

Physics > Big idea PMA: Matter > Topic PMA1: Heating and cooling

Key concept (age 11-14)

PMA1.2: Heating and cooling

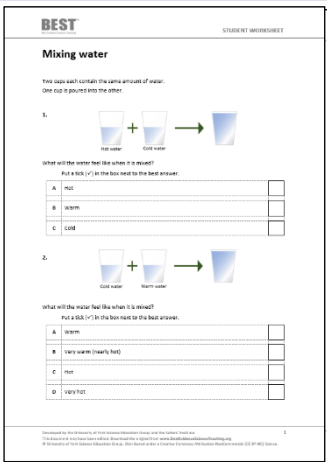


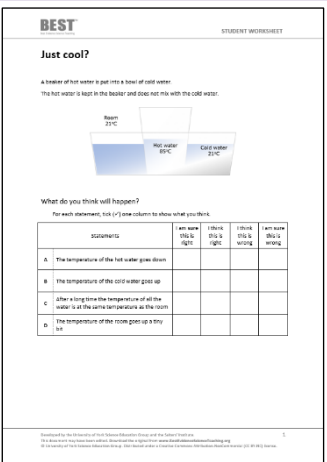
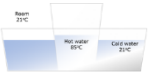
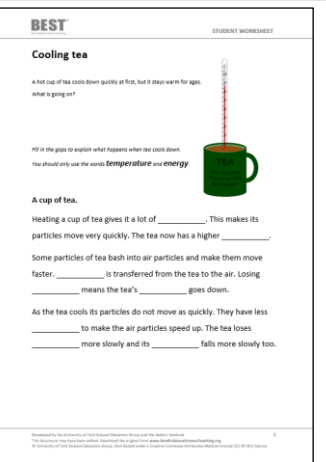
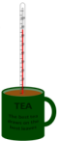
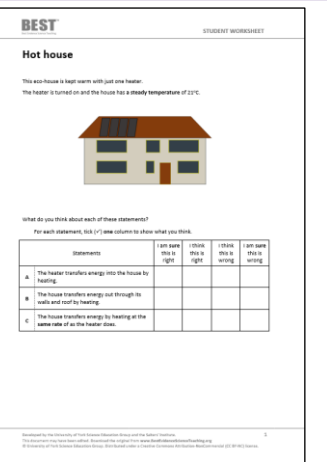


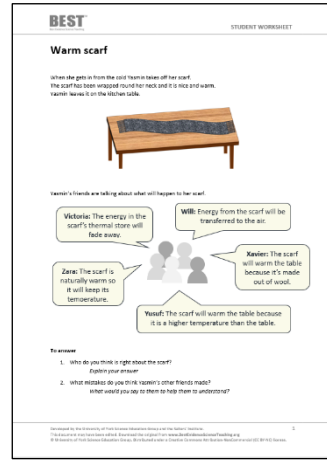

Progression toolkit: Heating and cooling

Learning focus	If two objects at different temperatures are in contact, energy will move spontaneously from the object at the higher temperature to the object at the lower temperature.				
As students' conceptual understanding progresses they can:	<div> <div>CONCEPTUAL PROGRESSION</div> <div></div> </div>				
	Make qualitative predictions about the resulting temperature when hot and cold water are mixed. P	Make quantitative predictions about the resulting temperature when hot and cold water are mixed.	Describe how the temperature of very hot water changes as it cools.	Explain how energy dissipates as a hot object cools down.	Apply the law of conservation of energy to explain what happens to energy in novel situations. B
Diagnostic questions	Mixing water		Just cool?	Cooling tea	Hot house
Response activities			Cooling curve	Warm scarf	

Key:

P Prior understanding from earlier stages of learning

B Bridge to later stages of learning

Mixing water	Just cool?	Cooling tea	Hot house	Cooling curve																																																											
 <p>Mixing water</p> <p>Two cups each contain the same amount of water. One cup is poured into the other.</p> <p>1. </p> <p>What will the water feel like when it is mixed?</p> <p>Put a tick (✓) in the box next to the best answer.</p> <table border="1"> <tr> <td>A. Hot</td> <td></td> </tr> <tr> <td>B. Warm</td> <td></td> </tr> <tr> <td>C. Cold</td> <td></td> </tr> </table> <p>2. </p> <p>What will the water feel like when it is mixed?</p> <p>Put a tick (✓) in the box next to the best answer.</p> <table border="1"> <tr> <td>A. Warm</td> <td></td> </tr> <tr> <td>B. Very warm (nearly hot)</td> <td></td> </tr> <tr> <td>C. Hot</td> <td></td> </tr> <tr> <td>D. Very hot</td> <td></td> </tr> </table>	A. Hot		B. Warm		C. Cold		A. Warm		B. Very warm (nearly hot)		C. Hot		D. Very hot		 <p>Just cool?</p> <p>A beaker of hot water is put into a beaker of cold water. The hot water is kept in the beaker and does not mix with the cold water.</p> <p></p> <p>What do you think will happen?</p> <p>For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th>Statements</th> <th>am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A. The temperature of the hot water goes down.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B. The temperature of the cold water goes up.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C. After a long time the temperature of all the water is at the same temperature as the room.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>D. The temperature of the room goes up a tiny bit.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Statements	am sure this is right	I think this is right	I think this is wrong	am sure this is wrong	A. The temperature of the hot water goes down.					B. The temperature of the cold water goes up.					C. After a long time the temperature of all the water is at the same temperature as the room.					D. The temperature of the room goes up a tiny bit.					 <p>Cooling tea</p> <p>A hot cup of tea cools down quickly at first, but it stays warm for ages. What is going on?</p> <p></p> <p>All in the gaps to explain what happens when tea cools down. You should only use the words temperature and energy.</p> <p>A cup of tea.</p> <p>Heating a cup of tea gives it a lot of _____. This makes its particles move very quickly. The tea now has a higher _____.</p> <p>Some particles of tea bash into air particles and make them move faster. _____ is transferred from the tea to the air. Losing _____ means the tea's _____ goes down.</p> <p>As the tea cools its particles do not move as quickly. They have less _____ to make the air particles speed up. The tea loses _____ more slowly and its _____ falls more slowly too.</p>	 <p>Hot house</p> <p>This sun house is kept warm with just one heater. The heater is turned on and the house has a steady temperature of 21°C.</p> <p></p> <p>What do you think about each of these statements?</p> <p>For each statement, tick (✓) one column to show what you think.</p> <table border="1"> <thead> <tr> <th>Statements</th> <th>am sure this is right</th> <th>I think this is right</th> <th>I think this is wrong</th> <th>am sure this is wrong</th> </tr> </thead> <tbody> <tr> <td>A. The heater transfers energy into the house by heating.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>B. The house transfers energy out through its walls and roof by heating.</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>C. The house transfers energy by heating at the same rate as the heater does.</td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Statements	am sure this is right	I think this is right	I think this is wrong	am sure this is wrong	A. The heater transfers energy into the house by heating.					B. The house transfers energy out through its walls and roof by heating.					C. The house transfers energy by heating at the same rate as the heater does.					 <p>Cooling curve</p> <p>Emma is a science teacher. She has noticed her coffee cools down faster when she is on outside break duty. She wonders what is happening.</p> <p>predict</p> <p>How quickly do you think the temperature of hot coffee will fall?</p> <p>What temperature do you think it will fall to?</p> <p>explain</p> <p>Why do you think this will happen?</p> <p>Now carry out the investigation</p> <p>observe</p> <p>Draw a graph to show what happens. Describe what happens to the temperature of water as it cools.</p> <p>explain</p> <p>Draw your prediction and explanation correct? If not, can you explain what you observed?</p>
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<p>Warm scarf</p>  <p>Warm scarf</p> <p>When the gas in from the coal train heats up the scarf, the scarf has been wrapped round for each and is kept at a high of warm, warm scarf is on the table side.</p> <p></p> <p>Victor's friends are talking about what will happen to the scarf.</p> <p>Victor: The energy in the scarf's thermal store will fade away.</p> <p>Will: Energy from the scarf will be transferred to the air.</p> <p>Naive: The scarf will warm the table because it's made out of wool.</p> <p>Zane: The scarf is naturally warm so it will keep its temperature.</p> <p>Yusuf: The scarf will warm the table because it is a higher temperature than the table.</p> <p>Answer</p> <p>1. Who do you think is right about the scarf? Explain your answer.</p> <p>2. What mistakes do you think Victor's other friends made? What would you say to them to help them to understand?</p>																																																															
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