**Unit 3 Outcome 1 – What you should know**

* Describe what a **field** is
* Draw the shape of a field, including direction and strength, surrounding masses, charges, or magnets
* Determine whether an object will be attracted to or repelled from another
* Calculate the force of attraction/repulsion between two masses or two charges using Newton’s Law of Gravitation or Coulomb’s Law
* Determine the magnitude and direction of a gravitational or electric field at a distance from the centre of a mass or charge
* Calculate the change in potential energy of a mass or charge as it moves from one position in a gravitational or electric field to another position
* Draw a graph of potential energy vs distance for masses or charges being attracted repelled
* Determine the final or initial velocity of an accelerated mass or charge after moving a certain distance in a field
* Use the area of a force vs distance graph to calculate the change in potential energy of charges/masses
* Use the area of a field strength vs distance graph to calculate the change in potential energy of charges/masses, by multiplying field strength by or respectively
* Draw the shape of the magnetic field surrounding current carrying wires, loops, or solenoids
* Calculate the potential difference (voltage) between two charges or charged plates given change in energy and separation distance
* Use the right hand grip rule to determine the direction of the magnetic field surrounding a section of a current carrying wire
* Determine the direction of current given a diagram of the shape of a field surrounding a current carrying wire
* Calculate the force applied to a moving charge in a uniform magnetic field using the right hand slap rule
* Determine the mass, radius, charge or velocity of a charged particle in circular motion in a magnetic field
* Use circular motion to model satellite or planetary motion and use this to calculate orbital radius, orbital velocity or period
* Understand geostationary orbits and use a geostationary orbit to calculate the orbital characteristics of a satellite orbiting the same body
* Describe the link between apparent weightlessness and the orbit of an objects inside a satellite that appears to be floating
* Calculate the force between two current carrying wires, or a current carrying wire inside a uniform magnetic field using the right hand slap rule
* Analyse the motion of a DC motor in terms of the force acting on the coil of current carrying wire between two magnets
* Describe the function of parts of the DC motor such as the split ring commutator

**Useful formulae and constants**

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|  | Newton’s Law of Universal Gravitation |
|  | Coulomb’s Law |
|  | Gravitational field strength exerted by mass at distance |
|  | Electric field strength given charge and distance |
|  | Force experienced by a mass in a gravitational field |
|  | Force experienced by a charge in an electric field |
|  | Potential energy of mass in the presence of a gravitational field exerted by mass |
|  | Potential energy of charge in the presence of an electric field exerted by charge |
|  | Electric field created between two charged plates separated by distance |
|  | Work done on a charge by the electric field between two charged plates with a potential difference separated by distance |
|  | Work done on a mass by the gravitational field after moving a distance |
|  | Force exerted on a bundle on wires carrying a current , each with length in the presence of a magnetic field with strength |
|  | Force exerted on a charge travelling with velocity perpendicular to a magnetic field with strength |
|  | Radius of a charged particle’s circular path while travelling inside a uniform electric field with strength |
|  | Relationship between centripetal force experienced by a particle of mass travelling in a circular path with radius and velocity |
|  | Velocity of a charged particle as it passes through crossed electric and magnetic fields |
|  | Relationship between an objects orbital velocity , orbital radius and orbital period |
|  | The condition that the ratio of orbital radius cubed and orbital period squared is the same for two objects orbiting the same mass |
| N m2 kg-2 | Gravitational constant |