**Evaporation rate**

The same volume of water is poured into two beakers.

Beaker A contains water at 60°C. In beaker B the temperature of the water is 20°C.

*Fill in the gaps to explain why the rate of evaporation is higher in beaker A.*

*You should only use the words* ***temperature*** *and* ***energy.***

Evaporation takes place from both beakers. Particles with enough \_\_\_\_\_\_\_ are able to escape from the liquid.

Beaker A is at a higher \_\_\_\_\_\_\_\_ than beaker B. This means that on average the particles in beaker A have more \_\_\_\_\_\_.

In both beaker A and beaker B some particles have more \_\_\_\_\_\_ than others.

However, in beaker A more particles have enough \_\_\_\_\_\_\_ to escape the liquid. For this reason, evaporation takes place faster from beaker A.

In general, the higher the \_\_\_\_\_\_\_\_\_\_, the faster the rate of evaporation.

*Chemistry > Big idea CPS: Particles and structure> Topic CPS5: Evaporation > Key concept CPS5.1: Explaining evaporation*

|  |
| --- |
| **Response activity** |
| **Evaporation rate** |

**Overview**

|  |  |
| --- | --- |
| Learning objective: | Evaporation takes place at any temperature between melting and boiling point |
| Observable learning outcome: | Use the idea that particles have a range of energies to explain how evaporation occurs below the boiling point of a substance. |
| Activity type: | Response, clarifying- focused cloze |
| Key words: | Energy, particle, evaporation |

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

* Evaporating particles

|  |  |
| --- | --- |
| **B** | **BRIDGING**  This activity explores ideas that are usually taught at age 14-16, to build a bridge to later stages of learning. |

**What does the research say?**

In the Association for Science Education publication “Teaching Secondary Chemistry” (Johnson, 2012), Phil Johnson writes that whilst the basic particle model can explain the overall ‘disappearance’ of water that is evaporating below boiling point in terms of mixing with the ‘air’ particles, it cannot explain *how* this can happen. It is likely that boiling has been explained to students in terms of water needing to be at the boiling point of 100°C in order for particles to have enough energy to escape.

This makes it very challenging for students to explain everyday observations of water evaporating below boiling point. In order to understand evaporation more fully, Johnson recommends that students should be introduced at a basic level to the idea that temperature is related to the average energy of particles but that any single particle could have a different temperature to another. Some particles therefore have sufficient energy to escape.

**Ways to use this activity**

This activity gives students the opportunity to clarify their thinking through discussion. To support this, students should answer complete the focused cloze activity in pairs or small groups.

Listening to individual groups as they work often highlights any difficulties they might have. These can often be overcome, through a whole class clarification or redirection part way through the activity.

Asking students to share their answer is a useful check.

*Differentiation*

It may help some students to be presented with the actual practical scenario.

**Expected answers**

Evaporation takes place from both beakers. Particles with enough **energy** are able to escape from the liquid.

Beaker A is at a higher **temperature** than beaker B. This means that on average the particles in beaker A have more **energy**.

In both beaker A and beaker B some particles have more **energy** than others.

However, in beaker A more particles have enough **energy** to escape the liquid. For this reason, evaporation takes place faster from beaker A.

In general, the higher the **temperatur**e, the faster the rate of evaporation.

**Acknowledgments**

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Images: None

**References**

Johnson, P. (2012). Introducing particle theory. In Taber, K. (ed.) *ASE Science Practice: Teaching Secondary Chemistry.* New edition ed. London, UK: Hodder Education.