Problems for part 10.

Revision: $\Phi = BA\cos\theta$

$$V = \frac{BA - B_0 A_0}{t}$$

$$V = Blv$$

$$V_2 = \frac{N_2}{N_1} V_1$$

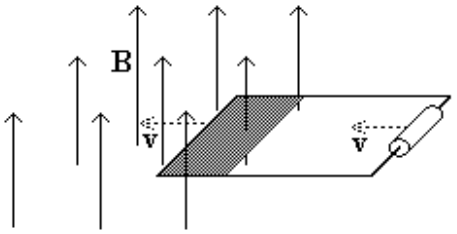
1.* A magnetic field of 0.45 T passes through circular one turn coil of radius 0.022 m. What is the minimum flux and maximum flux that can be found in this loop when the loop remains completely in the field?

2. A magnetic field of 0.25 T passes through circular ten turn coil of radius 0.025 m. What is the minimum flux and maximum flux that can be found in the coil when the coil remains completely in the field?

3.* If the coil of question 1. has 120 turns and is placed in the 0.45 T field so that a maximum flux is found in the coil and the field then decays to zero in 0.55 s, what is the average voltage generated across the coil terminals.

4. If the coil of question 2. has 10 turns and is placed in the 0.25 T field so that a maximum flux is found in the coil and the field then decays to zero in 0.05 s, what is the average voltage generated across the coil terminals.

5.* A wire with a circuit closed through a 100 Ω resistor is pulled horizontally through a uniform vertical field of 0.25 T, with a speed of 10.0 m s^{-1} so that only a length of 0.10 m cuts the field. What current flows through the resistor?



6. In question 5, the 100 Ω resistor is replaced by a piece of wire so that the total resistance of the circuit is 200 mΩ (we usually say that the resistor has been *short* circuit*ed* out). What current flows around the circuit when a 0.10 m length passes through the 0.25 T field at 10.0 m s^{-1}?

7. Use the concepts of magnetic field lines to explain why like poles of two small bar magnets repel each other while unlike poles attract each other. Now explain why the north pole of a

small bar magnet or compass points to the North while the south pole points south. If you have a single bar magnet you can try suspending by a thread so that it is balanced horizontally and is free to turn in any direction.

8.* The field between the horns of a horse shoe magnet can be as strong as $B = 0.40$ T. If you made a small coil of area $A = 0.0001$ m^2 and 100 turns and turned it over once in the field, the flux change could be as much as $200BA$. Estimate the half rotation time needed if a current of 1 mA is to flow through an ammeter in the circuit with an internal resistance of 0.5 Ω?

9. The field between the horns of a horse shoe magnet can be as strong as $B = 0.40$ T. If you made a small coil of area $A = 0.0001$ m^2 and 100 turns and pulled it from the field, the flux change could be as much as $100BA$. Estimate the minimum time to remove the coil if a current of 1 mA is to flow through an ammeter in the circuit with an internal resistance of 0.5 Ω? What is the minimum current that might flow when the same coil is pulled from the same field in the same time?

10.* In the ignition coil of a car 12 V is switched across a hundred turn primary coil of resistance 4.0 Ω. The secondary coil has 25 000 turns and is wound around the primary coils so that both share the same magnetic field. If the primary current is turned off so that the field collapses to zero in 0.015 s what average voltage is generated across the secondary coil during this time? Make an estimate of the flux through a single turn of either coil.

11. In the ignition coil of a car 12 V is switched across a two hundred turn primary coil of resistance 8.0 Ω. The secondary coil has 40 000 turns and is wound around the primary coils so that both share the same magnetic field. If the primary current is turned off so that the field collapses to zero in 0.015 s what average voltage is generated across the secondary coil during this time?

12.* A bar magnet is held vertically and dropped through a coil as shown below. If the leads A and B go to a closed circuit explain which way the current flows A to B, B to A or not at all when:

(i) the south pole passes through the centre of the coil,
(ii) the centre of the bar magnet passes through the centre of the coil,
(iii) the north pole passes through the centre of the coil.