You are applying for a position with Sun Homes, a firm that builds attractive and energy-efficient houses in your area. To get the job, you must show Sun Homes that you know about insulators and their efficiency. As part of the interview process, you must build a model of an energy-efficient home with your insulator of choice. Sun Homes will choose the applicant with the most efficient model. Good luck!

**STUDENT WORKSHEET**

**Energy-Efficient Home**

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**MATERIALS**

- large coffee can with plastic lid
- smaller can with a volume of at least 200 mL
- insulating material
- nail
- heat-resistant gloves
- 250 mL beaker
- water
- hot plate
- outdoor thermometer

**SAFETY ALERT!**

Always wear heat-resistant gloves while working with the hot plate or hot water or while disassembling the insulation tester. Do not heat the water above 60°C. Be careful not to spill hot water on yourself or others. If a thermometer breaks, notify your teacher immediately.

**Ask a Question**

Which insulating materials provide the most efficient home insulation?

**Make a Prediction**

1. Which insulating material do you think will work best? Select this material, and bring it to your workspace to test.

**Conduct an Experiment-Part 1: Testing Insulation**

2. Assemble an insulation tester as shown. Use a nail to punch a hole through the center of the plastic lid.

3. Completely fill the space between the two cans with your chosen insulation.

4. Put on heatproof mitts. Pour 200 mL of water into a beaker. Put the beaker on a hot plate, and heat the water to 60°C. Do not overheat the water. Water hotter than 60°C can scald.

5. Wearing heat-resistant gloves, pour the hot water into the inner can of the tester. Be very careful not to get the insulation wet.

6. Quickly seal the lid, and insert the thermometer. Immerse the bulb, but don’t let it touch the bottom of the can.

7. Immediately read the water temperature, and record the results in your ScienceLog. Repeat every 5 minutes for 30 minutes.

8. If time allows, repeat steps 1–7 with another insulating material or without any insulation.
9. Which is a more effective insulator, tightly packed material or loosely packed material? Explain your answer.

________________________________________________________________________

________________________________________________________________________

Draw Conclusions

10. Which material would you choose to insulate a house?

________________________________________________________________________

________________________________________________________________________

Part 2: Model an Energy-Efficient Home

Now that you have a good idea of what materials make good insulators, build a model of an energy-efficient home. Then make a second model home, adding features to improve its insulating efficiency.

11. Cut a 5 × 5 cm window in a cardboard box. Cover the window with plastic wrap, and tape it in place. Place a thermometer in the model so that it can be seen through the window. Tape the thermometer in place.

12. Position your control model so that it faces the sun to allow the most sunlight to enter the window.

13. Record the temperature in the model at the start of this experiment and every 5 minutes for 30 minutes.

<table>
<thead>
<tr>
<th>Model Home Temperatures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start</td>
</tr>
<tr>
<td>Control temperature (°C)</td>
</tr>
<tr>
<td>Experimental temperature (°C)</td>
</tr>
</tbody>
</table>
Energy-Efficient Home, continued

Ask a Question
14. How can you improve your home's performance?

Form a Hypothesis
15. With your group, design an energy-efficient home design that best improves your model's insulating ability. Consider the following design features:
   • location and surface area of windows
   • roof overhang
   • type of insulation
   • interior and exterior surface colors and finishes
   • air leakage around windows, doors, etc.

16. Based on your discussion, record a hypothesis in your ScienceLog about what kind of energy-efficient home will best save energy resources. Sketch your experimental model design in your ScienceLog.

Test the Hypothesis
17. After your teacher has approved your design, modify the box to build your new, improved model.

18. Repeat steps 12–13 to test your design, and record your results in the table on page 81.

Analyze the Results
In your ScienceLog, answer the following questions:

19. How do you account for any difference in the effectiveness of your two models?

20. Compare your results with the results of other groups. Were their designs more efficient? If so, what did they do differently? If you could redesign your model, what changes would you make?