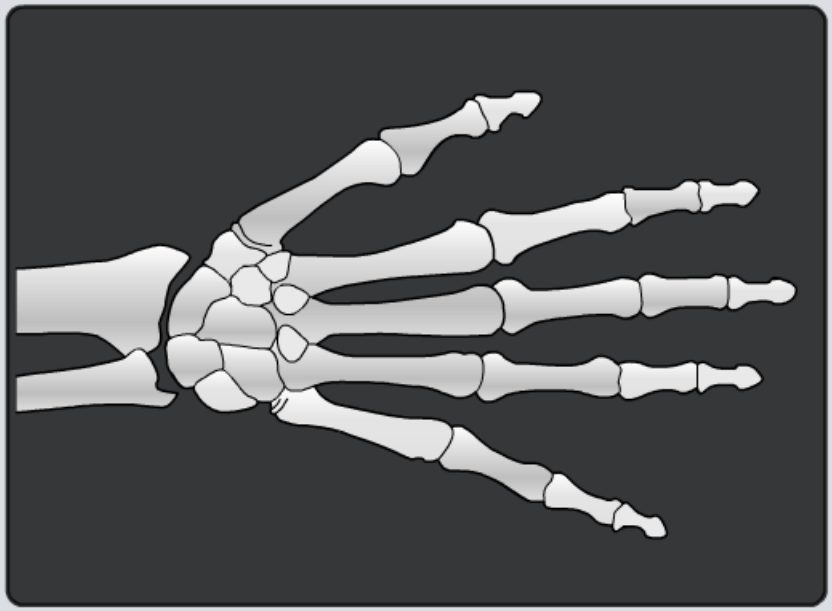
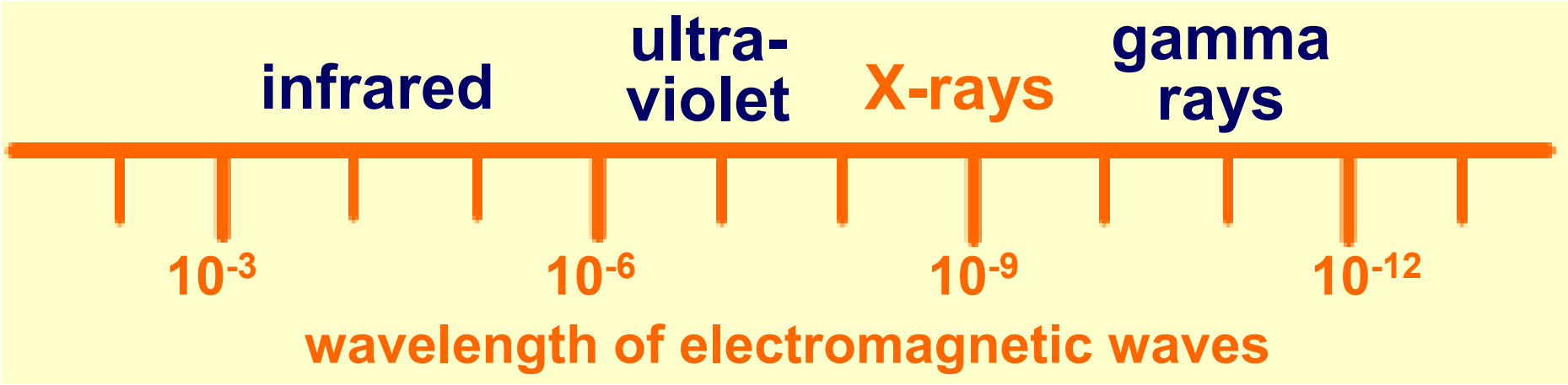
# X-rays



# What are X-rays?

Anyone who has been to the hospital with a broken bone will have had an X-ray photograph taken.

