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| **Lesson Number: 24.2** | | |
| **Lesson Title: Moving charges in a magnetic field** | | |
| **Specification Reference** | | **3.7.5.2** |
| **Learning Objectives** | | |
| Force on charged particles moving in a magnetic field, *F* = *BQv* when the field is perpendicular to velocity.  Direction of force on positive and negative charged particles.  Circular path of particles; application in devices such as the cyclotron. | | |
| **Opportunities for Assessment** | | |
| Page 402 questions | | |
| **Starter:** | Slide #1 allows the students to discuss and think about extending the previous lesson on current carrying conductors to individual particles | |
| **Main:** | Slide #2 introduces the Maltese cross experiment – Demonstrate this now using a bar magnet (Ensure the N-S are labelled in the magnet)  Slide #3 is a quick explanation of the motor force on particles and hints at some homework research (CERN) that could be set  Slide #4 is a picture courtesy of CERN of a high energy collision in a magnetic field  Slide #6 derives the formula for particles *F=BQv*  Slide #7 is an extension slide, not needed for A-level | |
| **Plenary:** | Slide #8 is a summary | |

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| **Homework:** | Page 402 questions, research CERN and cyclotrons, research Hall probes | |
| **Differentiation / Extension / S&C** | | |
| Extending the maths to any angle using trigonometric functions | | |
| **Numeracy / Literacy** | | **SMSC / Fundamental British Values** |
| Use and derivation of formula | | CERN, particle physics and the collaboration of scientists and governments |
| **RESOURCES:** | | |
| Demonstration:   * Maltese cross experiment and high voltage power supply * Bar magnet with North / South labelled | | |
| **Risk Assessment** e.g. CLEAPSS card reference | | |
| High voltage is dangerous – precautions must be taken to ensure that nobody can touch the live metal, use high voltage insulated wires  Test the laboratory RCCD system prior to using high voltage equipment | | |
| **Working Scientifically (HSW)** | | |
| “Hall Probe” on page 401 | | |

Pictures courtesy of:

Slide #1 – Wikipedia

Slide #2 by Chris Burks Chetvorno (Own work) [Public domain], via Wikimedia Commons

Slide #4 by Lucas Taylor / CERN (http://cdsweb.cern.ch/record/628469) [CC BY-SA 3.0 (http://creativecommons.org/licenses/by-sa/3.0)], via Wikimedia Commons