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ENRICHMENT ACADEMY

PSLE Science E-Guide

Magnets

To help your child with this, we have created a special e-guide on the topic of Magnets, which covers:

- A summary of the key content points within this topic that your child needs to know
- A breakdown of a diagram-based question and how your child can arrive at the right answers
- 2 sample questions that your child can try as well as the proposed answers that you can share with your child after he/she's attempted the questions

Science is a tricky subject to study for, because your child will need to retain topical knowledge and apply it accurately to various question types.

The latter task can be challenging, especially when it comes to free-response questions (FRQs) that include graphs or experimental set-ups.

Your child will need to first identify which concept(s) are tested, tap on his/her topical knowledge, and then apply the relevant facts through the appropriate answering techniques to meet the question's requirements. The correct scientific keywords or phrases must also be used in crafting the answer for your child to be awarded the full marks.

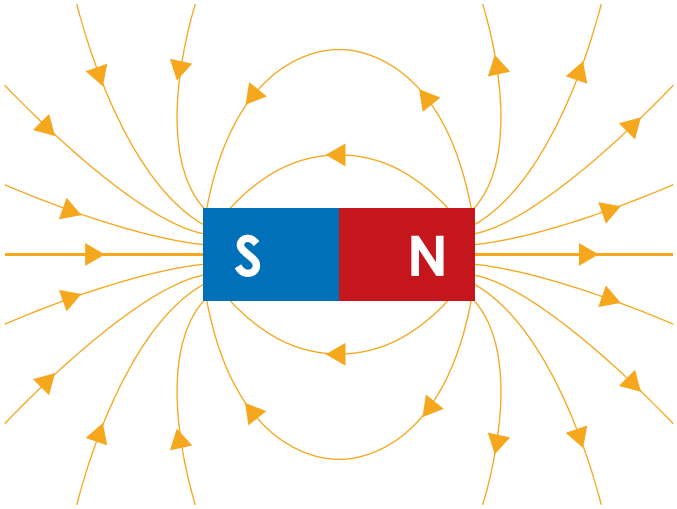
Reviewing the Topic

What Do You Need to Know?

Before attempting any questions, let us first review some of the information your child will need to know about Magnets.

1. WHAT ARE MAGNETS?

Magnets are objects that create an area of magnetic force known as a magnetic field. These fields are invisible to the human eye. Magnets only attract certain types of metals, such as nickel, cobalt, iron and steel.



Magnetic Field of a Magnet

Magnetic materials are materials that are attracted by magnets, while materials that cannot be attracted by magnets are called non-magnetic materials.

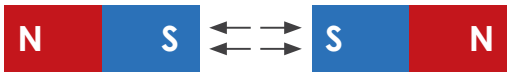
Magnetic Materials	Non-magnetic Materials	
Steel	Aluminum	Silver
Iron	Copper	Plastic
Nickel	Lead	Wood
Cobalt	Gold	Paper

Pro Tip!

Use the acronym "**S**uperman **I**s **N**ot **C**ool" to remember the first letters of the 4 magnetic materials.

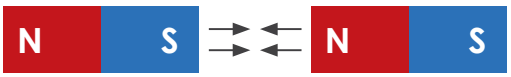
If the same pole of two magnets (like poles) are put close together, they will repel (push away from) each other, e.g. north pole with north pole or south pole with south pole.

Like Poles Repel



If different poles (unlike poles) are put close to each other, they will be attracted to (pull towards) each other, e.g. north pole with south pole.

Unlike Poles Attract



Magnets have a north pole and a south pole.

2. WHAT ARE THE CHARACTERISTICS OF MAGNETS?

Magnets can attract and repel through non-magnetic materials.

Magnetic objects must be inside the magnetic field to respond, which is why you may have to move a magnet closer for it to have an effect.

The strength of a magnet is stronger as you get closer to it. Likewise, its strength is weaker as you move farther from it.

A magnet is strongest at its poles. Its strength diminishes rapidly moving away from the poles. At a point midway between its two opposite poles, a bar magnet exhibits no magnetism at all, because the effects of the opposite poles cancel one another. The poles of a magnet are not necessarily of equal strength.

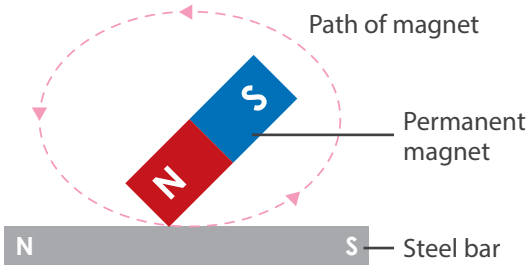
3. HOW ARE MAGNETS MADE?

Magnetism can be passed from magnets to other magnetic materials such that they become magnets too. This is known as induction.

Stroking a magnetic material with a permanent magnet causes the magnetic domains in the material to align. The material, thus, becomes a magnet.