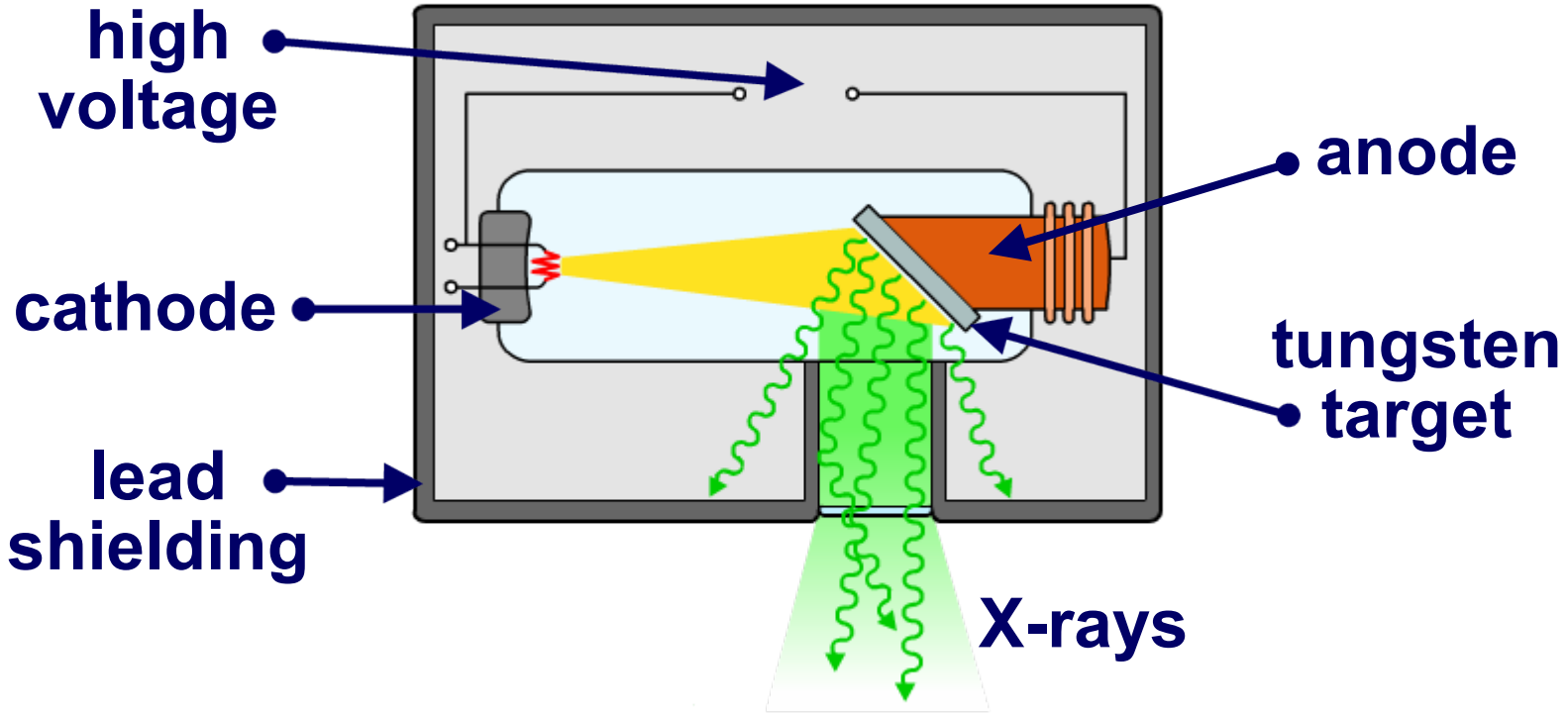
X-rays are a form of electromagnetic radiation that are very penetrating. In the electromagnetic spectrum, they are found between UV and gamma rays.




X-rays have a very short wavelengths between 0.1 and 10 nm. (The size of a water molecule is about 0.3 nm.)

# How are X-rays produced?

X-rays are created when high-energy electrons suddenly lose energy. X-rays are produced artificially using a **X-ray tube**.




Electrons from the hot cathode are fired at the tungsten target at high speed. When these high-energy electrons strike the target, some of their energy is changed into X-rays.

# How were X-rays discovered?

## The Discovery of X-rays

X-rays are commonly used for producing images of the inside of objects. You may have had an X-ray image taken of part of your body.

X-rays were discovered by chance when another scientific phenomenon was being investigated.

Click "**start**" to find out how X-rays were discovered.


start

# What are X-rays used for?

- **Imaging**

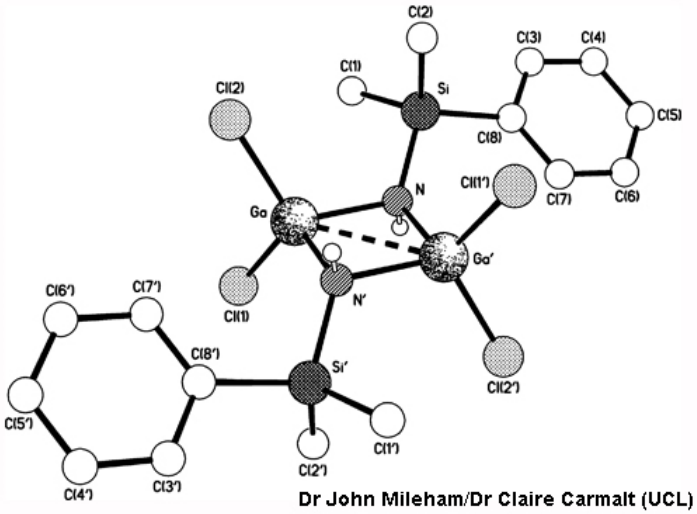
  X-rays are very penetrating and can pass through many forms of matter. They are used in medicine, industry and security to take pictures of the inside of objects.


- **Treating cancer**

  Concentrated beams of short wavelength X-rays can be used to kill cancerous cells.

- **Crystallography**

  X-rays are used to figure out the arrangement of atoms in various substances, including crystals.




Dr John Mileham/Dr Claire Carmalt (UCL)

# How can X-rays ‘look inside’ objects?

X-ray images can be taken because X-rays can pass through opaque materials and also expose photographic film.


X-rays pass through soft tissue, such as skin and muscle, without being absorbed. Denser tissue, such as bone, can absorb X-rays. Film that is exposed appears black and areas that are not exposed, because of X-ray absorption, appear white.

X-rays are used by airport security to check for weapons and drugs. Baggage is passed through an X-ray machine, which instantly reveals the contents.

# What do X-rays do to cells?

## How do X-rays affect living tissue and cells?

X-rays are very useful as they allow doctors to examine the inside of the human body without using surgery.

However, X-rays are very dangerous and can have a harmful effect on living tissue.

Click "**start**" to find out more about X-rays.

start

# How are X-ray images taken safely?

Precautions must be used when X-ray images are taken.

Only the area of the body being examined is targeted with X-rays. Other areas are protected with a lead shield, which is too dense for X-rays to pass through.

One X-ray does not pose much risk to one's health. Radiographers take several X-rays each day and their potential dose is much higher.

To minimize their exposure when an X-ray image is being taken, radiographers must wear a lead apron, stand behind a screen that absorbs X-rays or even leave the room.

# X-rays – true or false?