

PRIMARY 3

BASED ON MOE SCIENCE CURRICULUM

**OPEN-ENDED
QUESTIONS
SUGGESTED
ANSWERS**

#1

INTERACTIONS

Magnets (15 Questions)

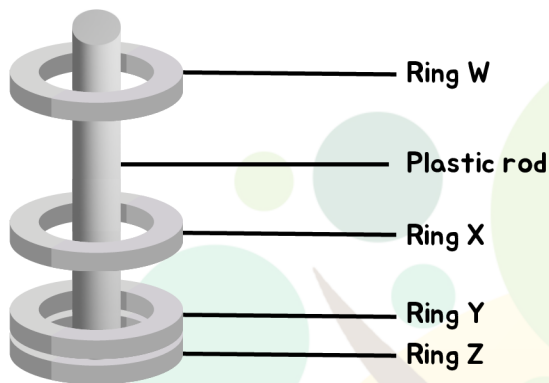


INTERACTIONS

MAGNETS

A1

Mandel slotted four similar rings onto a plastic rod and they came to rest in the positions shown below.



Four statements were made based on the above set-up.

In the table below, put a tick () under the correct heading to indicate if the statements are 'True', 'False', or 'Not Possible to Tell'.

	Statements	True	False	Not possible to tell
i)	All four rings are definitely magnets.			
ii)	Ring Z is made of iron.			
iii)	The like poles of Ring W and X are facing each other.			
iv)	Ring Y is made out of plastic.			

Suggested Answer(s):

	Statements	True	False	Not possible to tell
i)	All four rings are definitely magnets.		✓	
ii)	Ring Z is made of iron.			✓
iii)	The like poles of Ring W and X are facing each other.	✓		
iv)	Ring Y is made out of plastic.			✓

Explanation

(i) False: The positions alone don't confirm that all rings are magnets; other forces may be at play.

(ii) Not Possible to Tell: There's no evidence to determine if Ring Z is made of iron.

(iii) True: Rings W and X are floating apart, indicating their like poles are repelling.

(iv) Not Possible to Tell: The material of Ring Y isn't specified, so we can't confirm if it's plastic.

MAGNETS

A2

Yong Jie was given three objects, X, Y and Z, wrapped in paper. The objects were of similar sizes. He held a magnet about 2cm away from each one of them, as shown in the diagram below. Each object has parts A and B at their ends.

He then recorded his observations in the table below.

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

(a) Which one of the objects (X, Y or Z) could be made of aluminium?

(b) Using the letters (A, B, C or D) shown in the diagram above, describe what he could do to make object X move towards the magnet.

Suggested Answer(s):

(a) Object Z.

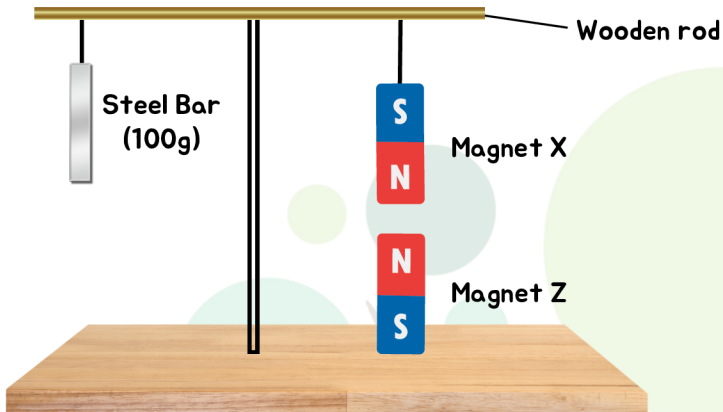
(b) To make object X move towards the magnet, Yong Jie could reverse the magnet's poles by using the opposite side (B instead of A, or C instead of D). This would likely cause the magnetic attraction instead of repulsion, making object X move towards the magnet.

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MAGNETS

A3

Linda set up an experiment as shown below. Magnet Z was fixed to the table below Magnet X to balance the wooden rod.



