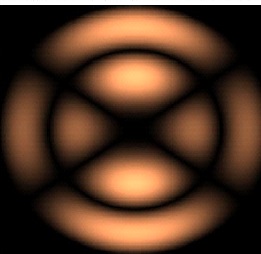
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[**VISUAL PHYSICS ONLINE**](http://www.physics.usyd.edu.au/teach_res/hsp/sp/spHome.htm)

**EQUATION MINDMAPS**

**Equations are essential part of physics, without them, we can’t start to explain our physical world and make predictions. An equation tells a story – a collection of a few symbols contains a wealth of information. Many examination questions can be answered by having an in-depth understanding of equations. To help you maximize your examination marks, you should use the equation mindmaps to gain this in-depth understanding. You need to commit to memory much of the information contained in the equation mindmaps so that you can appreciate the story told by each equation.**

* State what the symbols represent (meaning & interpretation), S.I. units, other units, typical values, vector or scalar, positive or negative quantity.
* A visualisation of what the equation is about, is it a definition or a law, when is it applicable, comments and an interpretation.
* Alternative forms of the equation.
* Graphical representations of the equation.
* Numerical examples.

**MECHANICS (Kinematics and Dynamics)**

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq01.pdf) | | |  | | | | | Average velocity  Instantaneous velocity in X direction  Average acceleration  Instantaneous acceleration in X direction |
|  | | | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq02.pdf) | | |  | Newton’s Second Law  acceleration  Weight of an object  Centripetal force: uniform circular motion  Centripetal acceleration | | |
|  | | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq03.pdf) | | |  | | | Newton’s Third Law  eg rocket propulsion | |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq04.pdf) |  | Momentum of a moving object  Impulse of a force *F* acting for a time interval *t*  Impulse = change in momentum  Law of Conservation of momentum |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq05.pdf) |  | Work done by a force during a displacement (force and displacement in same direction [1D]  Kinetic energy of a moving object  Work done = change in KE [1D] only  Work done on a charge in an electric field  Gain in KE electron due to a constant accelerating voltage |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq06.pdf) |  | **Equation for uniform accelerated motion in one-dimension**  *a* = constant |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq07.pdf) |  | **Equations for Projectile Motion**  *g* = 9.8 m.s-2  *ay* = - *g* = - 9.8 m.s-1 |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq08.pdf) |  | Gravitational force  Acceleration due to gravity at surface of a planet  Gravitational potential energy  Gravitational potential energy near Earth’s surface  Acceleration due to gravity (Earth)  Period of pendulum 🡪 *g* |

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| [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq09.pdf) |  |  | Kepler’s Third Law for satellite motion  orbital velocity  orbital period  geostationary satellite  T = 24 hours  escape velocity |

**SPECIAL RELATIVITY**

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| [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq10.pdf) |  |  | mass *m* is a constant  time dilation  length contract  total energy  momentum  total energy  kinetic energy  kinetic energy *v* << *c*  **photon** |

**ELECTRICITY**

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq11.pdf) |  | Resistance  Electrical power  Electrical energy |

**MAGNETISM**

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|  | | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq12.pdf)  [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq13.pdf) | |  | Magnetic force between two parallel conductors  Magnetic force on a conductor  Magnetic field surrounding a long straight conductor  Torque  Torque on a coil in a magnetic field | |
|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq14.pdf) | |  | | | Magnetic flux  average induced emf  induced emf  electric motor: back emf |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq16.pdf) |  | Transformer equation:  step up or step down voltages  ideal transformer  Power loss (eddy currents – transformer, induction heating; transmission lines) |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq17.pdf) |  | Force on a charged particle moving in a magnetic field  Electric field  Electric field (constant) between two parallel charged plates |

**NATURE OF LIGHT**

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|  | | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq19.pdf) | |  | Energy of a photon  Speed of light  Speed of electromagnetic radiation | |
|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq21.pdf) | |  | | | Gain in KE of electron due to accelerating voltage  **Photoelectric Effect**  Stopping voltage  Cut-off (critical) frequency |

**THE ATOM**

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq22.pdf) |  | Bragg’s Law – crystal structure (constructive interference)  Hydrogen atom - spectrum  Energy levels  Bohr Model of atom  Angular momentum quantized  *n* = 1, 2, 3, …  Energy levels hydrogen atom  Allowed orbits for electrons in hydrogen atom |

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq25.pdf) |  | de Broglie wavelength  de Broglie relationship  **Photon**  Matter wave  Heisenberg Uncertainty Principle |

**The NUCLUES**

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|  | [Image2](http://www.physics.usyd.edu.au/teach_res/hsp/eq/eq26.pdf) | Beta minus decay | Mass defect  Einstein – mass/energy  Chadwick discovers **neutron**  Beta decay  Pauli & Fermi **neutrino**  Alpha decay  **Standard model**  Proton  Neutron  Nuclear fission |