Section 16.3 Using Heat (pages 486–492)

This section describes ways in which humans benefit from heat engines, heating systems, and cooling systems. It also discusses how each of these systems works.

Reading Strategy (page 486)
Sequencing As you read, complete the cycle diagram to show the sequence of events in a gasoline engine. For more information on this Reading Strategy, see the Reading and Study Skills in the Skills and Reference Handbook at the end of your textbook.

Sequence of Events in a Gasoline Engine

Heat Engines (pages 486–487)

1. The two main types of heat engines are the ______________________ and the ______________________.

2. A steam engine is an external combustion engine because it burns fuel __________________ the engine.

3. Who developed the first practical steam engine?
   a. James Prescott Joule
   b. Thomas Newcomen
   c. James Watt
   d. Benjamin Thompson

4. How is heat converted into work in a steam engine? ____________________

5. A heat engine used by most cars in which fuel burns inside the engine is called a(n) ____________________.

6. Each upward or downward motion of a piston in an internal combustion engine is called a(n) ____________________.
Chapter 16  Thermal Energy and Heat

7. Is the following sentence true or false? In a typical car, the crankshaft produces a linear motion that turns the wheels.
   _____________________________

8. Why is it important for an internal combustion engine to have a cooling system? _____________________________

9. Is the following sentence true or false? Gasoline engines operate very efficiently in converting fuel energy to work.
   _____________________________

Heating Systems (pages 489–490)

10. What is a central heating system? _____________________________

11. List four energy sources used for central heating systems.
    a. _____________________________
    b. _____________________________
    c. _____________________________
    d. _____________________________

12. Is the following sentence true or false? In most heating systems, conduction is used to distribute most of the thermal energy.
    _____________________________

Match each description with the heating system it describes.

<table>
<thead>
<tr>
<th>Description</th>
<th>Heating System</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Water heated by a boiler circulates through radiators in each room, transferring thermal energy.</td>
<td>a. hot-water heating</td>
</tr>
<tr>
<td>14. Fans are used to circulate warm air through ducts to the rooms in a building.</td>
<td>b. steam heating</td>
</tr>
<tr>
<td>15. A hot coil heats air by conduction and radiation.</td>
<td>c. electric baseboard heating</td>
</tr>
<tr>
<td>16. This system is often used in older buildings or to heat many buildings from a single location.</td>
<td>d. forced-air heating</td>
</tr>
</tbody>
</table>

Cooling Systems (pages 490–492)

17. Is the following sentence true or false? Most cooling systems, such as air conditioners and refrigerators, are heat pumps.
    _____________________________

18. A fluid that vaporizes and condenses inside the tubing of a heat pump is called a(n) _____________________________.

19. How does a heat pump reverse the normal flow of thermal energy? _____________________________

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