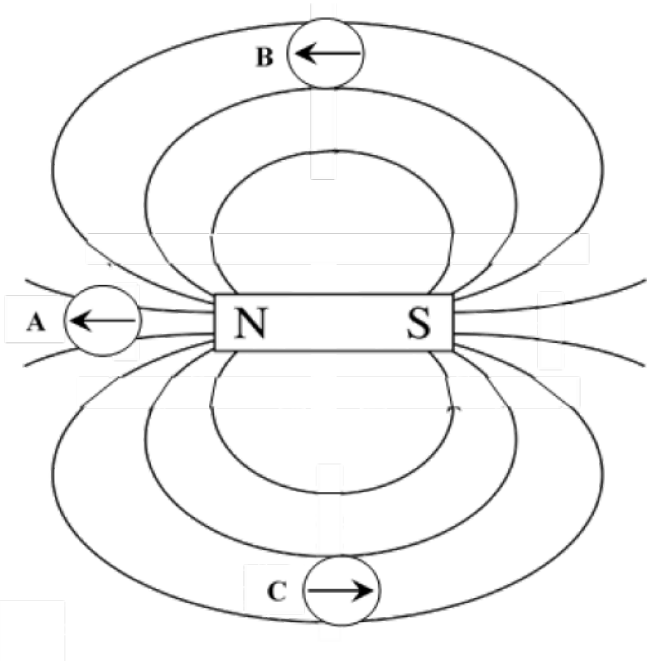
1(a). Two students are investigating magnets and electromagnets.

They use three plotting compasses to examine the magnetic field around a bar magnet.



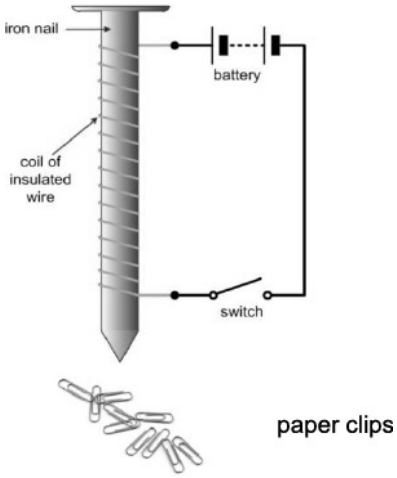
(i) Which of the plotting compasses, **A, B** or **C**, is faulty and pointing in the wrong direction?

_____ [1]

(ii) At which **ONE** of the three positions, **A, B** or **C**, will the bar magnet's field be the **strongest**?

_____ [1]

(b). They set up the apparatus below to test a simple electromagnet.



(i) The students decided to change one factor and see how it affected the strength of the electromagnet.

They both repeated their tests. Here are their results.

	Number of paper clips attracted	
Number of turns	Test 1	Test 2
0	0	0
10	6	5
20	13	14
30	22	20
Student A's results		

	Number of paper clips attracted	
Number of turns	Test 1	Test 2
0	0	0
10	2	4
20	5	9
30	11	17
Student B's results		

Student B used heavier paper clips.

In student B's experiment, calculate the mean for the number of paper clips attracted when **30 turns** were used.

_____ [1]

(ii) Which student, A or B, has collected better quality data?

Give **two** reasons to support your answer.

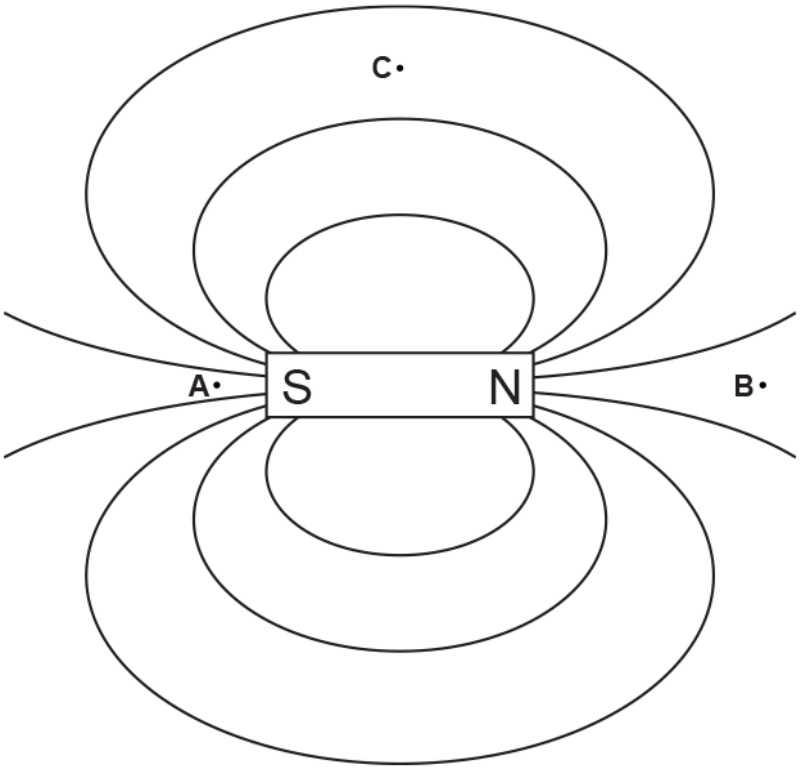
_____

_____

_____ [2]

2(a). The diagram shows the field around a bar magnet.

