

# Module 4 : Electrons, Waves and Photons

## Charge and current (4.1)

### Charge (4.1.1)

#### Elementary charge ( $e$ )

- $e = 1.6 \times 10^{-19} \text{ C}$
- Electric charge equivalent to charge on proton (with a minus sign it's charge on electron)
- Charges are a multiple of  $e$   $\therefore$  charges on objects are quantised
- Electron has charge  $-e$
- Proton has charge  $+e$

#### Charge carriers

- Charged particle that moves through material to form electric current, e.g.  $e^-$  in metal wire
- 4 main types
  - Electrons (main carrier in wires) ( $-1e$ )
  - Protons (not used often) ( $+1e$ )
  - Ions (main carrier in solution)
  - "holes" (mainly in p-type semiconductors)

#### Charge ( $Q$ )

- Physical property, either positive or negative, measured in Coulombs, or as a relative charge
- Unit: **Coulomb (C)**  $\Rightarrow$  amount of charge flowing past point in circuit, time 1s and current 1A
- Symbol:  **$Q$**

#### Current ( $I$ )

- Flow of charge passing a fixed point in a circuit per second ( $\therefore$  current is the rate of flow)
- Movement of electrons in metals; movement of ions in electrolytes
- $1\text{A} = 1\text{C}$  passing point for 1s
- Unit: **Ampere (A)**
- Symbol:  **$I$**
- Measured using ammeters in series  $\therefore$  lowest possible resistance to reduce effect on current

#### Charge, current and time

- $I = \frac{Q}{t}$
- $I$  = current in amps (A);  $Q$  = charge transferred in Coulombs (C);  $t$  = time in seconds (s)

#### Conventional current

- Charges/current travels from the positive end of the cell towards the negative end
- Direction in which +ve charges travel, as it's a model to describe electric current in circuit
- The above is regardless of the direction of movement of charge carriers (i.e. electrons/ions)

#### Electron flow

- Electrons leave from the negative end of the cell towards positive end

#### Kirchhoff's First Law

- At any point in an electrical circuit, sum of current into that point is equal to sum of current out of that point  $\Rightarrow$  electrical charge is conserved
- In parallel, current splits at junctions
- Sum of current going in = sum of current going out
- $\sum_N I_N = 0$  or simply  $\sum I = 0$  where  $I$  = current (A) (capital sigma  $\Sigma$  signifies a sum in maths notation)
- Current approaching junction defined positive (+)
- Current going away from junction defined negative (-)

Notes - definitions  
 Unit - important points (occasionally underlined)  
 units/symbols of quantities  
 equations  
 Numbers in brackets next to titles and subtitles refer to the chapters and sub-chapters within the specification and textbook that the particular section refers to.

# Ocr Physics A Electrons Waves Photons June 2014

**Robert Andrews Millikan**



**Ocr Physics A Electrons Waves Photons June 2014:**

**Electrons (+ and -)** Robert Andrews Millikan, 1935      **Electrons (+ and -), Protons, Photons, Neutrons, Mesotrons, and Cosmic Rays** Robert Andrews Millikan, 1947

## Unveiling the Magic of Words: A Review of "**Ocr Physics A Electrons Waves Photons June 2014**"

In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their ability to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Ocr Physics A Electrons Waves Photons June 2014**," a mesmerizing literary masterpiece penned by way of a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve into the book's central themes, examine its distinctive writing style, and assess its profound affect on the souls of its readers.

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