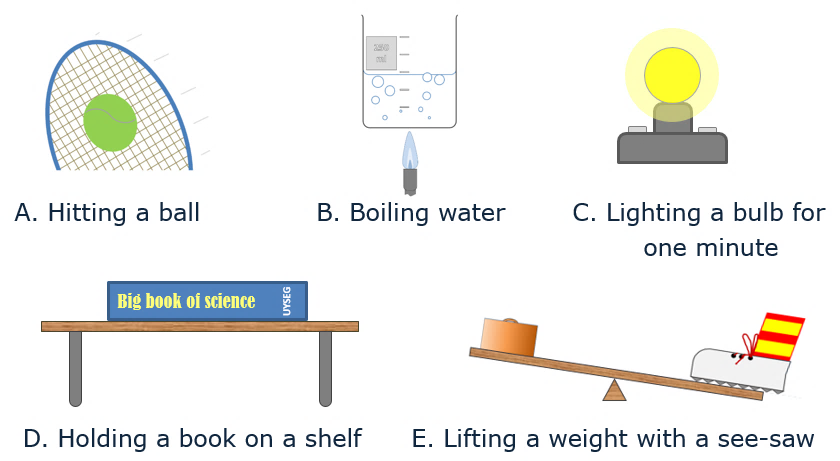
**Moving energy to different stores**

It is important to use the right words to describe an **energy transfer**.



Is each description right?

For each statement, tick (✓) **one** column to show what you think.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Statements** | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | Energy is moved from the chemical store of my arm to the kinetic store of me, the racket and the ball |  |  |  |  |
| **B** | A chemical store of energy is transferred to a kinetic store and a heat store |  |  |  |  |
| **C** | Energy is transferred from the chemical store of the battery to the heat store of the bulb and the room |  |  |  |  |
| **D** | The book has gravitational energy |  |  |  |  |
| **E** | A store of chemical energy is changed into a store of gravitational energy |  |  |  |  |

*Physics > Big idea PFM: Forces and motion > Topic PFM1: Forces > Key concept PFM1.5: Energy stores and transfers*

|  |
| --- |
| **Diagnostic question** |
| **Moving energy to different stores** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | An energy store of some kind is necessary for something to happen, and something happens when energy transfers between energy stores. |
| Observable learning outcome: | * Use precise language to describe transfers of energy between energy stores |
| Question type: | Diagnostic, confidence grid |
| Key words: | Energy store, energy transfer, chemical, heat, gravitational, kinetic |

**What does the research say?**

In teaching energy the BEST resources have adopted a framework based on ‘energy stores’ and ‘energy pathways’ which is advocated by, amongst others, (Boohan, 2014), (Millar, 2014) and (Tracy, 2014). As Millar (2014) says, this approach “is not perfect - but it is adequate and significantly better than [approaches] based on lists of ‘forms of energy’.” A clear guide to this approach can be found on the Institute of Physics’ website (Institute of Physics).

Rogers (2018) highlights that the precision in the language we use about energy is important. Because energy is an abstract concept we have to use words to describe it. He advises giving students opportunities to practise using language precisely to help them develop an accurate model of what is happening. This confidence grid requires students to consider different ways of writing about energy transfers and decide if the wording accurately describes the science.

A summary of the BEST approach to teaching energy can be found on the Best Evidence Science Teaching home page which is on the STEM Learning website (Fairhurst, 2018).

**Ways to use this question**

Students should complete the confidence grid individually. This could be a pencil and paper exercise, or you could use an electronic ‘voting system’ or mini white boards and the PowerPoint presentation.

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.

*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**

A, B and C are correct, D and E are wrong.

**How to respond - what next?**

1. Energy does move between these stores at the instant the ball is hit. It could be said that some energy is also moved into a heat store. The word *move* is a synonym of *transfer* and describes what happens to the energy.
2. The bubbles in the boiling water indicate movement. The burning gas, beaker, water and room all have heat stores, and the water, flame and air have kinetic stores.
3. The bulb is on for one minute and the end point is a hot filament bulb with the air in the room at a slightly higher temperature. The bulb **transfers energy** by lighting the room, but the energy is not moved to a ‘light store’.
4. The book has a gravitational store **of energy** – energy is best imagined as a substance that moves from store to store, the energy itself is the same ‘substance’ wherever it is. The wording ‘gravitational energy’ suggests a particular type of energy, which does not exist. Energy is stored in different ways.
5. The store of energy is not *changed* into something else, it is moved or transferred to a different store.

If students have difficulty identifying the correct ways of describing energy transfers, it can help to talk through a few more examples with the whole class and then give students the opportunity to describe these in their own words. It may be helpful for students to work in pairs or small groups and proof read each other’s descriptions to encourage more precise language through dialogue.

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

* Response activity: Energy stores circus

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: UYSEG

**References**

Boohan, R. (2014). Making sense of energy. *School Science Review,* 96(354)**,** 11.

Fairhurst, P. (2018). Teaching Energy. [Online]. Available at: <https://www.stem.org.uk/best-evidence-science-teaching>.

Institute of Physics. *Supporting Physics Teaching (SPT): Energy* [Online]. Available at: <http://supportingphysicsteaching.net/EnHome.html> [Accessed July 2018].

Millar, R. (2014). Teaching about energy: from everyday to scientific understandings. *School Science Review,* 96(354)**,** 6.

Rogers, B. (2018). *The big ideas in physics and how to teach them,* Abingdon and New York: Routledge.

Tracy, C. (2014). Energy in the new curriculum: an opportunity for change. *School Science Review,* 96(354)**,** 11.