Health & Safety – The Art of Induction

Induced Voltage and Distance

In this set up, the variation of the induced voltage with the distance from the moving magnet was explored. We had never heard of this experiment being attempted using school equipment before and were thus unsure of what to expect. Figure 7 shows a magnet with one of its poles uppermost. In theory, magnetic field strength varies as the inverse cube of x, the distance from the pole measured axially as shown.

This relationship breaks down if x is not large in comparison with a, the radius of the pole-face. Under these circumstances, the magnetic field strength varies with the inverse cube of r where $r = \sqrt{(x^2+a^2)}$. Our hypothesis was that induced voltage would follow the same relationship if we kept the speed of the magnet and the number of turns of the coil constant. When we plotted induced voltage versus r^{-3}, we got a straight line through the origin. This was with the small SEP coil (Figure 8). We felt that its dimensions were more suitable for an investigation involving distance.

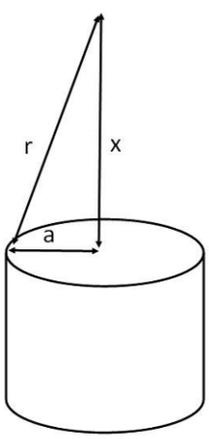

Figure 7

Figure 8 *- SEP coil.*

Taken as a group, we feel that these experiments could form the core of an Advanced Higher investigation. They go beyond the current curriculum but do not require exotic resources. The experiments work well and provide opportunities for data analysis and discussion.

Reference

[1] www.mutr.co.uk, part number SEP 172

Health & Safety – Laser guidance

We have recently revised our guidance on the use of lasers by pupils. Previously, we had said that certain lasers could be used by pupils in S3 and above. Much more is now known about lasers and their associated hazards. We therefore feel that we can extend their use to S1 and S2. Thus, all secondary pupils may work with lasers.

Rules for safe laser use

- The laser classification is either Class 1 or Class 2, but not Class 1M or Class 2M or anything greater than Class 2.
- Pupils are made aware of the safety precautions they must take. They must never stare into the beam, which should be terminated by some sort of beam stop.
- The laser is stable or clamped.
- Work is supervised at all times.

Why Class 2? Class 2 lasers emit only visible light and are rated at 1 mW or less. Our natural aversion reflex – blinking or turning away - prevents us from becoming exposed accidentally to a harmful amount of laser radiation. Note that certain laser pointers are unclassified. Their power output can vary significantly depending on the batteries fitted. Indeed, we have heard of some that are nine times more powerful than they ought to be.

Also, laser pointers may be picked up by pupils and waved around. Laser diode modules, such as the green one described in Bulletin 229 [1], are a safer option. Some may still ask why we would want pupils to use a laser device. Whilst it is true that using a laser introduces an additional hazard compared to a conventional light source, the risk is small if it is operated properly. Using a laser ray box (Figure 1) removes the need for a blackout, reducing the risks associated with moving around a darkened room.

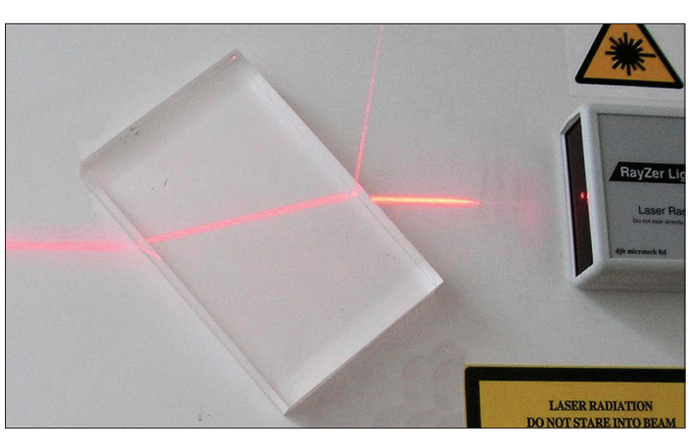

Figure 1 *- A laser ray box used in a refraction experiment.*

Reference

[1] http://tinyurl.com/green-lasers-sserc Green lasers, Bulletin 229, SSERC 2009