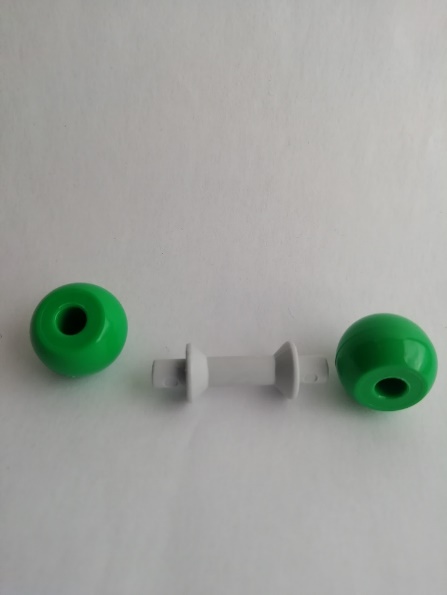
**Molecule models**

Some students make models of a hydrogen molecule.

The first model is made by pushing the parts together.



The second model is made of magnets which are attracted to each other.



1. Which model do you think best helps to explain that energy must be transferred to the molecule in order to break it apart AND that energy is transferred to the surroundings when the atoms combine?

*Chemistry > Big idea CCR: Chemical reactions > Topic CCR3: Energy and reactions > Key concept CCR3.1: Exothermic and endothermic reactions*

|  |
| --- |
| **Response activity** |
| **Molecule models** |

**Overview**

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| --- | --- |
| Learning objective: | During a chemical reaction energy may be transferred to or from the surroundings. |
| Observable learning outcome: | Describe the energy changes needed for the rearrangement of atoms during a chemical reaction. |
| Activity type: | Response, critiquing a model |
| Key words: | atom, energy |

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

* Energy and rearrangement of atoms

|  |  |
| --- | --- |
| **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?**

Research into chemistry misconceptions by Kind (2004) found that the phrase ‘fuels contain energy’ can lead some students to think that energy is stored in a fuel and released when it burns. This may then be extrapolated to conclude that this energy is stored in the chemical bonds and is released when these bonds break.

Research (Galley, 2004) asked 600 undergraduate biochemistry and physiology students to complete the sentence “ The release of energy during the combustion of ethylene is due to….” The chemical equation was provided. Over 80% of students selected bond breaking of the reactants as the origin of the energy released.

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

In this activity it can be helpful to take feedback whilst using the model to demonstrate what makes it a useful model and perhaps the ways in which it is less good. A good approach might be to encourage your students to suggest their ideas and make clear their reasons and to demonstrate how this works with the model. You might ask other students why they think it was a good contribution, or when appropriate, if they can improve on the idea’s clarity.

Ending with the students completing the worksheet or questions from the PowerPoint individually, might help them to consolidate their learning.

*Differentiation*

It may be helpful to bring in examples of the physical models used in the activity so that students can actually experience what happens when the components are separated and combined.

**Expected answers**

Both models may be used to show that energy must be transferred to the molecule in order to break it apart. However, the first model also requires energy to combine the atoms. The magnetic model better models the combining of atoms because as the parts are attracted to each other. This then transfers a small amount of energy to the surroundings. Evidence for this is an audible ‘click’.

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: Helen Harden

**References**

Galley, W. C. (2004). Exothermic bond breaking: A persistent misconception. *Journal of Chemical Education,* 81(4)**,** 523-525.

Kind, V. (2004). Beyond appearances: Students' misconceptions about basic chemical ideas. [Online]. Available at: <http://www.rsc.org/learn-chemistry/resource/res00002202/beyond-appearances?cmpid=CMP00007478>.