Year 3 General Physics **Electromagnetism**

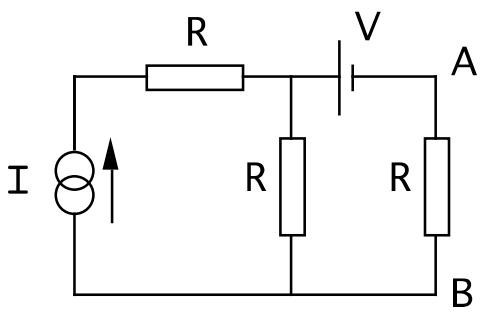
1. Three equal charges are placed on the corners of an equilateral triangle, whose side is of length, a. What is:
(i) the potential at the centre
(ii) the electric field at the centre.
(iii) the magnitude of the force on each charge
(iv) the potential energy of the system relative to that when the charges are at infinity.

2. Calculate the electric field a distance of 1 cm from the centre of a long, straight, cylindrical wire of radium much less than 1cm, carrying a uniformly distributed surface charge of 10 mC m^{-1}. Why are the charges only on the surface?

3. Derive an expression for the radius of the orbit described by a charged particle in a uniform magnetic field perpendicular to the plane of the orbit. What happens if the particle is given some velocity along the field direction?

4. A thin wire in the shape of circle of radius 10 cm carries a current of 5 Amp. What is the magnetic field in the middle of the circle and which way does it point?

5. What is the potential between points A & B in the circuit below?



6. A circular loop of thin wire having loop radius a and electrical resistance R rotates at frequency ω about an axis which lies along a diameter. A uniform magnetic field, B is perpendicular to the axis of rotation. What mean power is needed to sustain the rotation. [Assume the rotation rate is sufficiently slow that you can ignore the inductance of the loop]

7. A resistor R in series with an inductor L is connected across a sinusoidal voltage of magnitude V. Sketch the magnitude and phase of the voltage across the inductor and across the resistor versus frequency as the frequency is changed from zero to a high value. Take the phase of the voltage supply to be zero.