Mark Scheme

Q1.

Question number	Answer	Mark
(a)	An arrow on the line CD pointing upwards	1

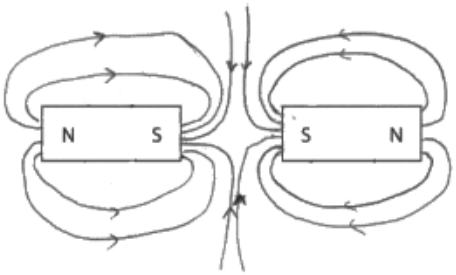
Question number	Answer	Mark
(b)	Any one from the following: • reverse polarity of magnetic field/equivalent • reverse direction of current/equivalent	1

Question number	Answer	Mark
(c)	Any two from the following: • decrease current/(battery) voltage/equivalent (1) • decrease strength of magnet/equivalent (1) • increase friction (in bearings) (1)	2

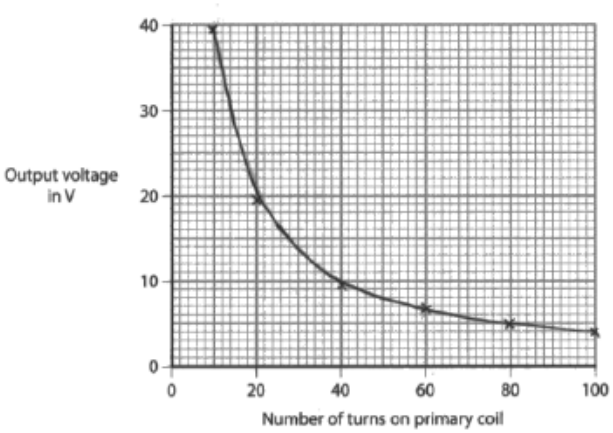
Q2.

Question number	Answer	Notes	Marks
	north; steel; hard; north; soft;	this order only	5

Q3.

Question number	Answer	Notes	Marks
(a)	MP1. method to show shape; e.g. use compass(es) use of iron filings / powder MP2. use of plotting compass **to show direction**; MP3. a further method detail; e.g. move compass / multiple compasses in different positions idea of another line or lines added sprinkle iron filings (on to card) tap card (to distribute iron filings)	all marks may be given from diagram allow if compass seen in diagram pointing in a suitable direction allow equivalent materials to card e.g. paper, plastic etc.	3
(b)	correctly drawn field line patterns for both bar magnets; correctly drawn field line pattern for region between the magnets; at least three field line directions given from north to south;  	 should show no lines linking south poles not every line needs to have an arrow reject mark if directions contradict 2 marks max. if any lines overlap condone lines touching	3

Q4.

Question number	Answer	Notes	Marks
(a) (i)	Points plotted to within half a small square; **Number of turns on primary coil** / **Output voltage in V** 10 / 39.6 20 / 19.7 40 / 9.9 60 / 6.6 80 / 5.0 100 / 4.0  	Points should lie on a very good curved line.	1
(ii)	Best fit line is smooth curve;	ECF their data points.	1
(iii)	As number of (primary) turns increases, (secondary) voltage decreases; At a decreasing rate/is non-linear;	Allow RA Allow unqualified 'inversely proportional' for 2 marks. Ignore: 'negative exponential'	2

(b) (i)	$(N_p/N_s) = (V_p/V_s)$;	Allow any correct rearrangment. Allow "i(nput) and o(utput)" or "1 and 2"for "p(rimary) and s(econdary)". Allow correct word equation. Ignore 'P' for 'N' Condone 'T', 't' or 'n' for 'N' Condone 'coils' for 'turns'	1
(ii)	Substitution of values for N_p, V_P and V_s ; Evaluation of N_s ; e.g. 40 / N_s = (6.8/9.9) = 0.686....; N_s = 40 /0.601.. = 58(.2....) ;	Allow any row of data from table or co-ordinates for a point on the line on the graph Accept answer in range 57-60. Accept non-integer number of turns.	2

Q5.

Question number	Answer	Additional guidance	Mark
(a)(i)	Number of metal discs	allow load	1

Question number	Answer	Additional guidance	Mark
(a)(ii)	(Soft) iron is a magnetic material	easy to magnetise/demagnetise	1

Question number	Answer	Mark
(b)(i)	• Scale on the y-axis (1) • Both axes labelled with variable and unit (1) • Plotted (1) • Bars drawn (1)	4

Question number	Answer	Mark
(b)(ii)	To support the weight of the (soft iron) bar (1)	1

Question number	Answer	Additional guidance	Mark
(b)(iii)	An explanation that makes reference to three of the following points: • repeat and average (1) • repeat anomalous result (1) • use intermediate weights e.g. 1, 3, 5, 7, 9 (1) • extend the range of the results beyond 10 weights (1) • use standard masses (1)	however expressed	3

(Total for question = 10 marks)

Q6.

