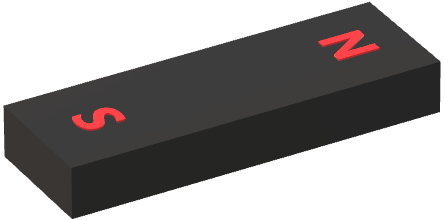
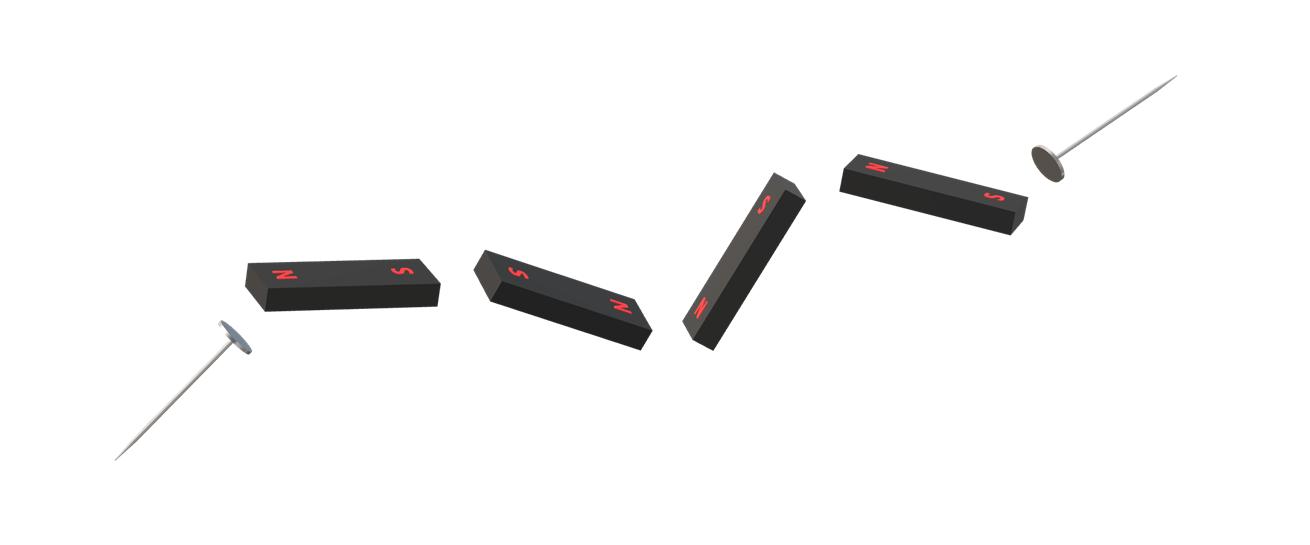
**Magnetic poles**



Every magnet has two poles.

A bar magnet has a north-seeking-pole at one end.

At the other end it has a south-seeking-pole.



These statements are about the magnetic poles.

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

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | | I am **sure** this is right | I think this is right | I think this is wrong | I am **sure** this is wrong |
| **A** | N attracts magnetic metals and  S attracts magnetic metals. |  |  |  |  |
| **B** | N attracts the S of another magnet and  N repels the N of another magnet. |  |  |  |  |
| **C** | N has a positive electric charge and  S has a negative electric charge. |  |  |  |  |
| **D** | N has extra electric charge and  S is short of electric charge. |  |  |  |  |

*Physics > Big idea PEM: Electricity and magnetism > Topic PEM3: Magnets and electromagnets > Key concept PEM3.1: Magnetic fields*

|  |
| --- |
| **Diagnostic question** |
| **Magnetic poles** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The magnetic field around a magnet can be represented by field lines, which indicate the size and direction of the force of the magnet on the north-seeking-pole of another magnet. |
| Observable learning outcome: | Describe the rules of attraction and repulsion between two magnets. |
| Question type: | Confidence grid |
| Key words: | Magnetic, north-seeking-pole, south-seeking-pole, attract, repel, electric charge |

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This diagnostic question probes understanding of ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

Borges and Gilbert (1998) unpicked how students aged 15 (n=9) and 18 (n=19), teachers (n=11), technicians (n=10) and electrical engineers (n=7) thought about magnetism. They found evidence of three models of understanding that Erickson had previously described (1994) and identified two further models, which encompassed more advanced thinking. They found that all of the 15-year-olds in their study held one or more of the first three models. The first model merely labels the observed effects of a magnet; and the second and third contain common misunderstandings:-

* Magnetism as a pull – describing what magnets do, rather than what they are.
* Magnetism as a cloud – an area of influence around a magnet that can act on other objects.
* Magnetism as electricity – described as an attractive force between unlike electric charges and a repulsive force between like electric charges.

The understanding of *magnetism as electricity* appears to be *caused by* the earlier teaching of static electricity. The similarities between the terminology used in magnetism and in electrostatics can also cause confusion. Some students, for example, refer to the positive pole and the negative pole of a magnet. Others described the poles of a magnet as regions with an ‘excess’ or a ‘lack’ of electric charge.

It is only possible to tell the difference between a magnetic material (that is attracted by a magnet) and a magnet if two magnets are used, because one magnet can repel part of another magnet, but not a magnetic material. The majority of students are unlikely to have experienced this repulsive force (Knight, 2004).

The poles of a magnet are called the north-seeking-pole and the south-seeking-pole, because when a magnet is free to rotate, the north-seeking-pole turns to point to the North Pole of the Earth. This means that at the Earth’s North Pole is a magnetic south-seeking-pole, in order to attract the north-seeking-pole of a magnet. Most often, ‘north-seeking-pole’ is shortened to ‘north-pole’, but using the full name better describes the action of a magnet and challenges some misunderstanding about the orientation of the Earth’s magnetic field.

**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**

Statements A and B are correct.

Statements C and D are wrong.

**How to respond - what next?**

Most students are likely to remember that unlike poles attract and like poles repel, although some may not have experienced the repulsive force between two magnets. Some students may not be familiar with the words *attract* and *repel* to mean ‘pulling towards’ and ‘pushing apart’ and may be confused by this terminology.

It is very common for students to wrongly think that magnetic attraction and repulsion are caused by a static electric charge at the poles of a magnet. The cause of magnetic fields is a very challenging concept to understand and is generally taught at the level of an undergraduate degree. At this stage, it is sufficient for students to know that magnetic fields are not caused by a static electric charge. In the BEST ‘key concept’: PEM3.2 Electromagnets, the connection is made between *moving* electric charge and a magnetic field.

If students have misunderstandings about the rules of attraction and repulsion between two magnets, it is helpful to give them hands on experience with a pair of magnets to clarify their understanding. They might be challenged to use one bar magnet to distinguish between one steel nail that has been made into a magnet and another that has not. The following BEST ‘response activity’ could be used with this activity:

* Response activity: Is it a magnet?

If students have misunderstandings about whether or not magnetic attraction and repulsion are caused by static electric charge, it can help to demonstrate the effect of a bar magnet on a compass needle and compare this to the effect of the force of an electrically charged plastic rod on the same needle. The south-seeking pole of the bar magnet will attract the north-seeking-pole of the compass needle and repel the opposite end of the needle. A plastic rod with a positive charge will attract both ends of the compass needle, as will a plastic rod with a negative charge.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG).

Images: Peter Fairhurst (UYSEG).

**References**

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