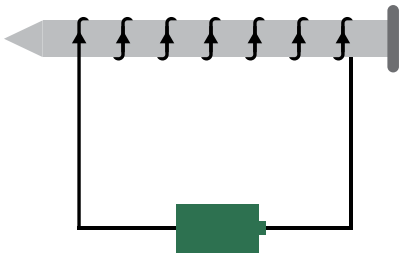
Magnetic materials like a piece of iron or steel can be magnetised using the following methods:

The 'Stroke' Method



Stroke the complete length of a steel nail with one of the poles of a bar magnet starting from one end of the nail. Do this about 30 times in **the same direction**.

The Electrical Method



Wind a piece of covered wire about 20 times around the length of an iron nail. Remove the covering on both ends of the wire and connect them to a battery. This creates an electromagnet.

4. HOW DO MAGNETS LOSE MAGNETIC STRENGTH OR BECOME DEMAGNETISED?

Temporary magnets lose their magnetism (become demagnetised) when not in the presence of a magnetic field.

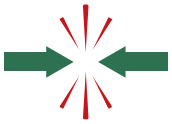
Permanent magnets remain magnetised without the influence of a nearby external magnetic field. They have their own field and are always magnetised.

A permanent magnet can lose its magnetism if its magnetic domains are arranged so that they are no longer aligned.

A permanent magnet can lose its magnetism by:

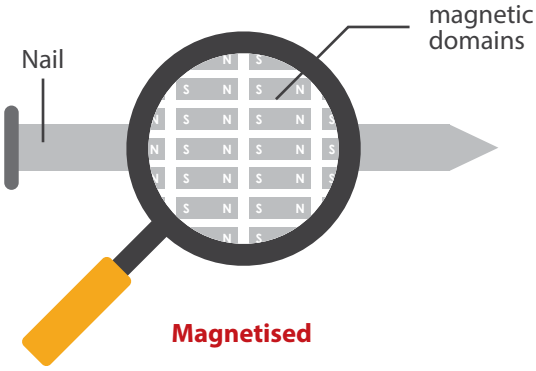
Heating

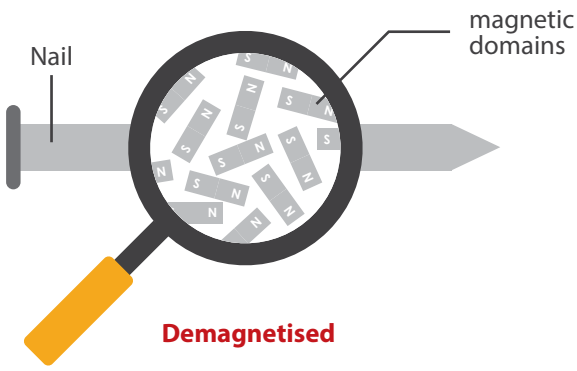
which increases the kinetic energy of the atoms.



Impact

which wrecks the orderly arrangement of the atoms.





5. WHAT ARE THE USES OF MAGNETS?

Magnets are used:

- in compasses
- to hold things together
- in electric motors
- in telephones, loudspeakers and doorbells
- to separate iron and steel from other materials
- to lift heavy iron and steel objects

Tackling Free-Response Questions (FRQs)

Now that we have reviewed the main points of the topic, we can start breaking down how your child can apply this knowledge when answering a diagram-based question.

The steps outlined here can be applied to any question, whether multiple-choice (MCQ) or open-ended/free-response (FRQ).

SAMPLE QUESTION

Three identical objects were separately wrapped in A4 size paper. George placed a bar magnet a distance of 1cm away from each one of them as shown in the diagram below.

Object wrapped in A4 paper | **Bar magnet**

His observations were recorded in the table below.

Object	Observation
X	It moved towards the magnet.
Y	It did not move.
Z	It moved away from the magnet.

Object Y is neither a magnetic material nor a magnet as it did not attract or repel the bar magnet

Object X could be a magnetic material or magnet as it was attracted to the bar magnet

Object Z is a magnet as it repelled the bar magnet

a. Which of the three objects (**X**, **Y** or **Z**) could be made from aluminum? (1)

Object Y

Step 1: Scan the Question

Identify what is being tested in the question and diagram or experiment.

For this question, you will need to recall the characteristics of magnets for parts (a) and (c) and the 4 magnetic materials for part (b).

Step 2: Read & Highlight

Read: Make notes or annotations to help you better understand the information presented in the question.

Here, you should pen down possible conclusions you can draw with each object given the observations indicated.

Highlight: Identify the keywords in the question that will help you arrive at the correct answer.

You can highlight the keywords and annotate in the margins as we have done below.

Step 3: Answer the Question

Note the marks awarded for each part of the question. They indicate the number of points & the amount of time you should allocate in crafting your response

Step 4: Check the Answer

Read the answer back to yourself on completing each part of the question.

Aluminium is not a magnetic material. Therefore, the correct answer would be Object Y, the only non-magnetic material in this set-up.

b. What material could Object **X** be made of? (1)

Iron

Object X is either a magnetic material or a magnet.

