to occur.

49. Is this reaction endothermic or exothermic? What is the heat of reaction?

50. Why is it necessary to provide energy to get this reaction started?

51. How could the graph be used to represent how energy changes when hydrogen iodide molecules break down to form hydrogen and iodine?

Problem

52. How much heat in kilojoules is released when 25.0 g of water is cooled from 85.0°C to 40.0°C?

53. A 1.5-g sample of methane (CH_4) gas is burned completely in a calorimeter that contains 500.0 g of water. The temperature of the water rises from 22.00°C to 23.50°C. How much heat in kilojoules was given off in the reaction? How much heat would 1.00 mol of the gas produce when burned?

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Answer Section

MULTIPLE CHOICE

1.	ANS: C	PTS: 1	DIF: B	OBJ: 20-1
2.	ANS: D	PTS: 1	DIF: B	OBJ: 20-2
3.	ANS: D	PTS: 1	DIF: B	OBJ: 20-2
4.	ANS: B	PTS: 1	DIF: B	OBJ: 20-3
5.	ANS: D	PTS: 1	DIF: B	OBJ: 20-4
6.	ANS: C	PTS: 1	DIF: B	OBJ: 20-9
7.	ANS: C	PTS: 1	DIF: B	OBJ: 20-9
8.	ANS: C	PTS: 1	DIF: B	OBJ: 20-1
9.	ANS: A	PTS: 1	DIF: B	OBJ: 20-2
10.	ANS: B	PTS: 1	DIF: B	OBJ: 20-2
11.	ANS: B	PTS: 1	DIF: B	OBJ: 20-1
12.	ANS: B	PTS: 1	DIF: B	OBJ: 20-2
13.	ANS: B	PTS: 1	DIF: B	OBJ: 20-2
14.	ANS: C	PTS: 1	DIF: B	OBJ: 20-2
15.	ANS: B	PTS: 1	DIF: B	OBJ: 20-3
16.	ANS: B	PTS: 1	DIF: B	OBJ: 20-3
17.	ANS: C	PTS: 1	DIF: B	OBJ: 20-3
18.	ANS: A	PTS: 1	DIF: B	OBJ: 20-4
19.	ANS: B	PTS: 1	DIF: B	OBJ: 20-5
20.	ANS: D	PTS: 1	DIF: A	OBJ: 20-6
21.	ANS: B	PTS: 1	DIF: B	OBJ: 20-8
22.	ANS: C	PTS: 1	DIF: B	OBJ: 20-7
23.	ANS: A	PTS: 1	DIF: B	OBJ: 20-9
24.	ANS: B	PTS: 1	DIF: B	OBJ: 20-8
25.	ANS: C	PTS: 1	DIF: A	OBJ: 20-8
26.	ANS: B	PTS: 1	DIF: A	OBJ: 20-8

COMPLETION

27. ANS: heat

   PTS: 1   DIF: B   OBJ: 20-1
28. ANS: law of conservation of energy

   PTS: 1   DIF: B   OBJ: 20-1
29. ANS: entropy

   PTS: 1   DIF: B   OBJ: 20-3

30. ANS: calorie

    PTS: 1   DIF: B   OBJ: 20-4
31. ANS:
    Calorie
    kilocalorie

    PTS: 1   DIF: B   OBJ: 20-5
32. ANS: fossil fuels

    PTS: 1   DIF: B   OBJ: 20-5
33. ANS: photosynthesis

    PTS: 1   DIF: B   OBJ: 20-7
34. ANS: calorimeter

    PTS: 1   DIF: B   OBJ: 20-4

SHORT ANSWER

35. ANS:
    Al_2O_3 is likely to be more stable.

    PTS: 1   DIF: B   OBJ: 20-2
36. ANS:
    Electricity is always produced in at least two steps, such as the boiling of water in a fossil-fuel or nuclear power plant, and the conversion of the energy to electricity. Some energy is lost at each of the stages in which it is transformed.

    PTS: 1   DIF: A   OBJ: 20-6
37. ANS:
    It is lost to the environment in the form of heat.

    PTS: 1   DIF: B   OBJ: 20-6
38. ANS:
    The overall reaction is: $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$. The two series of reactions are the light reactions and the Calvin cycle.

    PTS: 1   DIF: A   OBJ: 20-7
39. ANS:
    Not all the energy that is produced can be used to do work. Some of it is lost in the form of waste heat, which cannot be reclaimed because it has increased the disorder of particles in the environment.

    PTS: 1   DIF: B   OBJ: 20-6

40. ANS:
The molecule absorbs in the blue and orange regions most strongly and in the green region least strongly.

PTS: 1   DIF: B   OBJ: 20-7
41. ANS:
Because light in the green regions is not absorbed well, it must be transmitted or reflected, producing a green color.

PTS: 1   DIF: B   OBJ: 20-7
42. ANS:
The term *activated* means that the electron absorbed energy from light.

PTS: 1   DIF: B   OBJ: 20-7
43. ANS:
The electron is used in the production of the ATP or NADPH, which enter the Calvin cycle of photosynthesis.

PTS: 1   DIF: B   OBJ: 20-7
44. ANS:
It receives an electron removed from a water molecule.

PTS: 1   DIF: B   OBJ: 20-7
45. ANS:
The rate of photosynthesis and therefore the rate of production of oxygen are both functions of the wavelength of light absorbed by the molecule.

PTS: 1   DIF: A   OBJ: 20-7
46. ANS:
The energy of the reactants is about 450 J.

PTS: 1   DIF: B   OBJ: 20-2
47. ANS:
The energy of the products is about 200 J.

PTS: 1   DIF: B   OBJ: 20-2
48. ANS:
The activation energy is about 450 J.

PTS: 1   DIF: B   OBJ: 20-2
49. ANS:
The reaction is exothermic; the heat of reaction is about -250 J.

PTS: 1   DIF: B   OBJ: 20-1
50. ANS:
Energy must be put into the reactants to form the activated complex.

PTS: 1   DIF: B   OBJ: 20-2

51. ANS:
    The graph could be read from right to left.

    PTS: 1   DIF: A   OBJ: 20-2

PROBLEM

52. ANS:
    4.71 kJ

    PTS: 1   DIF: B   OBJ: 20-4
53. ANS:
    3.14 kJ; 33.5 kJ

    PTS: 1   DIF: A   OBJ: 20-4