Based on Linda's experiment, indicate if each of the following statements is True, 'False' or 'Not possible to tell' by placing a tick (✓) in the correct column. (4m)

	Statements	True	False	Not possible to tell
i)	Magnet X is heavier than the steel bar.			
ii)	If the steel bar is removed, the wooden rod will tilt upwards on the right.			
iii)	If Magnet Z is replaced by an iron bar, the wooden rod will be balanced.			
iv)	If Magnet Z is placed below the steel bar instead of below Magnet X, the wooden rod will be balanced.			

Suggested Answer(s):

	Statements	True	False	Not possible to tell
i)	Magnet X is heavier than the steel bar.		✓	
ii)	If the steel bar is removed, the wooden rod will tilt upwards on the right.	✓		
iii)	If Magnet Z is replaced by an iron bar, the wooden rod will be balanced.		✓	
iv)	If Magnet Z is placed below the steel bar instead of below Magnet X, the wooden rod will be balanced.			✓

(i) False - No evidence suggests Magnet X is heavier than the steel bar.

(ii) True - Removing the steel bar will cause the rod to tilt upwards due to the magnetic pull.

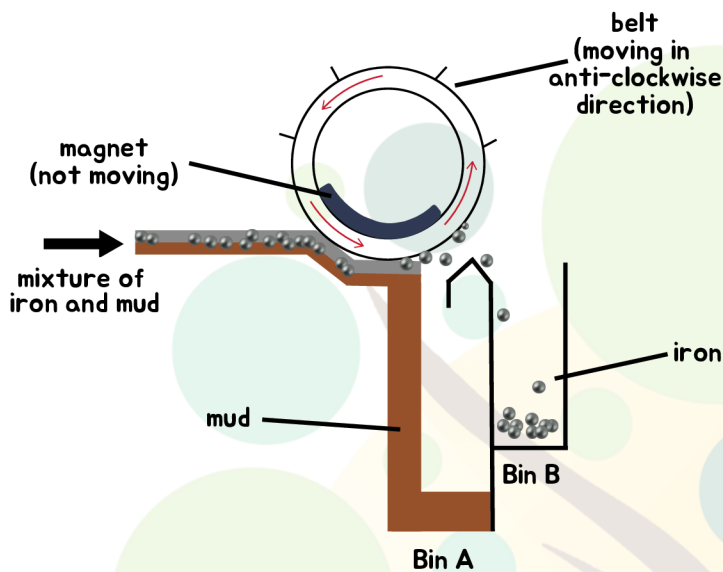
(iii) False - Replacing Magnet Z with an iron bar will not balance the rod.

(iv) Not possible to tell - The effect of placing Magnet Z below the steel bar is unclear based on the given setup.

MAGNETS

A4

The diagram below shows a machine used to separate iron from mud. A mixture of the iron pieces and mud was poured into the machine.



Suggested Answer(s):

(a) The belt passes near the magnet, which attracts the iron pieces and separates them from the mud.

(b) As the belt moved away from the magnetic field, the force of attraction between the magnet and the iron pieces weakened, allowing the iron to fall into bin B due to gravity.

(c) Increase the speed of the moving belt. (This would allow the machine to process the mixture faster and separate the iron from the mud more quickly.)

(a) The iron pieces in the mud were picked up by the moving belt. Give a reason for this.

(b) When the iron pieces on the moving belt moved away from bin A, the iron pieces dropped and were collected in bin B. Explain why this happened.

One way to fill bin B faster is to pour more mixture into the machine.

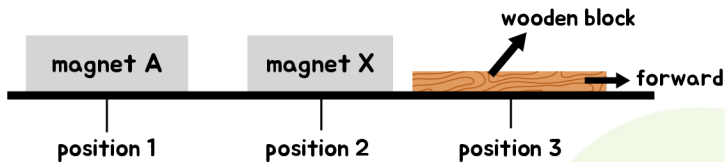
(c) Suggest another way to fill bin B faster.

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MAGNETS

A5

Eddie used the set-up shown below to investigate the effect of magnetic forces.



Eddie observed that when he placed magnet A at position 1, magnet X moved forward, pushing the wooden block forward as well. He recorded the distance travelled by the wooden block.

(a) Explain how magnet A was able to cause the wooden block to move forward.

He repeated the experiment by placing magnets B, C and D at position 1, one at a time. He then recorded his results as shown in the table below.

