

repulsion was caused by the interaction between the separate magnetic fields.

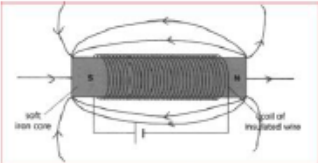
Mark Scheme

Q1.

Question number	Answer	Notes	Marks
(a)	A carbon;		(1)
(b)	A negatively charged electrons;		(1)
(c)	D steel;		(1)
(d)	C 2 N poles facing;		(1)

(Total for question = 4 marks)

Q2.

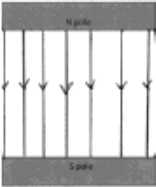
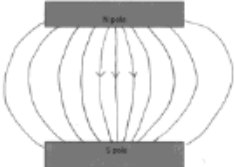
Question number	Answer	Notes	Marks
(a) (i)	<p>Any three from</p> <p>MP1. parallel field shown inside the core;</p> <p>MP2. one complete line from a pole and to the other pole;</p> <p>MP3. at least three lines at each pole with a minimum of two correctly curved lines;</p> <p>MP4. Arrow on any external field line from N or into S;</p> 	<p>Condone dotted lines</p> <p>Reject Crossing field lines for MP3 only conflicting arrows for MP4 only</p>	3
(ii)	<p>idea that strength of magnetic field is increased;</p>	<p>allow concentrates the magnetic field ignore</p> <ul style="list-style-type: none"> • 'channels the magnetic field'/eq • references to soft iron • references to easily magnetised /demagnetised 	1
(b)	<p>any two from:-</p> <p>MP1 Steel is magnetically hard material/eq ;</p> <p>MP2 Steel becomes (permanently) magnetised;</p> <p>MP3 Steel remains magnetised (when current switched off) /paper clips remain attracted to steel;</p>	<p>NB do not credit repeat of stem (<i>remain attached</i> is in the stem)</p>	2

Q3.

Question number		Answer	Notes	Marks
	a	one of: iron is (soft) magnetic; iron loses its magnetism easily;	allow RA for steel	1
	b	these can be shown on a labelled diagram MP1. current carrying (insulated) wire; MP2. wrapped into coil; MP3. wrapped on iron core;	allow wire shown connected to a battery solenoid = MP2 only	3
	c	Any two ideas from: MP1. current/ voltage reduces OR eq; MP2. magnetic field of em reduces; MP3. (magnetic) force holding the iron plate to the magnet no longer present;	do not give marks for • 'the door closes'/eq • electricity • power allow current stops circuit broken • iron plate no longer magnetised	2

Total 6 marks

Q4.

Question number	Answer	Notes	Marks
(a) (i)	arrows on two or more {lines from N to S and/or clockwise on loops around wire};	accept arrows beside lines showing correct directions reject contradicting arrows (i.e. one correct and one incorrect)	1
(a) (ii)	horizontal arrow (by eye); pointing to the left;	accept <ul style="list-style-type: none"> • arrow not passing through wire • unlabelled arrow if clear DOP	2
(b)	EITHER: Uniform field drawn MP1. single straight line drawn perpendicular to and between poles; MP2. additional straight lines drawn either side that are parallel and evenly spaced (by eye); OR Non-uniform field drawn MP1. central straight line(s) drawn perpendicular to and between poles; MP2. correctly curved lines drawn either side of the centre and drawn symmetrically (by eye);	Lines can start/end at faces or edges of poles   ignore all arrows on lines	2

(c)	MP1. place compass around magnet and note / mark its direction; MP2. place compass in new position and note / mark its direction again; MP3. directions linked together to find a field line / pattern;	ignore references to iron filings award marks if clear in diagram if contradiction between words and diagram, go by the diagram allow use of additional compass(es)	3
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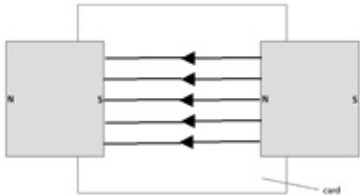
(Total for question = 8 marks)

Q5.

