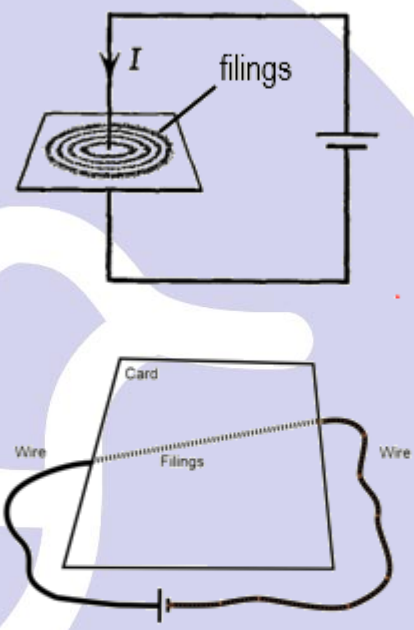


Mark Scheme

Q1.


| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|---|------------|
| | <p>An answer that combines four of the following points.</p> <p>MP1: Put wire {through card / near card / under card / over card / round rolled up card} (1)</p> <p>MP2: Put iron filings on card / around wire (1)</p> <p>MP3: Connect wire to power pack One wire is acceptable (1)</p> <p>MP4: Switch on or reference to current / charges flowing (in wire) NOT in filings (1)</p> <p>MP5: Filings attracted / moving / see if wire attracts filings (1)</p> <p>MP6: Pattern seen in filings – circles / lines / onion (1)</p> | <p>IGNORE use of apparatus not specified in the list (Iron nails etc)</p>  <p>marking points can be scored from a diagram</p> <p>filings show shape of field</p> | (4) |

Q2.

| Question number | Answer | Additional guidance | Mark |
|-----------------|------------------------------|---|------------|
| i | circle shown around wire (1) | allow tolerance for translation of 3D to 2D ignore any multiplicity of those circles | (1) AO1 |

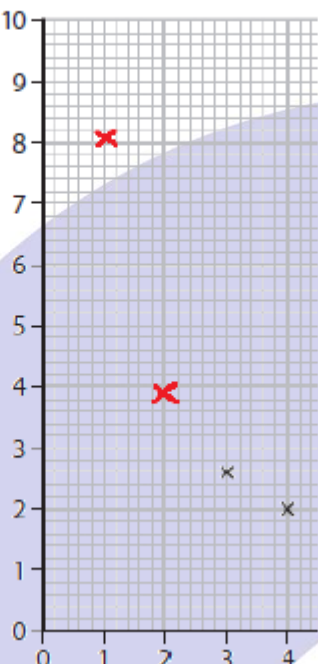
| Question number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------------|
| ii | arrow indicating a clockwise direction (for magnetic field line drawn for i) (1) | | (1) AO1 |

Q3.

| Question Number | Answer | Mark |
|-----------------|---|------|
| (i) | <p>The only correct answer is A</p>  <p>B is incorrect because it is not tangential to the (circular) magnetic field lines produced by the current C is incorrect because it is not tangential to the (circular) magnetic field lines produced by the current D is incorrect because it is not tangential to the (circular) magnetic field lines produced by the current</p> | (1) |

| Question Number | Answer | Additional guidance | Mark |
|-----------------|--|--|------|
| (ii) | <p>A description of the method that includes:</p> <p>EITHER (using single compass)</p> <p>record field at one location (1)</p> <p>find how field continues (1)</p> <p>connect the dots (to reveal overall shape of field / line) (1)</p> <p>OR</p> <p>arrange multiple compasses (1)</p> <p>over all of the card (1)</p> <p>direction of (all of) the compass needles indicates shape of field (1)</p> <p>OR</p> <p>sprinkle iron filings on card (before current is switched on) (1)</p> <p>switch on current/ tap card (1)</p> <p>pattern produced indicates shape of field (1)</p> | <p>Marking points may be awarded from a diagram.</p> <p>mark where compass points or put dots at each end of needle / arrow</p> <p>move compass to new position / until needle over previous dot</p> <p>start from different position and repeat (idea of obtaining concentric circles)</p> <p>all the way round the wire</p> <p>allow iron filings to arrange themselves</p> | (3) |

Q4.

| Question number | Answer | Additional guidance | Mark |
|-----------------|--|---------------------|------------|
| i |  <p>One mark for each point plotted correctly, to within ± 1 small square</p> | | (2) AO2 |

| Question number | Answer | Additional guidance | Mark |
|-----------------|---|---------------------|------------|
| ii | smooth curve drawn fitting the plotted points (1) | judge by eye | (1) AO2 |

| Question number | Answer | Additional guidance | Mark |
|-----------------|--|--|------------|
| iii | <p>substitution using an attempt at calculation – any subtraction seen (1) e.g. $2(.0) - 1(.0)$</p> <p>evaluation (1) (-) $1(.0)$ (mT)</p> | <p>accept any number that rounds to 1.0</p> <p>award full marks for correct answer without working</p> | (2) AO3 |

| Question number | Answer | Mark |
|-----------------|-------------------|------------|
| iv | (size of) current | (1) AO1 |

Q5.

| Question Number: | Answer | Additional Guidance | Mark |
|------------------|--|--|------------------------------|
| (i) | <p>a description to include 4 of the following:</p> <ul style="list-style-type: none"> • note position of pointer before current is switched on (1) • measure position of pointer when current in coil (1) • (use an ammeter to) measure current (1) • calculate the extension / stretch of the spring (1) • use force (of attraction) is proportional to extension / stretch (of spring) (1) • repeat with different currents (1) | <p>measure length of spring before current is switched on</p> <p>how far nail moves</p> <p>calculate force from spring constant and extension</p> <p>calibrate spring</p> <p>increase the current</p> <p>calculate the extension of the spring using new position of pointer minus starting position of pointer is worth 3 marks</p> | <p>(4) AO 2 2</p> |