Magnet	Distance travelled by the wooden block (cm)
A	5
B	8
C	3
D	0

(b) Which magnet, A, B, or C, has the strongest magnetism? Explain your answer.

(c) Give one possible reason why when magnet D was placed at position 1, the distance travelled by the wooden block was 0 cm.

Suggested Answer(s):

(a) Magnet A produced a magnetic force that attracted or repelled magnet X. This caused magnet X to move forward, pushing the wooden block along with it.

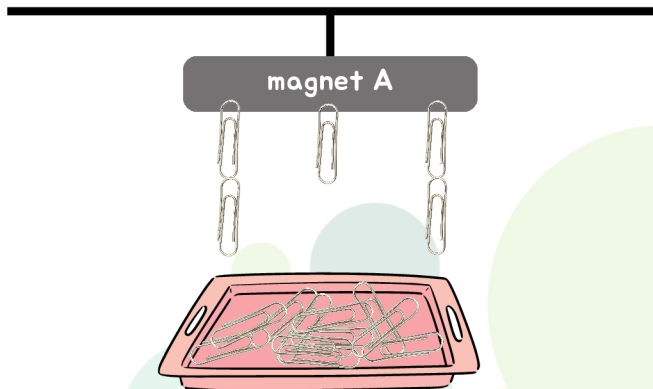
(b) Magnet B has the strongest magnetism because it caused the wooden block to travel the furthest distance (8 cm), indicating a stronger magnetic force acting on magnet X.

(c) Magnet D likely did not have any magnetic force (unlike poles), or its magnetic force was too weak to affect magnet X, resulting in no movement of the wooden block.

MAGNETS

A6

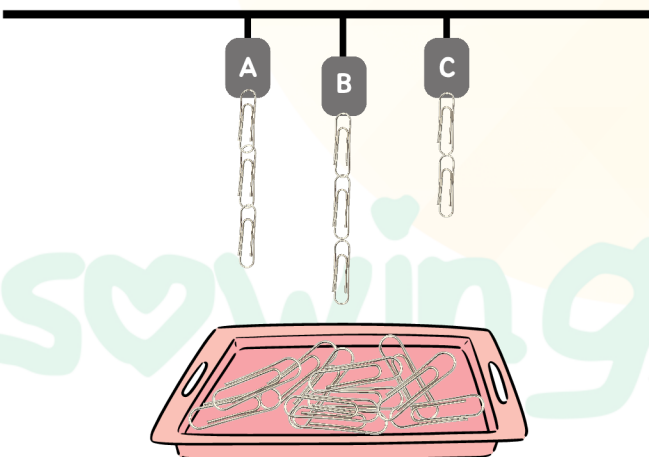
Alice hung magnet A over a tray of plastic, steel and copper paper clips as shown in the diagram below.



(a) Which type(s) of paper clips above would the magnet attract? Give a reason for your answer.

(b) She observed that the poles of magnet A attracted the most number of paper clips. Give a reason to explain her observation.

Alice changed the set up and hung magnets B and C. She then placed a tray of paper clips and observed the number of paper clips attracted by each magnet as shown below



Alice said that magnet A has a weaker pull than magnet B and C.

(c) Explain why her statement is incorrect.

Suggested Answer(s):

(a) The magnet would attract steel paper clips because steel is a magnetic material, while plastic and copper are non-magnetic materials and will not be attracted to the magnet.

(b) The poles of magnet A attracted the most number of paper clips because the magnetic force is the strongest at the poles of a magnet, allowing more paper clips to be attracted to those areas.

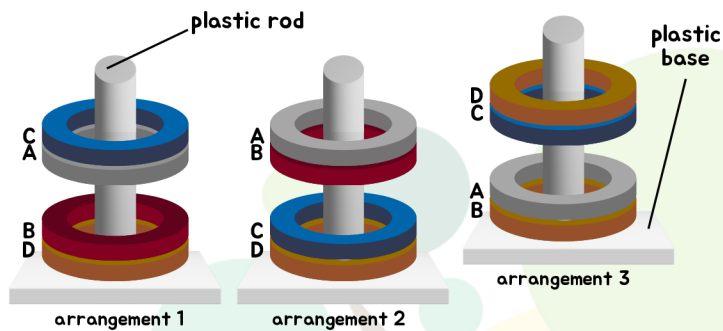
(c) Alice's statement that magnet A has a weaker pull than magnets B and C is incorrect because the number of paper clips attracted depends not only on the magnetic strength but also on the position of the magnets.