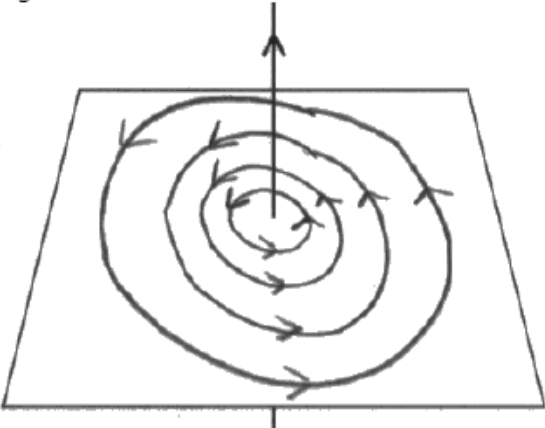
Question number	Answer	Notes	Marks
(a) (i)	MP1. minimum of 3 straight lines evenly spaced (by eye); MP2. at least one arrow showing direction from N to S;	ignore field outside the rectangle defined by the magnets	2
(b) (i)	any sensible suggestion; e.g. otherwise large heat loss/overheating thin wire would melt to reduce the resistance so it does not sag/bend/eq		1
(ii)	any 3 of: MP1. magnetic field of wire/current; MP2. interacts with; MP3. magnetic field of (2) magnets; MP4. Fleming's left hand rule;	For MP1 and MP3 must refer to what is causing the magnetic field	3
(iii)	MP1. reduce current; MP2. use less powerful magnets/greater separation of magnets;	ACCEPT Use thinner wire, switch off, reduce voltage not 'smaller' magnets allow rotate the wire so that the angle with the magnetic field is smaller	2

Total 8 marks

Q6.

Question number	Answer	Notes	Marks
(a) (i)	<ol style="list-style-type: none"> at least one arrow showing direction from N to S (right to left); one horizontal line between shaded faces; minimum of 3 horizontal lines evenly spaced (by eye); <p>e.g.</p> 	<p>Reject contradictory arrows</p> <p>For MP2,3 ignore any lines outside the rectangle between the shaded faces</p> <p>allow field lines that almost touch the faces</p>	3
(ii)	<ol style="list-style-type: none"> a method to show shape; e.g. use compass(es) Use of iron filings/ powder Use of (plotting) compass to show direction; a further method detail; e.g. mark card /move compass/multiple compasses idea of another line or lines added sprinkle (iron filings evenly on card) tap card (to distribute iron filings) 	<p>Ignore Position of card /Cling film</p> <p>Ignore pour/place/ drop /spill</p>	3
(b)	<p>any two of</p> <ol style="list-style-type: none"> (Fleming's) Left Hand (Motor) rule OR (current generates) magnetic field around the rod; Idea that there is a force (on rod); (translational) movement of rod; Correct direction given, i.e. out of the paper; 	<p>allow LHM rule/LH rule/motor rule/ motor effect</p> <p>Ignore upwards rod is magnetic</p>	2
		Total	8

Q7.

Question number	Answer	Notes	Marks
(a) (i)	<p>MP1. single circle centred on the wire and parallel to the plane of the card;</p> <p>MP2. at least two concentric circles;</p> <p>MP3. anti-clockwise direction arrow marked on at least one line;</p> <p>e.g.</p> 	<p>allow gap where circle crosses wire</p> <p>circles do not have to stay within the card</p> <p>DOP</p> <p>ignore spacing</p> <p>reject if contradicting arrows</p>	3

