Airdrie Academy Physics Department

Electricity

Study Guide

Monitoring and measuring a.c

- A.C. as a current which changes direction and instantaneous value with time.
- Calculations involving peak and r.m.s. values.
- Determination of frequency from graphical data.

Current, potential difference, power and resistance

- Use relationships involving potential difference, current, resistance and power to analyse circuits.
- Calculations may involve several steps.
- Calculations involving potential dividers circuits.

Electrical sources and internal resistance

- Electromotive force, internal resistance and terminal potential difference. Ideal supplies, short circuits and open circuits.
- Determining internal resistance and electromotive force using graphical analysis.

Capacitors

- Capacitors and the relationship between capacitance, charge and potential difference.
- The total energy stored in a charged capacitor is the area under the charge against potential
- difference graph.
- Use the relationships between energy, charge, capacitance and potential difference.
- Variation of current and potential difference against time for both charging and discharging.
- The effect of resistance and capacitance on charging and discharging curves.

Conductors, semiconductors and insulators

- Solids can be categorised into conductors, semiconductors or insulators by their ability to conduct electricity.
- The electrons in atoms are contained in energy levels. When the atoms come together to form solids, the electrons then become contained in energy bands separated by gaps.
- In metals, the highest occupied band is not completely full and this allows the electrons to move and therefore conduct. This band is known as the conduction band.
- In an insulator, the highest occupied band (called the valence band) is full. The first unfilled band above the valence band is the conduction band.
- For an insulator, the gap between the valence band and the conduction band is large and at room temperature there is not enough energy available to move electrons from the valence band into the conduction band where they would be able to contribute to conduction. There is no electrical conduction in an insulator.
- In a semiconductor, the gap between the valence band and conduction band is smaller and at room temperature there is sufficient energy available to move some electrons from the valence band into the conduction band allowing some conduction to take place. An increase in temperature increases the conductivity of a semiconductor.

p-n junctions

- During manufacture, the conductivity of semiconductors can be controlled, resulting in two types: p-type and n-type.
- When p-type and n-type materials are joined, a layer is formed at the junction. The electrical properties of this layer are used in a number of devices.
- Solar cells are p-n junctions designed so that a potential difference is produced when photons enter the layer. This is the photovoltaic effect.
- LEDs are p-n junctions which emit photons when a current is passed through the junction.