Magnet A might have been placed further away from the paper clips or not directly aligned, resulting in fewer paper clips being attracted. If placed under the same conditions, magnet A might attract an equal or greater number of paper clips.

MAGNETS

A7

Joo Seng put four metal rings A, B, C and D through a plastic rod in three different arrangements as shown below.



Suggested Answer(s):

(a) A, B and C.

(b) They all repel each other, indicating that they are magnets as like poles of magnets repel each other.

(c) Iron, steel, cobalt, nickel

(a) Based on the observations above, which of the metal rings are definitely magnets.

(b) Explain your answer in (a) above.

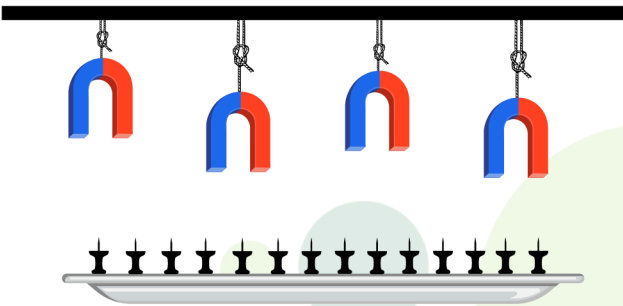
(c) Name two magnetic materials.

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MAGNETS

A8

Zhi Wen conducted an experiment to compare the strength of four U-shaped magnets as shown below. He hung the magnets on strings of different lengths over a tray of pins.



He recorded the number of pins attracted to the magnets in the table below.

Magnet	Number of pins attracted
W	10
X	2
Y	4
Z	6

(a) Which was the weakest magnet? Give a reason.

(b) Based on the set-up above, Zhi Wen, was unable to compare the strength of Magnets Y and Z. Give a reason.

(c) Magnet Y was replaced by a very strong magnet. Besides attracting more pins, state another possible observation that could happen.

Suggested Answer(s):

(a) The weakest magnet is Magnet X. Reason: Magnet X attracted the least number of pins (2), indicating its weak magnetic strength compared to the other magnets.

(b) Zhi Wen was unable to compare the strength of Magnets Y and Z because the strings holding the magnets are of different lengths. The varying distances from the tray affect the number of pins each magnet can attract, leading to inaccurate comparisons.

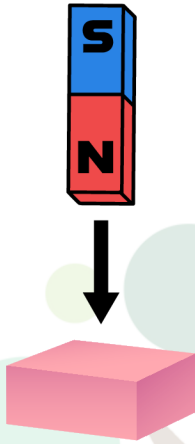
(c) Acceptable answers

- It would repel / attract Magnet X.
- It would repel / attract Magnet Z.
- It would repel / attract Magnet X and Z.
- It would repel / attract other magnets.

MAGNETS

A9

Joseph lowered a magnet towards an object as shown below.



As the magnet was lowered, the object moved up towards the magnet.

(a) What is the property of the material of the object?

(b) What would Joseph need to do to pick up a heavier object with the same magnet?

Suggested Answer(s):

(a) The material of the object is magnetic.

(Reason: It is attracted to the magnet and moves towards it.)

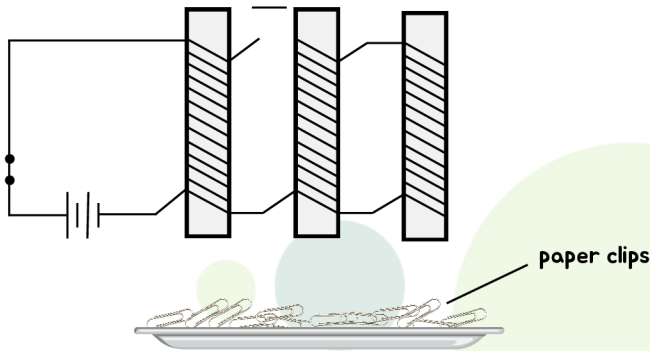
(b) Joseph would need to lower the magnet closer to the heavier object or use a magnet with a stronger magnetic force to lift the heavier object.

