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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 linkageFaraday’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 #2Demonstration showing reversing current to be done after slide #4Slides #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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Slides #1, #2 - By Svjo (Own work) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons

Slide #3 (Coil) - By Zureks (Own work) [Public domain], via Wikimedia Commons

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