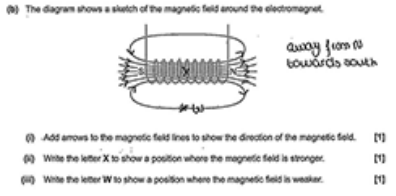
Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a	i	**Any two from**: Same (size/mass/weight/type of) paperclips ✓ Current (passing through wire) / voltage/potential difference (across turns) ✓ (Same) nail (throughout) ✓ Turns same distance apart ✓	2 (2 x AO 3.3a)	**ALLOW** type/material/diameter/length/resistance of wire **ALLOW** diameter of turns Size of turns is insufficient **Examiner's Comments** Only the higher performing candidates correctly identified control variables. Common errors were to put 'the number of turns' or the 'number of clips' having not realised that the question was asking for control variables or not understanding what a suitable control variable would be in this experiment. **Assessment for learning** It is not clear whether candidates who wrote 'the number of turns' or the 'number of clips' for example were unaware of what a control variable in an investigation is or that they did not read the question carefully and assumed it was asking about independent or dependent variables. Giving candidates the opportunity to learn how to read questions and instructions accurately is an important part of preparing for GCSE examinations.
		ii	As the number of turns increases the number of paperclips picked up increases ✓ **BUT** (they are) directly proportional ✓	2 (AO 3.1a) (AO 3.1b)	Every 4 turns picks up 5 more paperclips gains 2 marks Double the number of turns picks up double the number of paperclips gains 2 marks

					IGNORE (positive) correlation **Examiner's Comments** This was generally well answered by all candidates, with the higher performing candidates scoring 2 marks.
		iii	35 ✓	1 (AO 3.2a)	**Examiner's Comments** This was also very well answered by all candidates.
	b	i	Arrows drawn N to S on at least 1 field line and no contradicting arrows ✓	1 (AO 1.2)	
		ii	**X** labelled inside the solenoid or close to the either end of the electromagnet (where field lines are closer together) ✓	1 (AO 2.2)	Centre of the **X** anywhere within the space between the field lines and between the ends of the central 5 field lines on the diagram
		iii	**W** labelled at either side of the electromagnet (where the field lines are further apart) ✓	1 (AO 2.2)	The **W** anywhere outside the space between the 5 central field lines on the diagram **Examiner's Comments** This question was generally poorly answered. Only the higher performing candidates realised that the diagram was of a solenoid and that the strongest magnetic field would be inside the coils. A common misconception was that the field was stronger at the N end and weaker at the S end. More successful candidates were able to correctly label the direction of the magnetic field as coming from the N end and going to the S end. A common mistake was to draw arrows in both directions. Exemplar 1  (b) The diagram shows a sketch of the magnetic field around the electromagnet. away from (N) towards south (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]

					In Exemplar 1, the candidate has been given all 3 marks as they have drawn arrows on the magnetic field lines going from N to S, drawn an 'X' correctly inside the coil and drawn a 'W' outside the region where the field lines are close together.
			Total	**8**	
2			**D**	1 (AO 1.2)	
			Total	**1**	
3	a		**Any two from**: (Same) size/area of paper (sheets) ✓ (Same) thickness/type/mass of paper (sheets) ✓ (Same) amount of paper under the magnet (see Fig.) ✓ (Same) size/area of (fridge) magnets ✓ (Same) fridge ✓	2 (2× AO3.3a)	**Examiner's Comments** Despite the question stating that three different magnets were used, many candidates suggested 'the magnet' as a controlled variable.
	b		(Magnet C no mark) (It is the one which) held the most (paper) sheets / AW ✓	1 (AO3.2b)	**Examiner's Comments** This was mostly correctly answered although some candidates did not refer to the data in the table, stating, e.g. 'C is strongest.'
	c	i	A ✓	1 (AO3.2a)	**Examiner's Comments** Many candidates chose diagram D here, possibly attracted by the parallel straight field lines.
		ii	(direction of the) arrow ✓	1 (AO1.1)	**Examiner's Comments** Only some candidates referred to the arrows indicating the direction of the magnetic field.
	d		3 – 4 – 2 – 5 – 1 ✓ ✓	2 (2 × AO1.2)	**ALLOW** 1 mark for any three consecutive numbers in correct order (e.g. 3 – 4 – 2, 4 – 2 – 5, 2 – 5 – 1) **Examiner's Comments** This question discriminated well with successful candidates realising that statement 3 had to be the beginning

					and statement 1 had to be the end - this limited the options available.
			Total	**7**	
4			C ✓	1 (AO1.1)	
			Total	**1**	
5			C ✓	1 (AO1.2)	
			Total	**1**	