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MAGNETS

A10

Elsie set up the experiment as shown below.



When the switch was closed, some of the rods were able to attract some paper clips. Elsie counted the number of paper clips that were attracted to the rods and recorded her results in the table below.

Rod	Number of paper clips attracted when the switch was closed
A	0
B	4
C	6

(a) When the switch was closed, some of the paper clips were attracted to rods B and C. Explain why.

(b) Name one suitable material for rod A. Explain your choice.

Suggested Answer(s):

(a) When the switch was closed, electric current flowed through rods B and C, causing them to behave like electromagnets. The electric current generated a magnetic field around the rods, which attracted the paper clips.

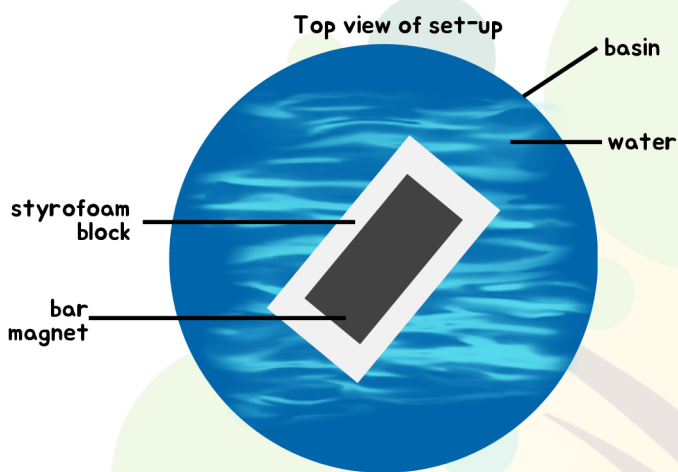
(b) Material: Plastic (or any non-magnetic material)

Explanation: Plastic is a non-conductor of electricity and cannot be magnetized. Thus, it will not attract any paper clips when the switch is closed.

MAGNETS

A11

Ahmad taped a bar magnet with poles X and Y, onto a piece of styrofoam block and spun it ten times in a basin of water. The diagram below shows the top view of the set-up when the magnet was at rest. The bar magnet always came to rest in the direction as shown in the diagram below.



The direction North is shown in the compass below.



Suggested Answer(s):

(a) A freely suspended magnet will come to rest in a north-south direction.

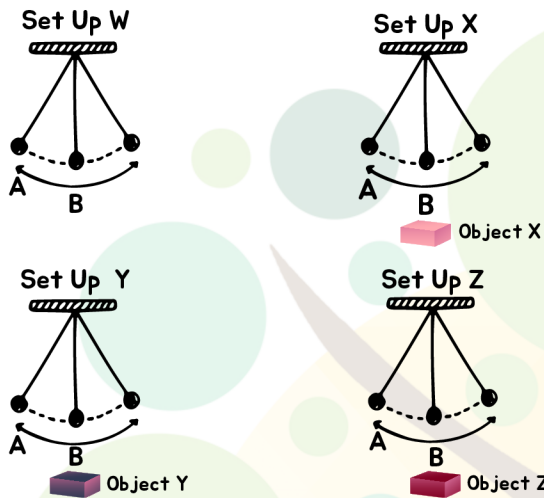
(a) Based on Ahmad's results, which property of magnets is shown in his observation?

MAGNETS

A12

In the four set-ups below, identical steel balls are hung on identical strings of the same length.

Objects X, Y and Z are placed under position B in set-ups X, Y and Z respectively.



The four steel balls were released from position A and allowed to swing freely till they came to a complete stop. The time taken for the balls to come to a complete stop is shown in the table below.

Set up	Time take for the ball to stop completely (s)
W	20
X	2
Y	5
Z	20

(a) Based on the results above, identify objects X, Y and Z using the categories below.

