**Burning Fuel**

Some students are discussing what happens when a fuel burns.

**Connor:** Burning makes energy.

**Will:** When a fuel burns, energy is transferred to the surroundings.

**Stacey:** Burning releases the energy that is stored in the fuel.

**Jodie:** The energy in the fuel is used up when it burns.

1. Who do you agree with?
2. Who do you disagree with and why?

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| --- | --- |
| Cards for  **Burning Fuel** |  |
| **Stacey:** Burning releases the energy that is stored in the fuel. | **Connor:** Burning makes energy. |
| **Jodie:** The energy in the fuel is used up when it burns. | **Will:** When a fuel burns, energy is transferred to the surroundings. |

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

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| **Diagnostic question** |
| **Burning fuel** |

**Overview**

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| Learning focus: | During a chemical reaction energy may be transferred to or from the surroundings. |
| Observable learning outcome: | Recognise that energy is conserved during exothermic reactions. |
| Question type: | Diagnostic, talking heads |
| Key words: | fuel, energy |

**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. Use of language in everyday life such as ‘energy running out’ can suggest to students that energy can be ‘used up’. Other misunderstandings about burning were found to lead to the misconception that burning creates energy. Both of these contradict the important idea of conservation of energy.

**Ways to use this question**

This task is intended for discussion in pairs or small groups. It can be done as a pencil and paper exercise or projected onto a screen.

Students should read the statements and follow the instructions on either the worksheet or the PowerPoint. Listening in to the conversations of each group will often give you insights into how your students are thinking. Each member of a group should be able to report back to the class.

Feedback from each group can be used, with careful teacher questioning, to bring out a clear description or explanation of the science.

*Differentiation*

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

NB in any class, small group discussions typically improve over time and a persistence with this strategy is often very successful in the medium to long term.

**Expected answers**

Will gives the scientifically correct answer that burning transfers energy to the surroundings.

Connor’s statement contradicts the idea of conservation of energy, as does Jodie’s. Energy cannot be created or destroyed. Stacey’s response suggests a lack of understanding of the chemical process of burning. Energy cannot simply be ‘released’ from a fuel. The transfer of energy is due to the chemical reaction between the fuel and oxygen and the formation of new products (carbon dioxide and water).

**How to respond - what next?**

If students have misunderstandings about burning you may consider these when planning further teaching. It may be helpful to revisit key concept CCR2.2: Combustion. This will help to ensure that students understand that burning is a chemical reaction between the fuel and oxygen. You may also wish to reinforce the idea of conservation of energy by clarifying think around the idea that energy is not lost, it is transferred to the surroundings. It is important that students are confident with the idea of dissipation of energy (see Key concept PMA1.2: Heating and cooling) and diagnostic questions ‘Temperature change 1 and 2’ in this key concept.

The following BEST ‘response activity’ could be used in follow-up to this diagnostic question:

* Magnesium powder

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: Helen Harden (UYSEG)

**References**

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>.