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>(a)</td><td>one mark for each correct row;;;

<table>
<tr><th>Energy store in magnet B</th><th>Increases</th><th>Decreases</th><th>Stays the same</th></tr>
<tr><td>gravitational</td><td></td><td>✓</td><td></td></tr>
<tr><td>magnetic</td><td>✓</td><td></td><td></td></tr>
<tr><td>kinetic</td><td></td><td></td><td>✓</td></tr>
</table>
</td><td></td><td>3</td></tr>
<tr><td>(b)</td><td>downward arrow labelled “weight”;

arrow same length as upward force arrow;</td><td>ignore gravity
allow gravitational force, gravitational pull
ignore arrows associated with magnet A
judge by eye</td><td>2</td></tr>
<tr><td>(c)</td><td>any five from:

MP1. caliper (to measure distance);

MP2. balance (to check mass is 10g);
MP3. use of set square to ensure vertical distance;
MP4. independent variable identified as the mass added;
MP5. dependent variable identified as the distance;
MP6. repeat readings and find mean (average);
MP7. plot graph of results;
MP8. (identify and) remove / ignore anomalies;</td><td>allow any marking point if clear from diagram
allow ruler, measuring tape
allow scales</td><td>5</td></tr>
<tr><td>(d)</td><td>any three from:

MP1. idea of magnet C providing a downward force on magnet B;
MP2. idea that total downward force on magnet B is greater (than before);
MP3. (creating) resultant downward force on magnet B;

MP4. idea that (upward) force of magnet A on magnet B increases (when B moves down the shaft);
MP5. (because) idea that decreased distance gives stronger magnetic field (between A and B);</td><td>ignore any references to magnets having different strengths
allow “B is repelled by C” / eq

allow idea that total downward force greater than upward force
allow A repels B more strongly</td><td>3

Exp</td></tr>
<tr><td colspan="4">Total for question 4 = 13 marks</td></tr>
</table>

Q7.

Question number	Answer	Additional guidance	Mark
(a)(i)	Advantage: any suitable (1) e.g. • does not contribute to global warming • wind available in all parts of Earth • can be used on a large or small scale Disadvantage: any suitable (1) e.g. • noisy • visual pollution • harm to (migratory flocks of) birds	ignore renewable as given in the stem	2

Question number	Answer	Additional guidance	Mark
(a)(ii)	A description that makes reference to the following three points: • no output until 5 m/s (1) • linear increase of output from 5 m/s to 15 m/s (1) • output constant at 0.6 MW for speeds over 15 m/s (1)	data points must be referenced allow 1 mark for correct trend without any data references.	3

Question number	Answer	Additional guidance	Mark
(b)	A description that includes reference to five of the following points: construction: • soft iron core (1) • primary coils (1) • secondary coils (1) operation: • lower voltage applied to the primary coils/RA (1) • must be a.c. (1) • number of primary coils< secondary coils (1) • turns ratio of 220 (1)	may be shown on a labelled diagram	5

(Total for question = 10 marks)

Q8.

Question number	Answer	Notes	Marks
(a)	use of voltage = current × resistance; calculation of voltage across 240 ohm resistor (2.88 V); idea that voltages of two resistors in series adds up to supply voltage; evaluation of voltage across R; e.g. $V = I \times R$ $V_{240} = (0.012 \times 240 =) 2.88$ (V) $V_R + V_{240} = 9.2$ $(V_R =) 6.3$ (V)	allow rearrangements and standard symbols calculate total resistance of circuit (767 Ω) evaluation of resistance of R (527 Ω) evaluation of voltage across R (using V = IR) allow 2.9 (V) allow 9.2 – 2.88 or V + 2.88 = 9.2 allow 6.32 (V) if mA not converted to A and 2880 seen then award 2 marks max.	4

(b) (i)	any three from: MP1. coil produces a magnetic field; MP2. (which) interacts with the magnetic field of the (permanent) magnet; MP3. producing a force acting on the coil; MP4. opposite forces on either side of coil; MP5. coil rotates / turns;	 allow coil becomes an electromagnet allow one side is pushed up and the other is pushed down allow coil spins, pointer moves (to the left)	3
(ii)	vertical arrow UP (on wire CD);		1
(iii)	any three from: MP1. more turns on the coil; MP2. stronger (permanent) magnet; MP3. add an iron core; MP4. producing a larger force (for the same current); MP5. use of a longer pointer; MP6. use of a weaker return spring; MP7. producing a greater movement at the end of the pointer (for the same current);	 allow "more coils" allow method to increase field strength e.g. moving magnets closer together allow producing the same force for a smaller current allow same movement for a smaller current	3