Fields Review

Gravitational Fields

- anything with mass creates a gravitational field,
- the force of gravitational attraction between two bodies can be calculated with

$$F_g = \frac{Gm_1m_2}{r^2}$$

- the strength of a gravitational field on a body at a given point can be calculated with the following formula where g is the acceleration at a given point of the mody

$$g = \frac{Gm_{planet}}{r^2}$$

- this can be refactored with the centripetal acceleration formula to solve for velocity in an orbiting system, such that the velocity of one body orbiting another can be calculated

$$v = \sqrt{\frac{Gm}{r}}$$

- Tidal forces are the difference in gravitational force on a body between the two ends of the body

Electrical Fields

- The attraction force between two charged bodies can be calculated with the following formula

$$F_e = \frac{kq_1q_2}{r^2}$$

- the acceleration of an electric field at a given point can be calculated with the following formula, where ϵ is the force / Coulomb

$$\epsilon = \frac{kq_2}{r^2}$$

- as the strength fo an electric field at a given point is defined as N/C the strength of an electric field can be calculated with the formula

$$F_e = \epsilon q$$

Electrical Potential

- As work is defined as force over a distance, electrical potential energy can be defined as our definition for a force $F_e = \epsilon q$ multiplied by ΔD (the displacement in the positive direction of a constant electric field), this electrical potential energy can eb converted into another other type of energy (i.e. Kinetic energy)

$$E_e = -\epsilon q \Delta d$$

Voltage

- Voltage is the amount of work per unit charge, required to move a positive charge from one point to another in the presence of an electrical field.

$$\Delta V = \frac{E_e}{q}$$

Magnetic Fields

- Permanent magnets generate magnetic fields that are very similar to standard electrical fields,
- A current creates a magnetic field

the movement of a charged body through a magnetic field will cause a force on both bodies. This force can be found by the equation

$$F_m = qvBsin\theta$$

where q is the charge of body being moved, v is the velocity of the body, B is the strength of the electric field in Teslas $T = \frac{Kg}{C \cdot s}$ and θ is the angle between the velocity of the body and the electric field

The same force can be found between a body and a current flowing through a wire with

$$F_m = ILBSin\theta$$

_I is current, L is the length of the wire, B is the strength of the magnetic field, and θ is the angle between the velocity vector and the magnetic field

Right Hand Rule

The direction of the force imposed upon a charged body can be detwermined with teh right hand rule, where your thumb is the velocity vector of the body, your