**Warm scarf**

When she gets in from the cold Yasmin takes off her scarf.

The scarf has been wrapped round her neck and it is nice and warm.

Yasmin leaves it on the kitchen table.



Yasmin’s friends are talking about what will happen to her scarf.

**Will:** Energy from the scarf will be transferred to the air.

**Victoria:** The energy in the scarf’s thermal store will fade away.

**Xavier:** The scarf will warm the table because it’s made out of wool.

**Zara:** The scarf is naturally warm so it will keep its temperature.

**Yusuf:** The scarf will warm the table because it is a higher temperature than the table.

**To answer**

1. Who do you think is right about the scarf?

*Explain your answer*

1. What mistakes do you think Yasmin’s other friends made?

*What would you say to them to help them to understand?*

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| ***Sort cards for***  ***PMA1.2: Warm Scarf*** | **Victoria:** The energy in the scarf’s thermal store will fade away. |
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| **Yusuf:** The scarf will warm the table because it is a higher temperature than the table. | **Zara:** The scarf is naturally warm so it will keep its temperature. |

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*Physics > Big idea PMA: Matter > Topic PMA1: Heating and cooling > Key concept PMA1.2: Heating and cooling*

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| --- |
| **Response activity** |
| **Warm scarf** |

**Overview**

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| 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. |
| Observable learning outcome: | Explain how energy dissipates as a hot object cools down |
| Activity type: | Talking heads |
| Key words: | Temperature, dissipation |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

Diagnostic question: Cooling tea

**What does the research say?**

The difference between temperature and a thermal store of energy is a crucial idea in the understanding of thermal concepts. When an object is warmed up its temperature rises, the amount of energy in its thermal store increases and the particles in the object move or vibrate more. All of these changes are interconnected and happen at the same time. More specifically, and at a level students may encounter in more advanced studies, temperature is a measure of the average amount of energy in the kinetic store of the particles and the extra energy gained by the particles increases the energy in the thermal store (Institute of Physics).

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. The statements are also provided as cut-out cards for students to physically organise.

Students should work together to follow the instructions on either the worksheet or the PowerPoint. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

If there is disagreement when you take feedback, a good way to progress might be through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*Differentiation*

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

**Expected answers**

1. Will and Yusuf are correct. At the beginning the scarf is at a higher temperature than the table and the air, so energy spontaneously transfers from the scarf into the table and the air.

2. Victoria is wrong, because the energy cannot just disappear. The vibrating scarf particles will make the air particles move more quickly and so on.

Xavier is wrong, because the scarf would warm the table if it is initially at a higher temperature, no matter what it was made from. Wool feels warm because it is a good insulator, not because it is always at a higher temperature, which is the answer that Zara gave.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

Institute of Physics. *Supporting Physics Teaching (SPT): Energy* [Online]. Available at: <http://supportingphysicsteaching.net/EnHome.html> [Accessed July 2018].