CHEM110 – Chapter 4
Atomic Energy Levels

Dr Erica Smith
Room 2.01 – Riggs C23
erica.smith@une.edu.au
02 6773 5130

une
University of
New England

Chapter 4 – Atomic Energy Levels

- **Properties of atoms** and light and energy changes that accompany their interactions
- **Properties of electrons** bound to atoms how this contributes to atomic structure
- **Orbital energies** and the relation to ordering of atoms
  - Periodic table
  - Stability of atoms and how they react
  - Interpretation of chemical behaviour

4.1 Characteristics of Atoms

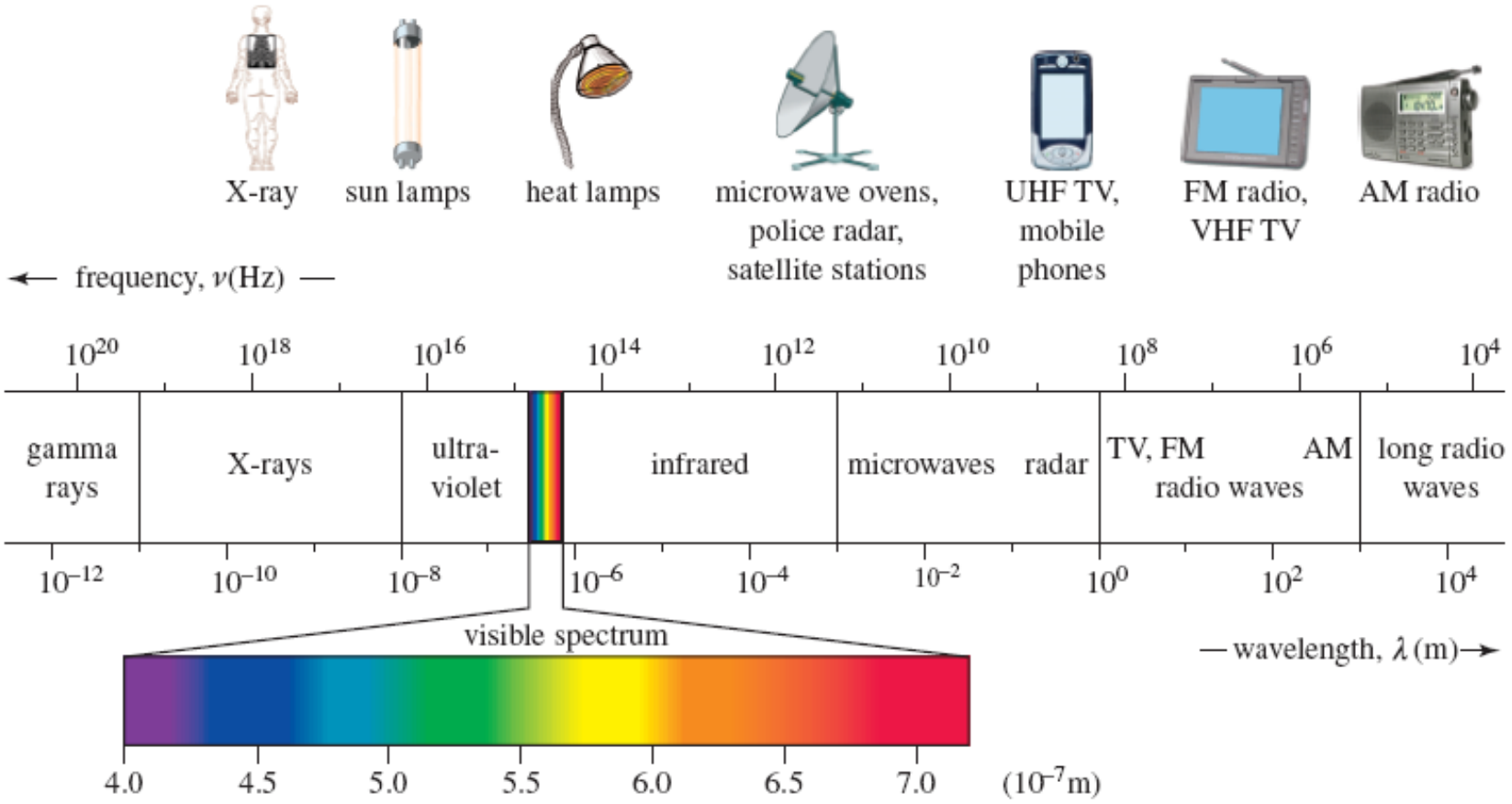
- An atom consists of a positive nucleus (protons + neutrons), where the mass is concentrated, surrounded by a negative electron cloud
- An atom is electrically neutral → it contains an equal number of protons and electrons
- Properties largely determined by atomic size and number of valence (accessible) electrons

