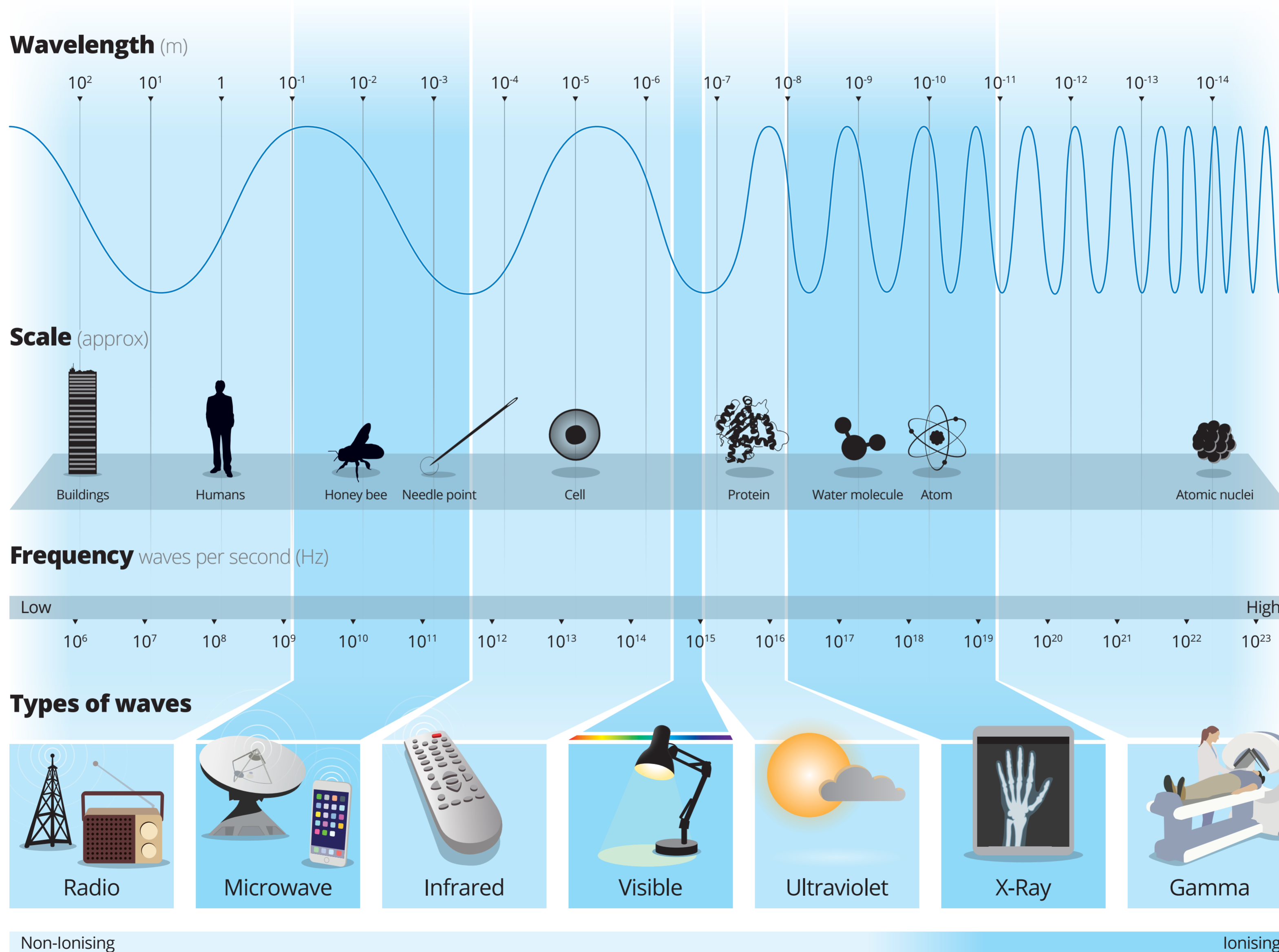# The Electromagnetic Spectrum

ANSTO

The Electromagnetic Spectrum and ANSTO

The Australian Nuclear Science and Technology Organisation (ANSTO) is home to Australia's nuclear science and technology expertise. ANSTO utilises different parts of the electromagnetic spectrum for environmental and medical research. Each week, ANSTO delivers 10,000 patient doses of potentially lifesaving nuclear medicines to more than 250 hospitals and medical practices across Australia.

By releasing small targeted amounts of gamma radiation, these medicines are used in medical scans to diagnose a wide range of illnesses including heart disease, cancers and skeletal injuries.

The ANSTO operated Australian Synchrotron is a highly intense source of light ranging from infrared to X-rays. Light from the Australian Synchrotron is used in many fields of research, including biosciences, medical research, environmental sciences, agriculture, minerals exploration, engineering and forensics.

Wavelength (m)

10^2 10^1 1 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} 10^{-9} 10^{-10} 10^{-11} 10^{-12} 10^{-13} 10^{-14}

Scale (approx)

Buildings   Humans   Honey bee   Needle point   Cell   Protein   Water molecule   Atom   Atomic nuclei

Frequency waves per second (Hz)

Low   High

10^6 10^7 10^8 10^9 10^{10} 10^{11} 10^{12} 10^{13} 10^{14} 10^{15} 10^{16} 10^{17} 10^{18} 10^{19} 10^{20} 10^{21} 10^{22} 10^{23}

Types of waves

Radio   Microwave   Infrared   Visible   Ultraviolet   X-Ray   Gamma

Non-Ionising   Ionising

The information in this poster is of a general nature and for educational purposes only.

The energy from the Sun and other objects in the universe travels to Earth in waves. Unlike sound, electromagnetic energy can travel through a vacuum (empty space).

Speed

All electromagnetic waves travel at the speed of light (300,000 km per second) in a vacuum.

Wavelength

Although the waves all travel at the same speed, the shape of the wave may repeat very quickly (short wavelength), while others repeat more slowly (long wavelength). In the electromagnetic spectrum, wavelengths vary from several kilometres long to smaller than an atom.

Energy

Long wavelength waves have low energy, while those with short wavelengths have high energy.

Frequency

The frequency of a wave is simply the number of times that the top of the wave passes a point in one second. This is called 'cycles per second' and the scientific unit is 'Hertz' (Hz). The wavelength of an electromagnetic wave, multiplied by its frequency, equals the speed of light.