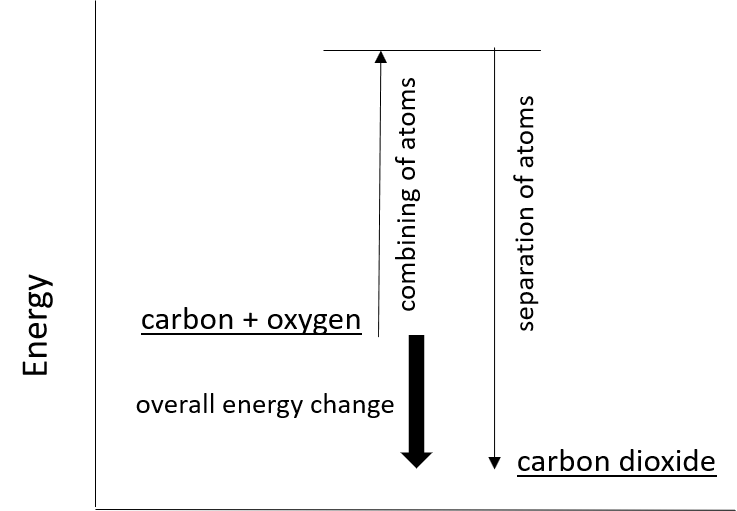
**Energy change diagram**

Carbon reacts with oxygen.

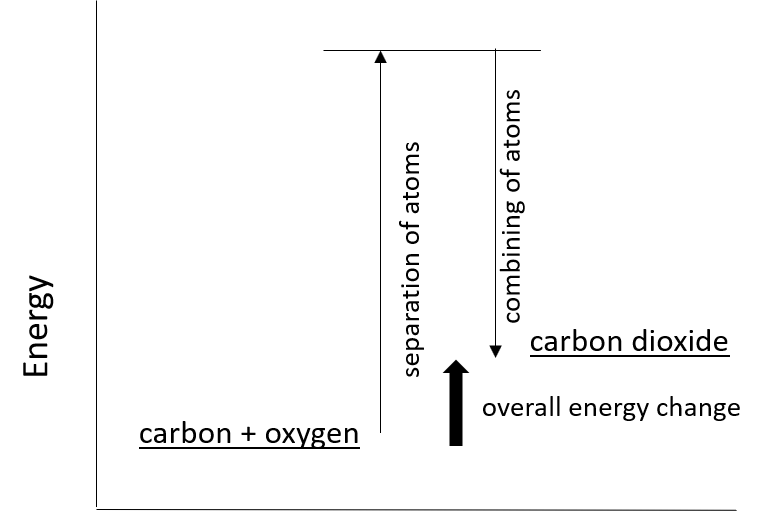
C+O2 → CO2

As a result of this chemical reaction, energy is transferred to the surroundings.

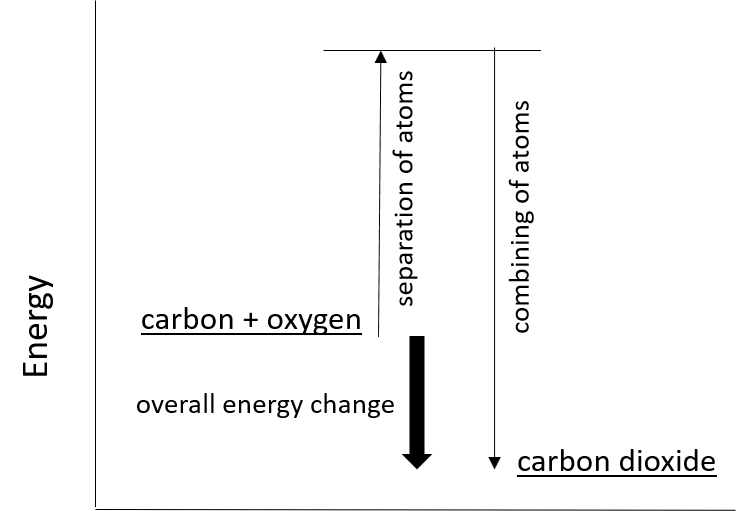
1. Which diagram best shows the energy changes that take place when the atoms rearrange?

****

**A**



**B**

****

**C**

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

|  |
| --- |
| **Response activity** |
| **Energy change diagrams** |

**Overview**

|  |  |
| --- | --- |
| Learning objective: | During a chemical reaction energy may be transferred to or from the surroundings. |
| Observable learning outcome: | Recognise that the overall energy change of a chemical reaction depends on the relative amount of energy needed to separate and combine atoms during the reaction. |
| Activity type: | Response, clarifying |
| Key words: | atom, energy change |

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

* Overall energy change

|  |  |
| --- | --- |
| **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 student misconceptions (Kind, 2004) found that everyday language such as “fuels contain energy” may lead to the misconception that “a fuel is an energy store” and hence the inference that energy is stored in chemical bonds.

As part of their research Cooper and Klymkowsky (2013) reported on a survey of general chemistry texts which showed that the most common approach was to place the macroscopic (temperature changes) in a section on “thermochemistry” and behaviour at atomic level (bonding) in a different section on “bonding”. This approach, if used in teaching, does not help students move from one level of thinking about energy changes of reaction to another.

**Ways to use this activity**

This activity aims to support students in clarifying their understanding of the energy changes during a chemical reaction by using a diagrammatic representation. Students may also benefit from the opportunity to clarify their thinking through discussion. To support this, students should answer the question in pairs or small groups.

Asking students to share their answer is a useful check. After a group has fed back, it might be helpful to model an even better answer. You could do this, for example, by asking another group to add to, or clarify, the first observation.

*Differentiation*

If some students are working with a teaching assistant, then a list of prompt questions could help to make this activity more purposeful.

**Expected answers**

C

**Acknowledgments**

Developed by Helen Harden (UYSEG).

Images: Helen Harden

**References**

Cooper, M. M. and Klymkowsky, M. W. (2013). The trouble with chemical energy: Why understanding bond energies requires an interdisciplinary systems approach. *CBE-Life Sciences Education,* 12(2)**,** 306-312.

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>.