Problems for chapter 9.

Revision: $B = 2\times10^{-7}\frac{I}{r}$ for the magnetic field about a single straight conductor.

$F = BIl$

$F = qvB$

moment = $NIAB$

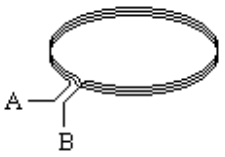
1.* If you measure an electric field E a distance r from a single charge what distance from the charge should you be to measure the field as $2E$? If you measure a magnetic field B a distance r from a long straight conductor what distance from this conductor should you be to measure the field as $2B$?

2. If you measure an electric field E a distance r from a single charge what distance from the charge should you be to measure the field as $3E$? If you measure a magnetic field B a distance r from a long straight conductor what distance from this conductor should you be to measure the field as $3B$?

3.* The standard Ampere is defined by measuring the force between two parallel straight wires of 1.00 m length and 1.00 m apart. If the same current flows through both wires what force exists between the wires when 1 Amp flows. What current flows when the force is 1.00 N?

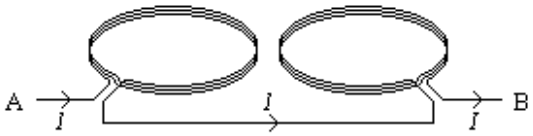
4. A current is measured, by measuring the force between two parallel straight wires of 0.10 m length and 0.10 m apart. If the same current flows through both wires what force exists between the wires when 1 Amp flows. What current flows when the force is 0.50 N?

5.*



In the above continuous three turn coil is the field at the centre vertically up or down when the field current flows in through A and out through B?

6.



In the above two three turn coils are connected in series as shown and a current I is passed through both coils. Are the coils drawn together or pushed apart by the magnetic fields which pass through each coil? What is the answer if the current is reversed from B to A?

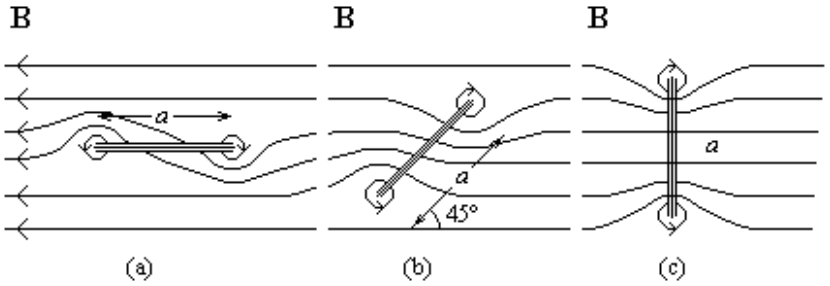
7.* The magnetic field like the electric field is found at a point by adding the separate fields from each source. If a long straight wire runs vertically while another runs horizontally and both carry the same current I = 200 mA, describe as best you can the combined field that might be found half way along the shortest line that separates these two wires. Given that the length of this shortest line is d = 0.060 m, can you find the strength of the magnetic field?

8. The magnetic field like the electric field is found at a point by adding the separate fields from each source. If two long straight wires run parallel a distance d = 0.060 apart and both carry the same current I = 200 mA, describe as best you can the combined field that might be found half way along the shortest line that separates these two wires.

9.* What is the speed of an electron ($m_e = 9.11\times10^{-31}$ kg and $q = 1.60\times10^{-19}$ C) if the electron accelerates from rest over a distance of 0.020 m along a uniform electric field of 10 000 V m^{-1}?
This electron (still moving at this speed) now enters a uniform perpendicular magnetic field of strength 0.050 T, so that it moves in a circle, what is the radius of this circle? Is it possible for this electron to enter this magnetic field so that it does not experience any acceleration, that is it travels in a straight line?

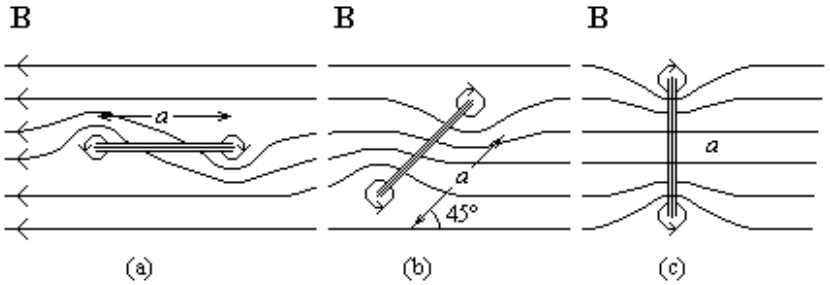
10. What is the speed of an electron ($m_e = 9.11\times10^{-31}$ kg and $q = 1.60\times10^{-19}$ C) if the electron accelerates from rest through 200 V.
The electron still moving at this speed now enters a uniform perpendicular magnetic field of strength 0.070 T, so that it moves in a circle, what is the radius of this circle?

11.*



A square coil of area 25×10^{-4} m^2, (a = 0.050 m) is shown placed at three orientations in a uniform magnetic field of 0.75 T. The coil has 100 turns and carries a current of 150 mA. Find the strength of the force on each of the four sides for each of the three cases (a), (b) and (c). Find also the moment of the forces around the coil for each of the three cases.

12.



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