9.3.5 AC Motors

Motors are used in industries and the home usually to convert electrical energy into more useful forms of energy

5.1 Describe the **main features of an AC electric motor**

- Motors that run on AC: **motor with two slip-rings, universal motor and AC induction motor**
- Motor with **slip-rings** (prevents tangling of wire)
    - Current switches to change direction of force (rather than a commutator switching)
    - Magnetic field must go **only one direction** (or, electromagnet, see universal motor)
- **Universal motor**: works with **DC or AC current**
    - Magnetic field must be an **electromagnet** and connected (in series) to power
    - A **split-ring commutator** must be used
    - DC: electromagnet generates magnetic flux in one direction, split ring changes the current
    - **AC**: magnetic flux changes direction whenever current changes, so works like a DC motor
- **AC induction motor**: brushless and induces current
    - AC current fed into stator, which have **a number of coils** (which generate magnetic flux)
    - **Eddy currents** form on the rotor, which will **cause it to rotate** (as if it was a motor)
        - **Rotor** is like a squirrel cage, with many aluminium bars
        - No current is fed into the rotor
    - As it moves, AC current will change **reverse magnetic flux direction**, which will cause it to **rotate to the next coil** and continue the movement
    - As one rotor pair decreases in magnetic strength, the next one increases, forming something like a **rotating magnetic field**
    - Lag time between squirrel cage and magnetic field is **slip time**
    - A good explanation can be found http://www.phys.unsw.edu.au/hsc/hsc/electric_motors1.html

5.P1 Perform an investigation to **demonstrate the principle of an AC induction motor**

- A dangling aluminium disc at the end of a string (free to move) is set up
- A magnet is circled around the bottom (without contact)
- The disc should start **moving in the same direction as magnet**
    - Eddy currents are induced on the disc that **oppose the cause of induction** (Lenz's Law)
    - However, it cannot stop the magnet's movement, so the disc will move along with/chase the magnet

5.P2 Gather, process and analyse information to identify some of the **energy transfers and transformations** involving the **conversion of electrical energy into more useful forms in the home and industry**

- Note: law of conservation of energy – transfer energy, not destroy or create
    - Also, not 100% efficient (heat or sound losses)
- **Electrical to kinetic/mechanical:** Fans, drills, blenders (using motors)
- **Electrical to heat:** Electric stovetops (using induction), heaters, hot glue gun
- **Electrical to light:** Light bulbs, LED lights, computer screens
- **Electrical to chemical**: Recharging batteries,
- **Electrical to sound:** Speakers