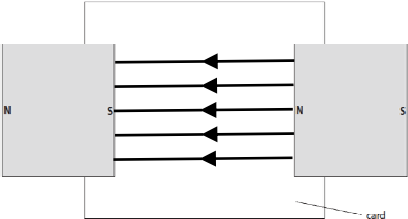


Question number	Answer	Notes	Marks
2 (a) (i)	MP1. minimum of 3 straight lines evenly spaced (by eye); MP2. at least one arrow showing direction from N to S;	ignore field outside the rectangle defined by the magnets	2
(b) (i)	any sensible suggestion; e.g. otherwise large heat loss/overheating thin wire 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

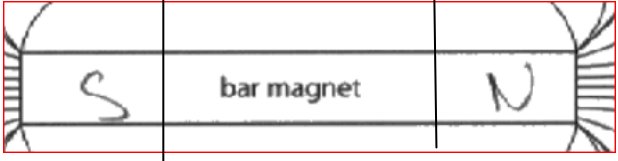
Question number	Answer	Notes	Marks
3 (a) (i)	<p>1. at least one arrow showing direction from N to S (right to left);</p> <p>2. one horizontal line between shaded faces;</p> <p>3. minimum of 3 horizontal lines evenly spaced (by eye);</p> <p>e.</p>  <p>(ii)</p> <p>1. a method to show shape;</p> <p>e.</p> <p>use compass(es)</p> <p>Use of iron filings/ powder</p> <p>2. Use f (plotting) compass to show direction;</p> <p>3. further method detail;</p> <p>e.</p> <p>mark card /move compass/multiple compasses</p> <p>idea of another line or lines added</p> <p>sprinkle (iron filings evenly on card)</p> <p>tap card (to distribute iron filings)</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> <p>Ignore Position of card /Cling film</p> <p>Ignore pour/place/ drop /spill</p>	<p>3</p> <p>3</p>

Question number	Answer	Notes	Marks
(b)	any two of 1. (Fleming's) Left Hand (Motor) rule OR (current generates) magnetic field around the rod; 2. Idea that there is a force (on rod); 3. (translational) movement of rod; 4. Correct direction given, i.e. out of the paper;	allow LHM rule/LH rule/motor rule/ motor effect Ignore upwards rod is magnetic	2
		Total	8

Question number		Answer	Notes	Marks
4 (a)		any three of MP1 idea that there is current (in the wire/coil); MP2 idea that (the coil has) a magnetic field ; MP3 idea that coil's magnetic field interacts with field of permanent magnet; MP4 idea that there is a force on the coil/wire; MP5 Idea that current or force reverses every half turn;	Allow ideas of electromagnetic field, electromagnet Allow - 'magnetic fields touch / overlap' Ignore - 'cutting of magnetic fields' Allow ideas of LHM rule, Fleming's LHR, catapult field, attraction, repulsion Allow action of a commutator described	3

<p>(b) (i)</p>		<p>any two of</p> <p>MP1 increase magnetic field(e.g. stronger magnets or magnets closer or magnets curved round coil);</p> <p>MP2 increase current OR voltage Or more cells;</p> <p>MP3 increase number of turns (on coil);</p> <p>MP4 a sensible alternative suggestion e.g. use two or more sets of coils at angles, lubricate axle;</p>	<p>Allow “use thicker wire”</p> <p>Ignore “stronger battery”</p> <p>Allow idea of 3 phase supply, iron stator</p>	<p>2</p>
<p>(ii)</p>		<p>Suggestion that clearly results in reversal of the current OR the cell connections OR the magnet’s field;</p>		<p>1</p>
<p>(c)</p>		<p>any two of</p> <p>MP1 Idea that force is increased (by stronger field);</p> <p>MP2 Idea of radial magnetic field (rather than a uniform one);</p> <p>MP3 Coil remains in the field for a longer time;</p>	<p>Allow idea that iron is magnetised</p> <p>Allow idea that magnetic field acts “all the way around”</p> <p>Allow idea that force acts over a larger part of a cycle</p>	<p>2</p>

Question number	Answer	Notes	Marks
5 (a) i	<p>there is a voltage;</p> <p>And one of (because there is a) change of flux OR field (lines) are cut; (which is) an induced voltage / emf;</p>	<p>Allow induced current</p>	2
ii	<p>greater deflection/voltage; Idea that rate of change of flux (linkage) is greater; eg more magnetic field lines cutting coil (per second)</p>	<p>ignore speed of magnet</p>	2
(b) i	<p>Idea that deflection is smaller;</p>		1
ii	<p>Idea that deflection is greater;</p>		1
iii	<p>Idea that deflection is in opposite direction;</p>		1
		Total	7

Question number	Answer	Notes	Marks
6 (a)	Position of poles indicated correctly near end of magnet; S on L AND N on R ;	Allow at the end of the magnet within $\frac{1}{4}$ or either end 	2
(b)	Any suitable method, e.g. <ul style="list-style-type: none"> • Place plotting compass at side/end of magnet; • Mark position of end of compass; • Move end of compass needle to new mark (and repeat); OR <ul style="list-style-type: none"> ○ Place magnet under paper / plastic; ○ Sprinkle iron filings over; ○ Tap paper gently (to reveal pattern); 	allow suitably clear diagram(s) reject for one mark 'charges' ignore comments about finding the direction of the field allow: steel dust for iron filings place for sprinkle	3

Total 5 marks

Question number	Answer	Notes	Marks
7 (a)	parallel field (DOP)	ACCEPT equally spaced and straight / equally spaced and do not change direction	2
(b)	<p>two (permanent / bar) magnets</p> <p>pole pieces arranged correctly e.g. North facing South</p> <p>idea of magnets being the correct distance apart</p>	<p>ACCEPT points made on an annotated diagram</p> <p>REJECT description of poles as positive / negative</p> <p>ACCEPT "close together", "not touching"</p> <p>ACCEPT idea that field is produced in the space between the N pole of one magnet and the S pole of the other</p> <p>REJECT answers that are clearly referring to electromagnets</p>	3

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

Total for Question 8 = 4 marks

Question number	Answer	Notes	Marks
9 (a) (i)	any two ideas from: - MP1. voltage / current is <u>induced</u> ; MP2. (because) field in coil is changing / field (lines) cut; MP3. current/voltage changes direction when magnet does; MP4. magnet slows down causing decrease in amplitude;	allow voltage for amplitude	2
(ii)	Either of - (voltage/current) changes direction; Positive <u>and</u> negative (voltage/current);	Ignore "wave"	1
(iii)	any two of - MP1. direction of magnet changes; MP2. amount of field (lines) cut changes / rate of flux cutting; MP3. direction of flux cutting changes; MP4. speed of magnet changes / slows down; MP5. as movement diminishes, so does voltage;		2
(b)	Any three of - MP1. Alternating trace that diminishes; MP2. Amplitude is larger; MP3. Frequency is lower;		3

Total 8 marks