Quantum Theory:

Important concepts:

- Light can behave as a wave:
    - $\lambda v = c$
    - λ= wavelength
    - v = frequency
    - c = speed of light ($3x10^8$ $m.s^{-1}$)
- Photoelectric effect shows light is quantised (ie, acts as a particle)
    - $E_{photon} = hv = \frac{hc}{\lambda}$
    - $\lambda = \frac{h}{mv}$ (relation of wavelength/energy to momentum – de Broglie wavelength)
- Bohr model:
    - Hydrogen showed line spectrum → electron transitions must be discrete
    - Only certain energies are allowed
        - $\Delta E = hv = \frac{hc}{\lambda}$
        - $E = -2.178 \times 10^{-18} \left(\frac{Z^2}{n^2}\right)$

    This only works for the hydrogen atom…

- Schroedinger's description of the atom
    - Treats electrons as a wave instead of a particle
    - Needs to take Heisenburg's uncertainty principle into account:
        - $\Delta x . \Delta p \geq \frac{\hbar}{2}$
    - Easy to visualise by treating as a particle trapped in a 1D box
        - $E = \frac{\hbar^2 k^2}{2m}$ which gives $E = \frac{n^2 h^2}{8mL^2}$ where n is an integer
        - Rydberg equation: $\frac{1}{\lambda} = R\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$
- These equations give you the probability of where an electron will be.

- Quantum numbers:

    - n
        - principal quantum number
        - Can take any integer value
        - Corresponds to shell number

    - l
        - angular momentum quantum number
        - Can take integer values from 0 to n-1
        - Corresponds to orbital (0 = s, 1 = p etc)
    - m_l
        - magnetic quantum number
        - can take integer values from *l* to –l
        - corresponds to orientation of orbital in space
    - $m_{1/2}$
        - spin quantum number
        - can take values of ½ or – ½
        - corresponds to spin of electron
- Pauli Principle
    - No electron can have the same quantum numbers as any other
- Aufbau Principle
    - Pg 551 of Zumdahl