Magnet with strong magnetism:
Magnet with weak magnetism:
Wooden box:

Suggested Answer(s):

(a)

Magnet with strong magnetism: X

Magnet with weak magnetism: Y

Wooden box: Z

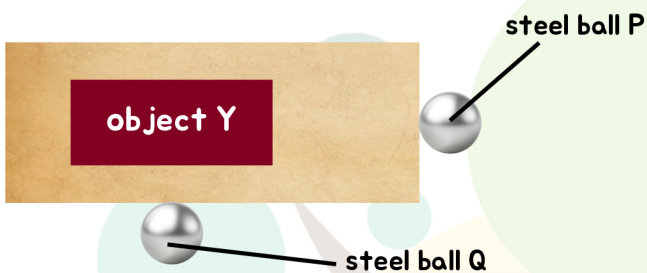
- Set-up W (20 s): No object under position B, unaffected.
- Set-up X (2 s): Greatest effect, object X absorbs the most energy.
- Set-up Y (5 s): Moderate effect, object Y absorbs some energy.
- Set-up Z (20 s): Behaves like W, object Z has no effect or energy absorption.

MAGNETS

A12

Qn 12 Continue ...

Two identical steel balls, P and Q, were placed next to object Y as shown below.



When object Y is lifted, only ball P remained attached to object Y.

(b) Explain why this is so.

(c) After object Y was heated for 5 minutes, ball P could no longer be lifted up together with object Y. Explain why.

(d) What can be done to increase reliability of the results?

Suggested Answer(s):

(b) As Y is a magnet, its magnetism is strongest at its poles so P could stay attracted while Q dropped.

(c) When object Y was heated, its magnetic properties weakened or were lost due to the increase in temperature, which can demagnetize the material. As a result, the magnetic force was no longer strong enough to hold ball P.

(d) Repeat the experiment at least 3 times and take the average.

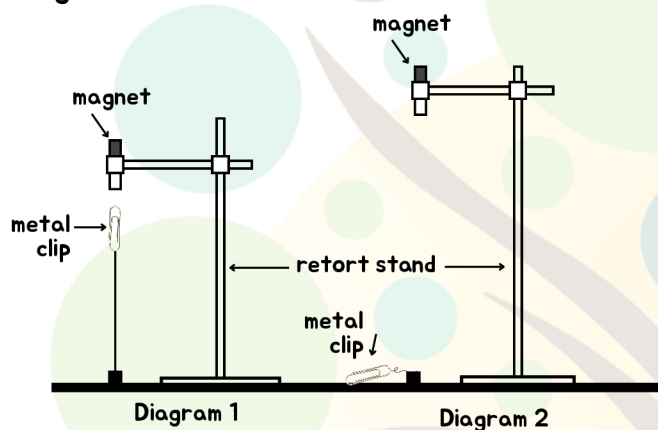
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MAGNETS

A13

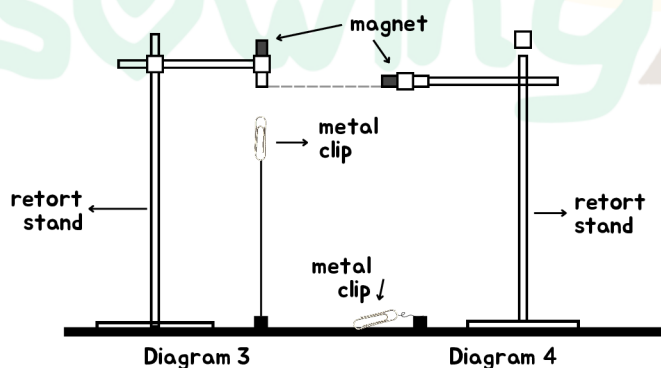
A metal clip, held by a string to the table, was attracted by the magnet and remained hanging in the air as shown in Diagram 1.

The experiment was then repeated by placing the magnet at a higher position above the table and the metal clip did not remain hanging in the air as shown in Diagram 2.



(a) Explain why the metal clip dropped to the table when the magnet was placed higher.

Another experiment was conducted as shown in Diagram 3 where the weight holding the metal clip is placed directly below the magnet. The experiment was repeated by placing the same magnet horizontally as shown in Diagram 4 where the weight holding the metal clip is placed directly below the center of the magnet.



(b) Explain why the metal clip in Diagram 4 will not be attracted.

