1(a). A student investigates how the number of turns of wire on an electromagnet affects the strength of the magnetic field produced.

The student passes a current through a wire wrapped around an iron nail and uses this to pick up paperclips.

i. Name **two** variables the student controls in the experiment.

1 ---

2 ---

[2]

ii. The table shows the student's results.

Number of turns	Number of paperclips picked up
4	5
8	10
12	15
16	20
20	25

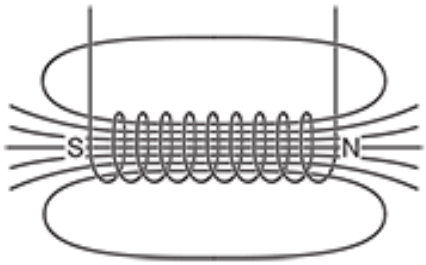
Describe the pattern shown by the student's results.

---**[2]**

iii. Predict how many paperclips the electromagnet will pick up if it has 28 turns.

---**[1]**

(b). The diagram shows a sketch of the magnetic field around the electromagnet.



i. Add arrows to the magnetic field lines to show the direction of the magnetic field.

[1]

ii. Write the letter **X** to show a position where the magnetic field is stronger.

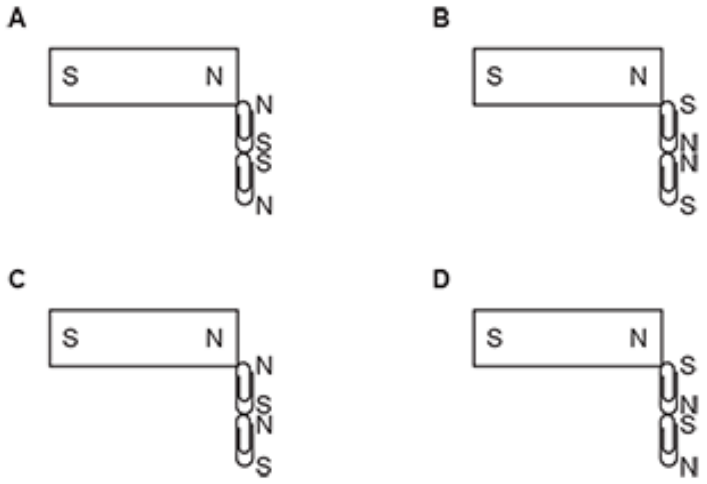
[1]

iii. Write the letter **W** to show a position where the magnetic field is weaker.

[1]

2. A magnet attracts two paperclips. S represents a South pole and N represents a North pole.

Which diagram shows the correct magnetic poles of each paperclip?



Your answer ☐ **[1]**

3(a). A fridge magnet is used to hold pieces of paper onto a metal fridge.

A student tests the strength of **three** square fridge magnets using this method:

- Place pieces of paper between each magnet and the fridge
- Increase the amount of pieces of paper until the magnets no longer stick to the fridge.

Suggest **two** variables that the student should keep the same for this experiment.

1 _____

2 _____

[2]

(b). The student tests three different magnets **A**, **B** and **C** and puts their results into a table.

Magnet	Maximum number of pieces of paper held by the magnet
A	24
B	20
C	26

Which magnet is the strongest? Give a reason for your answer.

Magnet _____

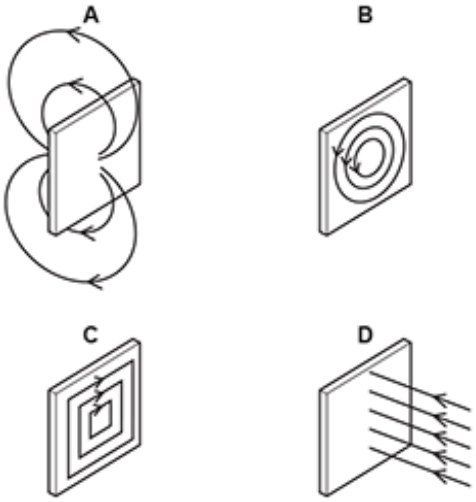
Reason _____

_____

[1]

(c). The front and back faces of fridge magnets are the poles.

A student draws four magnetic field line diagrams for a fridge magnet.



i. Which diagram, **A**, **B**, **C** or **D**, shows the correct magnetic field around a fridge magnet?

_____ **[1]**

ii. How does this diagram show the direction of the magnetic field?

_____ **[1]**

(d). A student writes a method to plot the magnetic field around a bar magnet using a plotting compass.

1 Join the dots together on the paper to show the field line.
2 Move the compass so that the opposite end of its arrow points to the dot you have just drawn.
3 Place the magnet on a piece of paper and draw around the magnet.
4 Place the compass near to one end of the bar magnet and mark where the compass arrow points to with a dot.
5 Draw another dot on the paper for the new compass position and repeat.

The student has written their method steps in the wrong order.

Write down the correct order for their method.

[2]

4. What is an induced magnet?

A A permanent magnet which is always magnetic.
B A permanent magnet with two identical poles.
C A temporary magnet which is only magnetic when it is within a magnetic field.
D A temporary magnet with two identical poles.

Your answer ☐ **[1]**

5. A student places a magnet next to a copper rod and then an iron rod.

	Copper rod	Iron rod
A	attracts	attracts
B	attracts	repels
C	nothing happens	attracts
D	nothing happens	repels

Which row in the table describes what happens?

Your answer ☐ **[1]**

END OF QUESTION PAPER