4.2 Characteristics of Light

- **Electromagnetic radiation to study structure of atoms**

- **Light is one form of this radiation**

4.2 Characteristics of Light

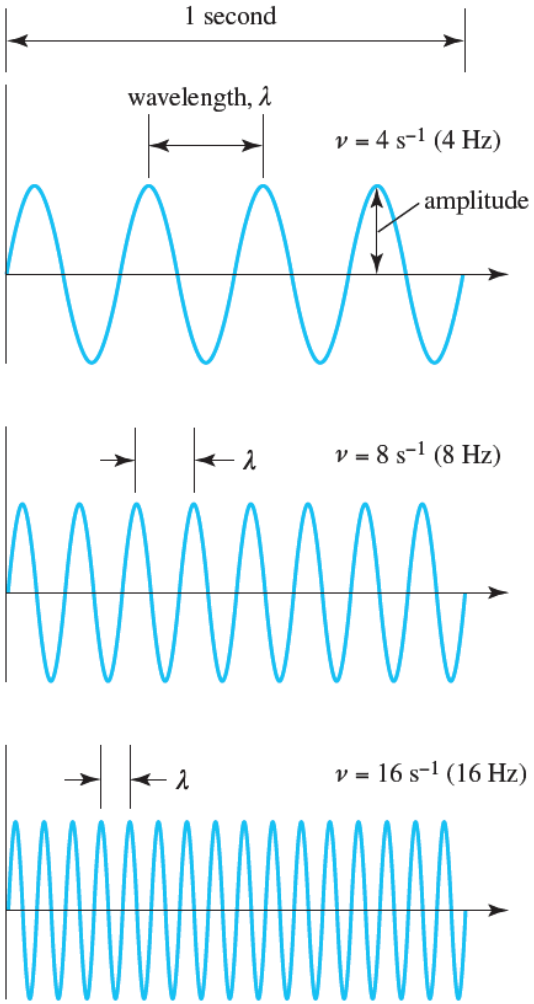


4.2 Characteristics of Light

- **Wave-particle duality of light**

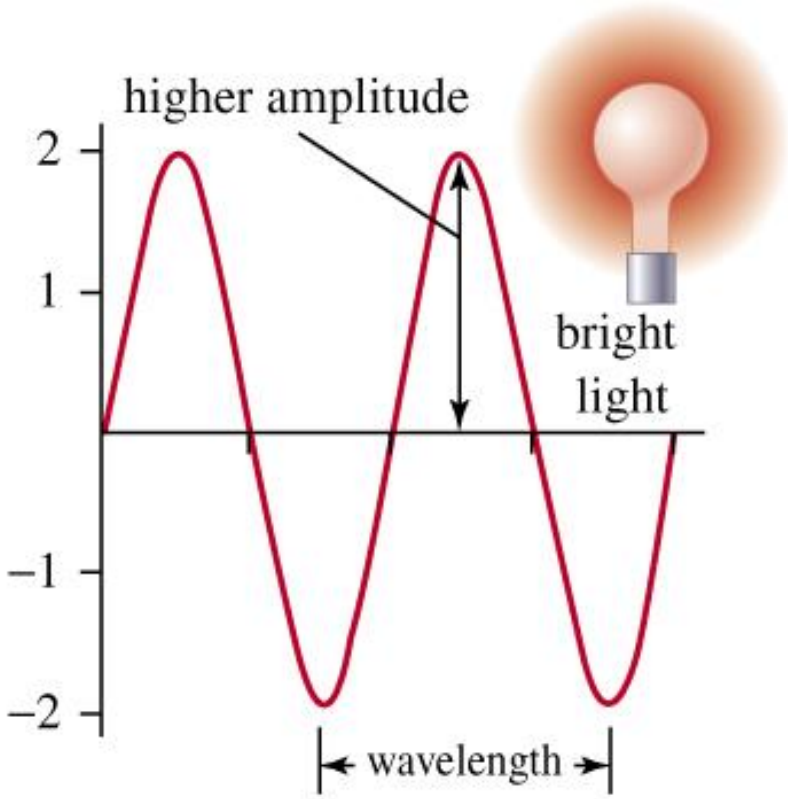
- **Wave-like properties of light**

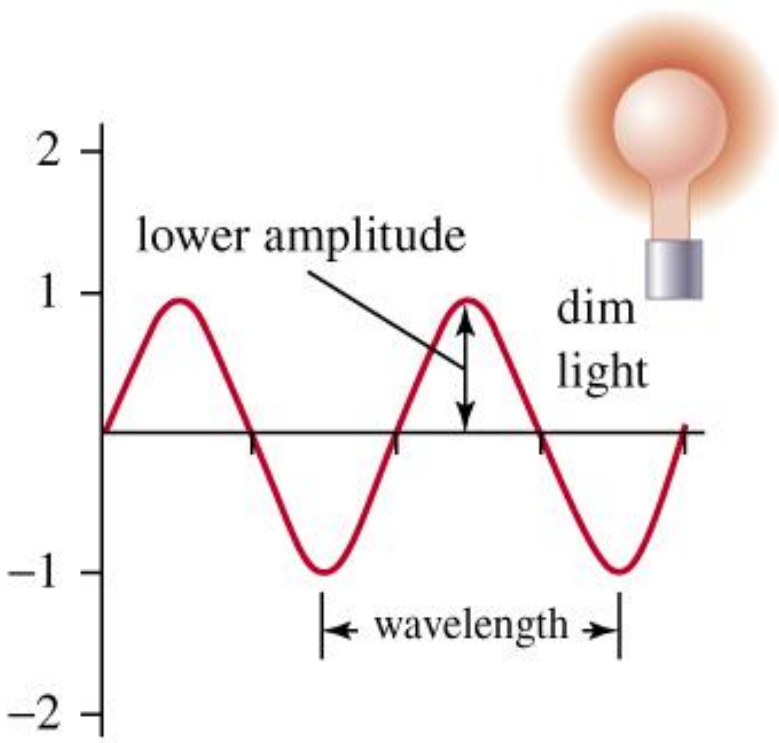
4.2 Characteristics of Light



- A wave is a regular oscillation
- Wavelength (λ)→ the distance between two successive crests (in m or nm)
- Frequency (ν) → the number of waves passing a certain point in 1 s (in s^{-1} = Hz)