Suggested Answer(s):

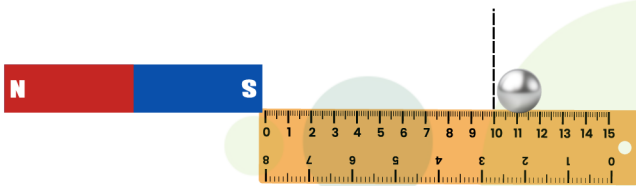
(a) The metal clip dropped to the table when the magnet was placed higher because the magnetic force between the magnet and the metal clip became weaker as the distance between them increased. This caused the gravitational force acting on the clip to exceed the magnetic force, making the clip fall.

(b) The magnet is the weakest at the centre.

MAGNETS

A14

Herman set up an experiment as shown. He moved the steel ball slowly from the 10 cm mark along the ruler towards Magnet W. He recorded the distance, d , at the point where the magnet attracted the steel ball. He repeated the experiment using Magnets X, Y and Z.



The table shows the results for all the four magnets, W, X, Y and Z.

Magnet	Distance d (cm)
W	6
X	8
Y	3
Z	5

(a) Why did the steel ball get attracted to the magnet?

(b) Based on the result of his experiment, arrange the magnets according to their strength from the strongest to the weakest.

Suggested Answer(s):

(a) The steel ball is a magnetic object and gets attracted to the magnet.

(b) X, W, Z, Y

MAGNETS

A14

Qn 14 Continue ...

(c) In the table, tick (✓) the variable(s) that Herman must keep the same to ensure a fair test?

Variables	Tick
Magnets of different sizes	
Same steel ball for each experiment	
Magnets of the same magnetic strength	

Herman replaced Magnet Y with a bigger sized magnet. It attracted the steel ball from a distance of 3 cm.

(d) What can you conclude about magnetic strength and size of magnet?

Herman dropped Magnet X several times and tested it out again.

(e) Will Magnet X attract the steel ball from a distance of 8 cm, more than 8 cm or less than 8 cm? Explain your answer.

Suggested Answer(s):

(c)

Variables	Tick
Magnets of different sizes	
Same steel ball for each experiment	✓
Magnets of the same magnetic strength	

(d) The magnetic strength of a magnet does not solely depend on its size. Even a smaller magnet can have a stronger magnetic force if it is more powerful.

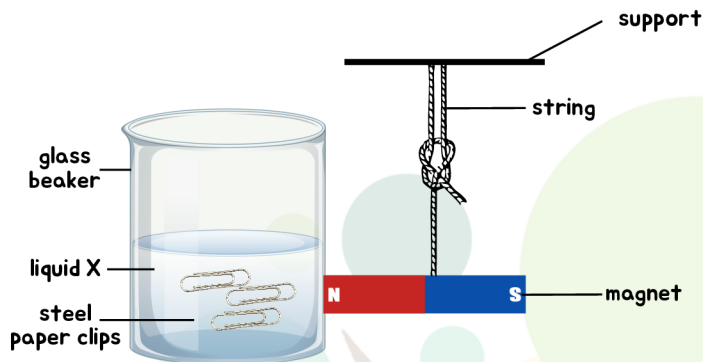
(e) Magnet X will likely attract the steel ball from less than 8 cm because dropping the magnet may weaken its magnetic strength, reducing the range at which it can attract the steel ball.

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MAGNETS

A15

Kumar placed three steel paper clips into a glass beaker containing liquid X. He used the North pole (N) of the magnet to touch the glass beaker as shown below.



(a) State a property of magnets that Kumar is trying to show? [1]

Kumar repeated the same experiment but he changed the part of the magnet touching the glass beaker. Using the same beaker, steel paper clips and magnet, he observed that the steel paper clips moved slower towards the magnet.

(bi) Which part of the magnet was touching the glass beaker? Explain. [1]

(bii) State another variable that Kumar must keep the same in the above experiment. [1]

Suggested Answer(s):

(a) Magnets can attract magnetic materials (like steel paper clips) even through non-magnetic materials such as glass or liquid.

(bi) The middle part of the magnet was touching the glass beaker. This is because the middle of a bar magnet has weaker magnetic strength compared to its poles, causing the steel paper clips to move slower toward the magnet.

(bii) The type of liquid used / the type of the paper clips / the size of the paper clips.

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PRIMARY 3

**OPEN-ENDED QUESTIONS
SUGGESTED ANSWERS #1**

INTERACTIONS: MAGNETS

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