Review and Assessment

**LESSON 1  Work and Power**

1. The amount of work done on an object is found by multiplying
   a. force times distance.  
   b. force times time.  
   c. power times efficiency.  
   d. speed times time.

2. The rate at which work is done is called ________

   **power.**

3. **Calculate** You go rock climbing with a pack that weighs 70 N and you reach a height of 30 m. How much work did you do to lift your pack? If you finished the climb in 10 minutes (600 s), what was your power?
   \[
   Work = 70 \text{ N} \times 30 \text{ m} = 2100 \text{ J} \\
   Power = \frac{2100 \text{ J}}{600 \text{ s}} = 3.5 \text{ W}
   \]

4. **Apply Concepts** What do automobile makers mean when they say their cars are more powerful than their competitors' cars?
   **Their products do more work in the same amount of time.**

5. **Write About It** Your friend's parents tell him that he needs to do more work around the house. How can your friend use science to explain to them that he does plenty of work just by going through his daily activities?
   **See TE Rubric.**

**LESSON 2  Understanding Machines**

6. One way a machine can make work easier is by
   a. increasing force  
   b. decreasing time  
   c. increasing work  
   d. reducing work

7. The actual mechanical advantage of any machine is its __________ divided by its __________.

8. **Solve Problems** You and your friends are building a treehouse, and you need a machine to get a heavy load of wood from the ground to the top of the tree. You set up a pulley system that allows you to pull down on a rope to lift the wood up. You end up able to lift a load you normally couldn't. In what way(s) does your machine make work easier?
   **Sample: It would increase the force I applied and change the direction of my input force.**

9. **Control Variables** You are designing an experiment to test the efficiency of different bikes. What variables do you have to control?
   **Sample: the input force of the bike rider, the surface being ridden on.**

10. **Relate Cause and Effect** You push on an old skateboard with a force of 20 N. The output force is only 10 N. What is the skateboard's efficiency? How would the efficiency change if the old, rusty ball bearings were replaced with new ones?
    **Efficiency = \frac{10 \text{ N}}{20 \text{ N}} \times 100\% = 50\%. The efficiency would increase.**
LESSON 3  Inclined Planes and Levers

11. Which of these is an example of a simple machine from the inclined plane family?
   a. baseball bat  b. jar lid
   c. bottle opener  d. wheelbarrow

12. The fixed point that a lever pivots around is called the ________________.

13. Interpret Diagrams  Which ramp has the greater ideal mechanical advantage?
   Ramp Y
   4.0 m
   0.5 m

   Ramp Z
   3.0 m
   1.0 m

   Ramp Y: MA = 8; Ramp Z: MA = 3
   Ramp Y has the greater ideal mechanical advantage

LESSON 4  Putting Machines Together

16. Which of these is an example of a wheel and axle?
   a. axe  b. seesaw
c. doorknob  d. flagpole rigging

17. A ____________ is a system that consists of at least one fixed pulley and one movable pulley.

18. Apply Concepts  A circular faucet handle is an example of a wheel and axle. How could you increase the mechanical advantage of a circular faucet handle?
   ______________________________
   You could increase the handle's radius or decrease the shaft's radius.

19. This paper cutter is a compound machine. How does it make cutting paper easier? What simple machines make up the paper cutter? Describe how they interact.
   ______________________________
   Sample: The paper cutter lets me cut in straight lines neatly and easily. It contains a lever and a wedge. I push down on the lever, which pushes the wedge down through the paper.

15. Math!  On a separate sheet of paper, draw one example of each of the three different classes of levers. For each lever, measure the distance between the fulcrum and the input force, the distance between the fulcrum and the output force, and calculate the ideal mechanical advantage.
Standardized Test Prep

Multiple Choice
Circle the letter of the best answer.

1. The table below shows the input work and output work for four different pulleys. Which pulley has the highest efficiency?

<table>
<thead>
<tr>
<th>Pulley</th>
<th>Input Work</th>
<th>Output Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed pulley A</td>
<td>20,000 J</td>
<td>8,000 J</td>
</tr>
<tr>
<td>Fixed pulley B</td>
<td>20,000 J</td>
<td>10,000 J</td>
</tr>
<tr>
<td>Movable pulley</td>
<td>20,000 J</td>
<td>12,000 J</td>
</tr>
<tr>
<td>Block and tackle</td>
<td>20,000 J</td>
<td>16,000 J</td>
</tr>
</tbody>
</table>

A) Fixed pulley A  
B) Fixed pulley B  
C) Movable pulley  
D) Block and tackle

2. Why does it take more work to carry a 22-N bag of birdseed to the third floor of a house than it takes to move a 16-N bag of cat food to the second floor of a house?

A) Work equals distance divided by force and the birdseed requires less force to lift it.
B) The force exerted on the birdseed is not the direction of motion.
C) The cat food has less mass than the birdseed.
D) The birdseed has greater mass and has to be moved farther.

3. Which is the best scientific definition of a machine?

A) A machine is a timesaving device that uses motors and gears.
B) A machine changes the amount of input force.
C) A machine makes work easier by changing force, distance, or direction.
D) A machine can either be simple or compound.

4. Which of the following will increase the ideal mechanical advantage of a wheel and axle?

A) increasing the wheel’s radius  
B) decreasing the wheel’s radius  
C) increasing the axle’s radius  
D) increasing the wheel’s radius and the axle’s radius equally

5. Which activity describes work being done on an object?

A) walking a dog on a leash  
B) lifting a bag of groceries  
C) holding an umbrella still  
D) pressing a stamp onto an envelope

Constructed Response
Use your knowledge of science to help you answer Question 6. Write your answer on a separate sheet of paper.

6. Explain why an engineer would design a road to wind around a mountain rather than go straight up the side. Explain how this design would be better.