Three points are labelled **A**, **B** and **C**.



(i) Where is the field strongest?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

[1]

(ii) Where would a magnetic compass point to the right?

Tick (✓) **two** boxes.

A ☐

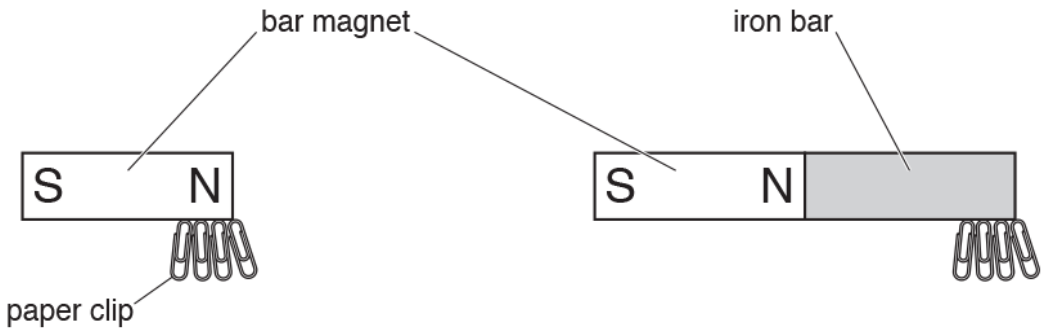
B ☐

C ☐

[1]

(b). The bar magnet can pick up paper clips.

An iron bar can also pick up paper clips if it is held next to a bar magnet.



Describe the difference in magnetism between the bar magnet and the iron bar.

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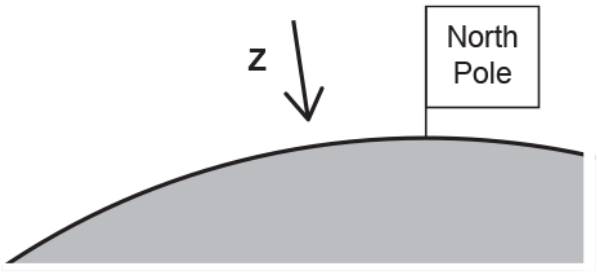
[1]

(c). The diagram shows a section through the Earth.

The flag marks the position of the geographic north pole of the Earth.

The arrow **Z** shows the point at which a compass needle would point vertically down at the surface.



Here are some statements about the Earth's magnetism, some are **true**, and some are **false**.

Put a **tick** (✓) in the correct box after each statement.

	True	False
A compass will always point towards the centre of the Earth.	☐	☐
The Earth's magnetic north pole is in the same place as the Earth's geographic north pole.	☐	☐
The core of the Earth is magnetic and produces a magnetic field.	☐	☐
The compass points down because the surface at the north pole is covered with iron.	☐	☐

[2]

END OF QUESTION PAPER

Question			Answer/Indicative content	Marks	Guidance
1	a	i	B	1	
		ii	A	1	
	b	i	14	1	
		ii	Student A's data is more repeatable / shows less scatter (1) Data is more accurate / precise as lighter paper clips used (1)	2	**ora** **do not allow** 'less range'; **allow** 'repeats show less range'. **ora**
			Total	**5**	
2	a	i	A ☑ ✓ B ☐ C ☐	1 (AO 1.1)	
		ii	A ☑ ✓ B ☑ C ☐	1 (AO 1.1)	Both ticks required for the mark. <u>Examiner's Comments</u> More candidates were able to answer part (i) correctly. There were a significant number of candidates who only ticked one box in part (ii), which could imply that the question was not read properly.

Question			Answer/Indicative content	Marks	Guidance
	b		EITHER bar magnet is permanent / does not lose magnetism / stays magnetic OR iron bar is induced magnet / will lose magnetism / will not stay magnetic ✓	1 (AO 1.1)	ALLOW: Iron bar in only magnetic / picks up paper clips when the magnet is there. Examiner's Comments Many candidates realised that the iron bar was not a permanent magnet and were given credit if they were able to explain this without using the words permanent or induced. Comments regarding the relative strength of the magnetic field were ignored in this question. Some candidates did mention positive or negative here, so were probably confusing ideas about magnetism with ideas about electric charge.
	c		<table><tr><th></th><th>True</th><th>False</th></tr><tr><td>A compass will always point towards…..</td><td></td><td>✓</td></tr><tr><td>The Earth's magnetic north pole is the same…..</td><td></td><td>✓</td></tr><tr><td>The core of the Earth is magnetic…..</td><td>✓</td><td></td></tr><tr><td>The compass points down because the surface…..</td><td></td><td>✓</td></tr></table>	2 (AO 1.1) (AO 2.1) (AO 1.1) (AO 2.1)	All 4 correct = 2 marks 2 or 3 correct = 1 mark 1 correct = 0 mark Examiner's Comments Two marks were available here for 4 correct ticks, and candidates who got two or three correct were credited one of the two marks. The most common incorrect response was to identify the first statement and/or the second as true.
			Total	**5**	