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| **Lesson Number: 25.2** | | |
| **Lesson Title: The laws of electromagnetic induction** | | |
| **Specification Reference** | | **3.7.5.3 / 3.7.5.4** |
| **Learning Objectives** | | |
| Magnetic flux defined by where *B* is normal to *A*.  Flux linkage as where *N* is the number of turns cutting the flux.  Flux and flux linkage passing through a rectangular coil rotated in a magnetic field: flux linkage    Faraday’s and Lenz’s laws.  Magnitude of induced emf = rate of change of flux linkage | | |
| **Opportunities for Assessment** | | |
| Page 416 questions | | |
| **Starter:** | Slide#1 recaps previous work (KS3, KS4) on solenoids | |
| **Main:** | Slides #2 - #4 show a method for applying Lenz’s law to working out the current direction that is induced in a solenoid due to the insertion of a magnet – There are many methods for doing this but this system of lettering seems to lodge in students minds easiest!  Demonstration dropping the Neodymium magnet to be done after slide #2  Demonstration showing reversing current to be done after slide #4  Slides #5 - #10 are step by step work-through of the formulae and derivation of each. A useful activity is to get pupils to start listing all the ways of calculating each variable and then testing each other on the units (Volts, Tesla, Webber) of each one. | |
| **Plenary:** | Slides #11 and #12 are the summary | |

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| **Homework:** | Page 416 questions, research electric cars and regenerative braking systems | |
| **Differentiation / Extension / S&C** | | |
| Discussion and self-creation of Lenz’s law from ideas about Solenoids | | |
| **Numeracy / Literacy** | | **SMSC / Fundamental British Values** |
| Numerous formulae and units for magnetic flux, flux density flux linkage and *emf* | | N/A |
| **RESOURCES:**  Demonstration: | | |
| * Small Neodymium magnet * Copper pipe (or any non-magnetic metal pipe) about 1m long and slightly larger diameter than the magnet   Demonstration:   * Bar magnet * Coil of wire * Micro-ammeter | | |
| **Risk Assessment** e.g. CLEAPSS card reference | | |
| None however Neodymium magnets are brittle and should not be allowed to drop onto the floor | | |
| **Working Scientifically (HSW)** | | |
| “Regenerative braking” page 414 | | |

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Slide #3 (Magnet) - Wikipedia

Slide #4 (Right hand grip rule) - By The original uploader was Schorschi2 at German Wikipedia (Eigene Zeichnung) [Public domain or Public domain], via Wikimedia Commons