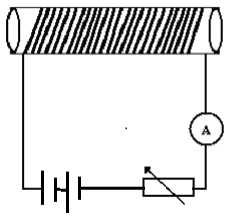
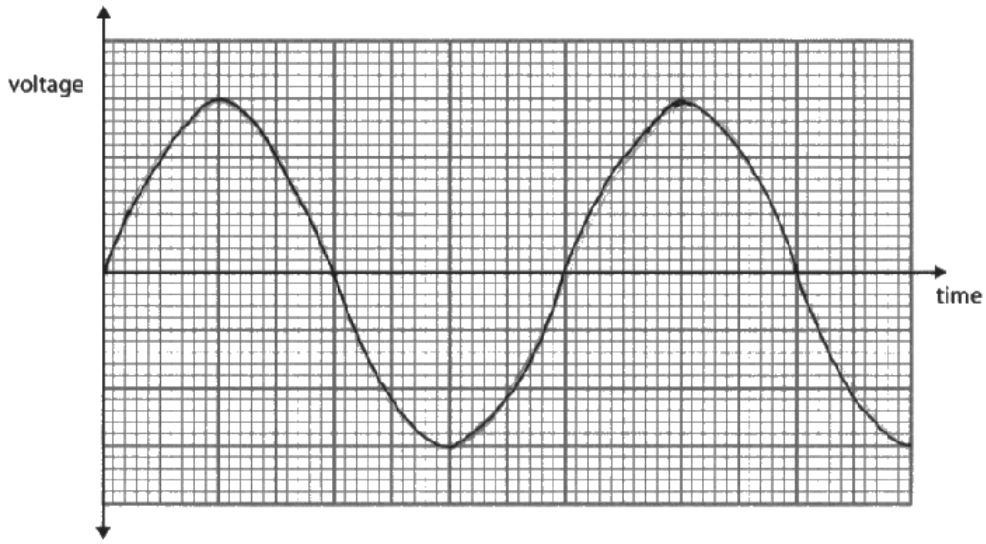
Question number	Answer	Notes	Marks
1	friction; negatively; repel; electrons;		4

Total for Question 1 = 4 marks

Question number	Answer	Notes	Marks
4 (a) (i)	any two from: MP1. pin/steel is a magnetic material; MP2. Y/pin(s) has become a (temporary/induced) magnet; MP3. (hence) attraction between pins;	 allow pin(s) have become magnetised	2
(ii)	any two from: MP1. the stronger the magnetic field, the more pins stick to it; MP2. the strength of the magnet is greater at the poles; MP3. N and S pole equally strong;	allow ends for poles throughout ignore references to magnetic properties of steel / iron allow (more) pins stick to both poles if no other MP seen, allow 'pins show the magnetic field (of the magnet)' for 1 mark	2
(iii)	more iron pins {attached / attracted};	ignore comments about ease of demagnetisation or pins falling off the magnet	1

Question number	Answer	Notes	Marks
(b) (i)	current; (because) the student selects the values / OWTTE;	 allow 'it is the variable the student changes' do not credit a repeat of the stem	2
(ii)	any two from: MP1. (same) number of turns; MP2. (same) core; MP3. (same) temperature; MP4. (same) number of turns per unit length;	ignore references to thickness/material of wire allow coils for turns allow tightness of coils	
(iii)	any six from: MP1. continuous circuit with electromagnet/coil shown clearly; MP2. power-pack OR cell/battery and variable resistor; MP3. use of ammeter; MP4. viable method of detecting strength of field; MP5. vary the current; MP6. measure/record the results; MP7. repeat and average;	shown in text or on diagram  allow iron/steel pins, paperclips, iron filings, newton-meter needs to be a quantitative statement e.g. 'see how many pins are picked up'	6

Total for Question 4 = 13 marks

Question number	Answer	Notes	Marks
6	a sketch graph to show: a.c. voltage; sinusoidal shape; constant frequency; constant amplitude;  	 should be curved at peaks and troughs by eye by eye by eye, tolerance 1 small square	4

Total for Question 6 = 4 marks