- Amplitude → the maximum displacement of the wave from its centre (intensity)

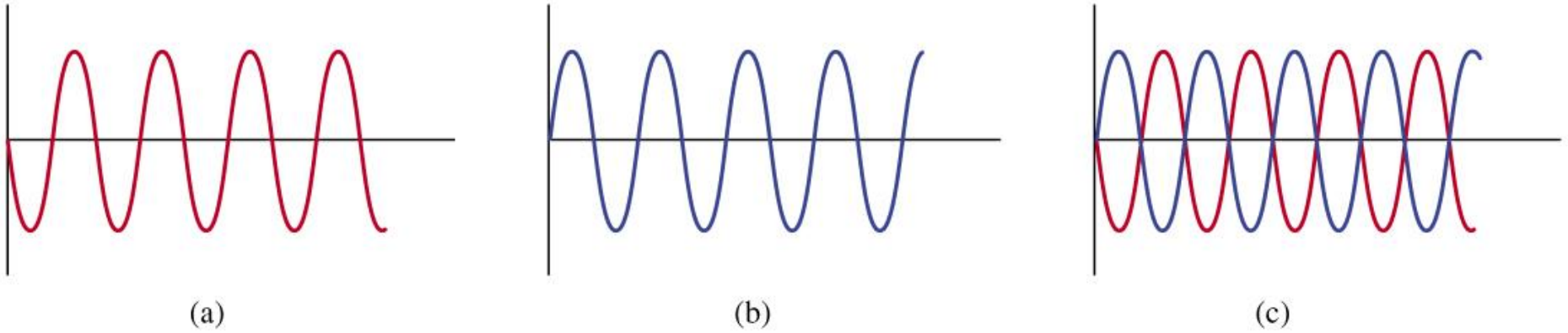
4.2 Characteristics of Light





4.2 Characteristics of Light

Figure 4.3



Waves can be described in terms of their phase

4.2 Characteristics of Light

- **Light waves (and all electromagnetic radiation) move through a vacuum at the SAME SPEED**
  → $c = 2.998 \times 10^8\ ms^{-1}$

$$c = \nu\lambda$$

- **λ → wavelength in m**
- **ν → frequency in s^{-1} (Hz)**

Worked Example 4.1 – page 111

An FM radio transmits its signal at 88.1 MHz. What is the wavelength of the signal?