Since you are unable to tell which of the two it could be, the most appropriate answer would be any of the magnetic materials (steel, iron, nickel or cobalt).

c. Using exactly the same materials he used for the experiment above, George was able to make Object **Z** move towards the magnet when he repeated the experiment. What did he do to Object **Z** to make it move towards the magnet? (1)

He turned it around so that the unlike poles of Object Z and the magnet faced each other.

Object Z is a magnet which repelled the bar magnet in the set-up above. This means the like poles of the two magnets were facing each other.

In order for two magnets to attract each other, their unlike poles have to be facing each other instead.

Therefore, the appropriate answer would be to flip Object Z so that their unlike poles are facing each other.

Note that you should not state that he flipped the bar magnet, as the question specifically asks for what he did to Object Z.

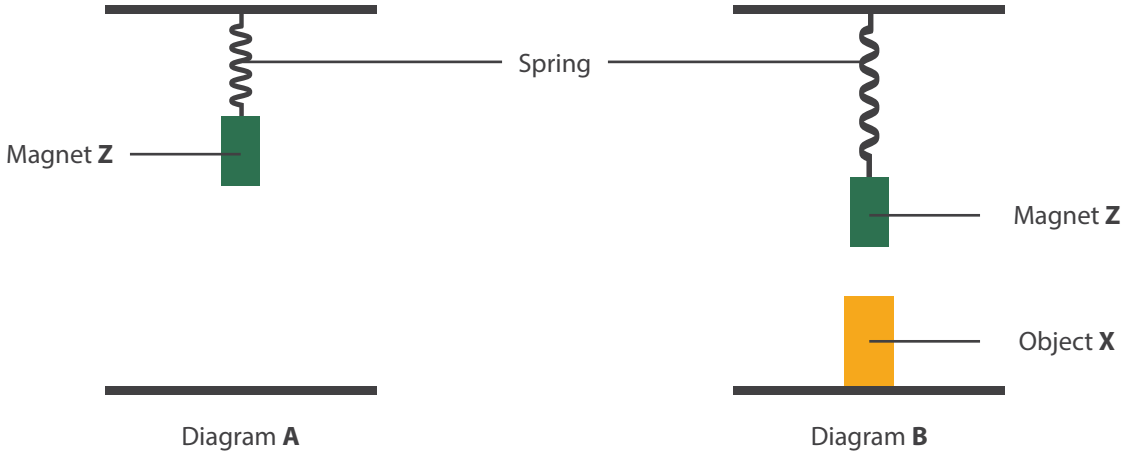
Try It Yourself!

Now that we have run through the step-by-step process your child can use to effectively understand and answer a question, he/she should be ready to try out some questions on his/her own. Here are two practice questions (one MCQ and one FRQ) that your child can try.

We have also included the proposed answers at the end of this guide, so that you can review your child's responses together with him/her.

PRACTICE QUESTION 1

Diagram **A** shows a magnet hanging from a spring. Diagram **B** shows what happened when Object **X** was placed beneath it.



Based on the diagrams, which of the following statement(s) could be true?

A. Object **X** is a metal.

B. Object **X** is a magnet.

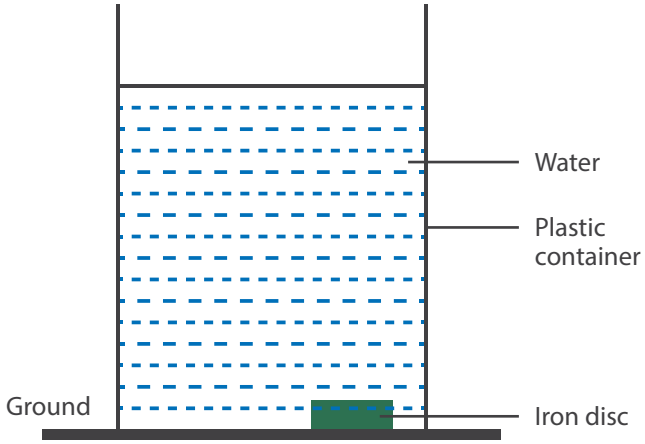
C. Object **X** is a non-metal.

D. Magnet **Z** was too heavy to be supported by the spring.

1. **A** and **B** only
2. **A** and **D** only
3. **B** and **C** only
4. **B** and **D** only

PRACTICE QUESTION 2

Watson found an iron disc at the bottom of a plastic container almost completely filled with water.



a. By using a large bar magnet only, describe how he can remove the iron disc without moving the barrel or wetting the magnet. (1)

b. Would Watson still be able to remove the disc in the manner you described in (a) if the container was filled with oil instead? Give a reason for your answer. (1)

Answer Key

PRACTICE QUESTION 1

Answer	Explanation
1	Object **X** could be made of a magnetic material (or it could be a magnet) as Magnet **Z** is attracted to it.

PRACTICE QUESTION 2

a. Place the magnet on the outside of the container as close to the iron disc as possible to attract it (½) then slowly slide the magnet to the top of the container and remove it (½).

b. Yes. Oil, like water, is not magnetic and will not prevent the magnet from attracting the iron disc (1).