(ii)	<p>EITHER:</p> <p>MP1. iron filings used;</p> <p>MP2. tap card / eq.;</p> <p>OR</p> <p>MP1. (plotting) compass used;</p> <p>MP2. multiple compasses used / compass moved to new position;</p> <p>OR</p> <p>MP1. use of a magnet / another current-carrying conductor;</p> <p>MP2. to produce a force / movement;</p>	<p>ignore references to magnets, other current-carrying wires being used</p> <p>allow iron powder, steel dust etc.</p> <p>allow use of a magnetometer</p>	2
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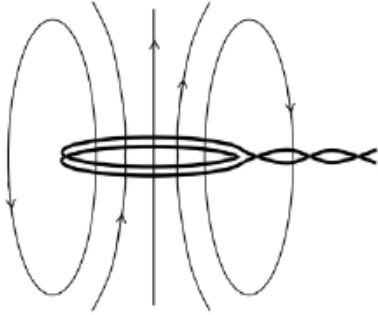
(b)	(i)	<table border="1"> <thead> <tr> <th>Statements</th> <th>Order</th> </tr> </thead> <tbody> <tr> <td>the switch is closed</td> <td>1</td> </tr> <tr> <td>the lamp is on</td> <td>(6)</td> </tr> <tr> <td>the armature is attracted</td> <td>3</td> </tr> <tr> <td>the contacts are pushed together</td> <td>5</td> </tr> <tr> <td>the electromagnet is magnetised</td> <td>2</td> </tr> <tr> <td>the armature rotates</td> <td>4</td> </tr> </tbody> </table> <p>all five numbers in correct positions = 3 marks;;; three-four numbers in correct positions = 2 marks only;; one-two numbers in correct positions = 1 mark only;</p>	Statements	Order	the switch is closed	1	the lamp is on	(6)	the armature is attracted	3	the contacts are pushed together	5	the electromagnet is magnetised	2	the armature rotates	4		3
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	(ii)	<p>idea that electromagnet loses its magnetism;</p> <p>AND 1 of;</p> <ul style="list-style-type: none"> armature no longer attracted / idea that armature moves away from the magnet opens the contacts / breaks the lamp circuit 	<p>condone idea that electromagnet is not magnetic</p> <p>allow iron for armature</p> <p>ignore references to current not flowing</p>	2														

Total for question = 10 marks

Q8.

Question number	Answer	Notes	Marks
a	Any FOUR from: MP1. Current in <u>coil</u> ; MP2. (Creates) magnetic field (around the wires of the coil); MP3. Interaction of (this) field with that of (permanent) magnets; MP4. There is a force on the wire(of coil); MP5. Reference to left hand rule; MP6. force up on one side and down on other side;	current in circuit is not enough coil becomes an electromagnet allow field cutting as the interaction idea of catapult field reference to moment/turning effect on the coil	4
b i	one of <ul style="list-style-type: none"> • Reverse supply polarity (however described); • reverse current direction (however described); • swap magnets over(however described); 		1
ii	any one from: <ul style="list-style-type: none"> • Reduce current (however described); • Reduce voltage (however described); • increase resistance of circuit (however described); • weaker magnetic field (however described); 	Allow : less turns on coil Condone: fewer coils	1

Q9.

Question number	Answer	Notes	Marks
(a)	<p>MP1. at least one straight, vertical central field line;</p> <p>MP2. any field line drawn circling the wire / at least one peripheral field loop;</p> <p>MP3. field directions correct and consistent throughout and shown on at least two lines;</p> 	<p>ignore breaking of field lines as they pass through the centre of the coil by eye</p> <p>condone spiral drawn round wire</p>	3
(b)	<p>any 3 from:</p> <p>MP1. idea of magnetic fields interacting;</p> <p>MP2. idea of (magnetic) attraction or repulsion;</p> <p>MP3. reversing current reverses direction of magnetic field / force;</p> <p>MP4. some comparison with magnets, e.g. like poles repel, unlike poles attract;</p>	<p>allow field lines crossing</p> <p>ignore 'cutting'</p> <p>reject mention of electrostatic force or charge</p> <p>mention of having 'poles'</p>	3

(Total for question = 6 marks)