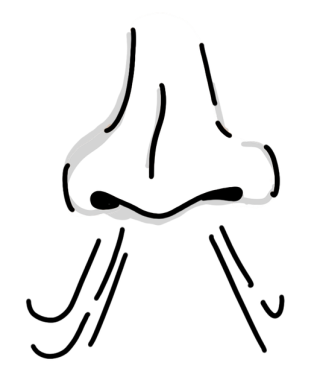
**Making gas (Part 1)**



1. Which of the following gasses does the human body make?

|  |  |
| --- | --- |
| **A** | Carbon dioxide and oxygen. |
| **B** | Only carbon dioxide. |
| **C** | Only oxygen. |
| **D** | Neither. |

1. How would you explain your answer to question 1?

|  |  |
| --- | --- |
| **A** | Both cellular respiration and photosynthesis take place in humans. |
| **B** | Only cellular respiration takes place in humans. |
| **C** | Only photosynthesis takes place in humans. |
| **D** | Neither cellular respiration nor photosynthesis takes place in humans. |

*Biology > Big idea BCL: The cellular basis of life > Topic BCL3: Biochemistry > Key concept BCL3.2: Cellular respiration*

|  |
| --- |
| **Diagnostic question** |
| **Making gas (Part 1)** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Energy for life processes is provided by a chemical process called cellular respiration inside all living cells, which uses glucose (from food) as fuel. |
| Observable learning outcome: | Describe aerobic cellular respiration using a simple model of the process, including what it uses as fuel (glucose plus oxygen) and what it makes as waste products (carbon dioxide and water). |
| Question type: | Two-tier multiple choice |
| Key words: | cellular respiration, gas exchange |

**What does the research say?**

In many curricula, students are required to learn about respiration at multiple points. Students could get the impression that what they were told “last time” was wrong. To avoid this, it may be helpful to be explicit about the fact that we use *models* of respiration to explain it, and that models containing different amounts of detail – but all describing the same process – are useful at different stages of learning about it. The EEF *Improving Secondary Science* guidance report advocates explicitly teaching pupils about models to help them develop a deeper understanding of scientific concepts (Holman and Yeomans, 2018).

Aerobic

cellular

respiration

energy

water

glucose from carbohydrate food

oxygen

carbon dioxide

At ages 11-14, a simple model of the inputs and outputs of the process may be good enough to explain what aerobic respiration requires, what the outputs of the process are, and to make predictions about the effects of decreasing or increasing an input. (Note, however, that the use of a word or symbol equation has been avoided in the BEST 11-14 resources, as it may reinforce the misunderstanding that photosynthesis is a single reaction.)

Two-tier multiple choice questions have commonly been used in the research to probe students’ understanding of cellular respiration (e.g. Haslam and Treagust, 1987; Svandova, 2014). A number of studies have assessed students’ understanding of cellular respiration by probing their understanding of the gasses taken in and made by animals and plants (e.g. Haslam and Treagust, 1987; Seymour and Longden, 1991; Maeng and Gonczi, 2019). The questions in this activity are adapted from those used by Maeng and Gonczi (2019).

**Ways to use this question**

This activity challenge students to apply their understanding of the model by applying it to decide which gasses are produced.

Students should complete the questions individually. This could be a pencil and paper exercise, or you could use the presentation with an electronic voting system or mini white boards.

*Differentiation*

You may choose to read the questions to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

1. B – Only carbon dioxide.
2. B – Only cellular respiration takes place in humans.

**How to respond - what next?**

If there is a range of answers, you may choose to respond 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. Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas (meaning making) through dialogue.

The following BEST ‘response activities’ challenge students to apply their understanding of the model to predict how cellular respiration in animals and plants will change the composition of air or the colour of an indicator solution, and could be used in follow-up to this diagnostic question:

* Response activity: Flames
* Response activity: Respiration indications

If students appear to be mixing up cellular respiration and photosynthesis, the fifth column in the progression toolkit for this key concept provides diagnostic questions and response activities to further probe and challenge their understanding.

**Acknowledgments**

Developed by Alistair Moore (UYSEG), from an idea by Maeng and Gonczi (2019).

Images: exhaling nose – pixabay.com/AsoyID (5458997)

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