

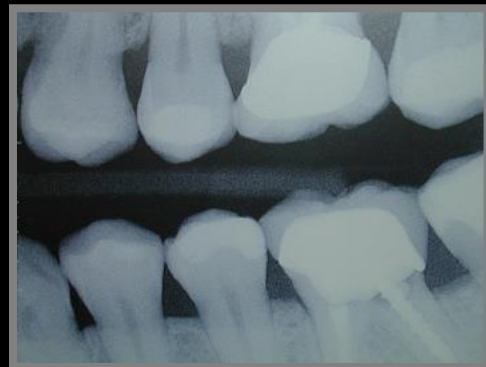
Basics of X-Ray

Shamel Goma



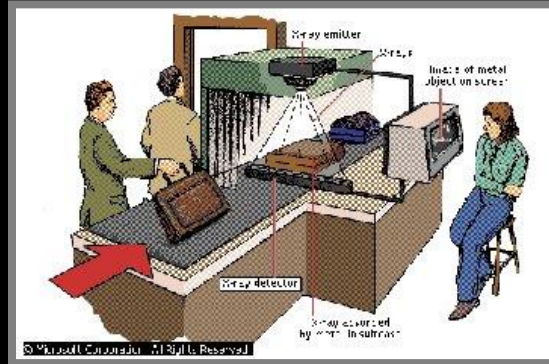
What is an X-ray used for?

- Used in many medical purposes and security purposes



What is an X-ray used for?

- One specific place x-rays are used are in security checkpoints at airports



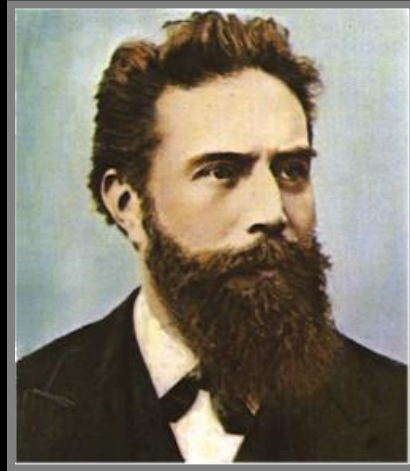
What are X-rays used for?

- X-rays are also used for looking at fractured bones in the human body.
- Can show cavities and and swallowed objects or objects stuck inside humans



History of X-rays

- Accidentally discovered in 1895
- William Roentgen takes credit for discovery

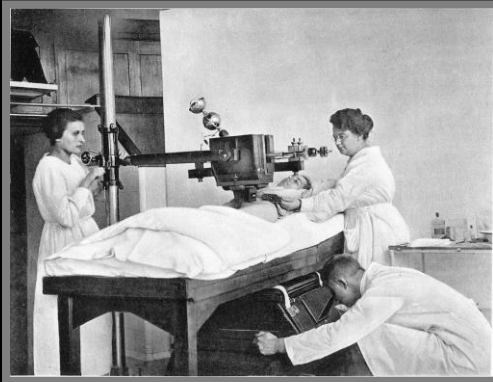


History of X-rays

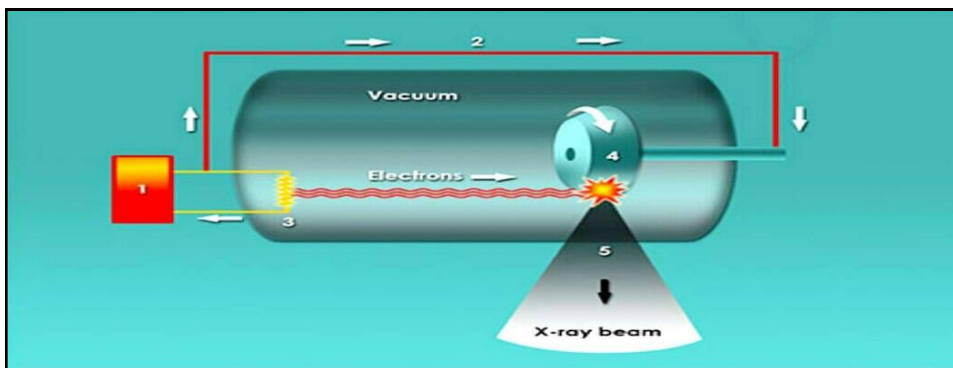


- Roentgen placed hand in front of machine and saw the bones in his hand on the wall

History of X-rays



- X-rays later called Roentgen-rays in his honor
- Doctors don't have to do surgery to see bones



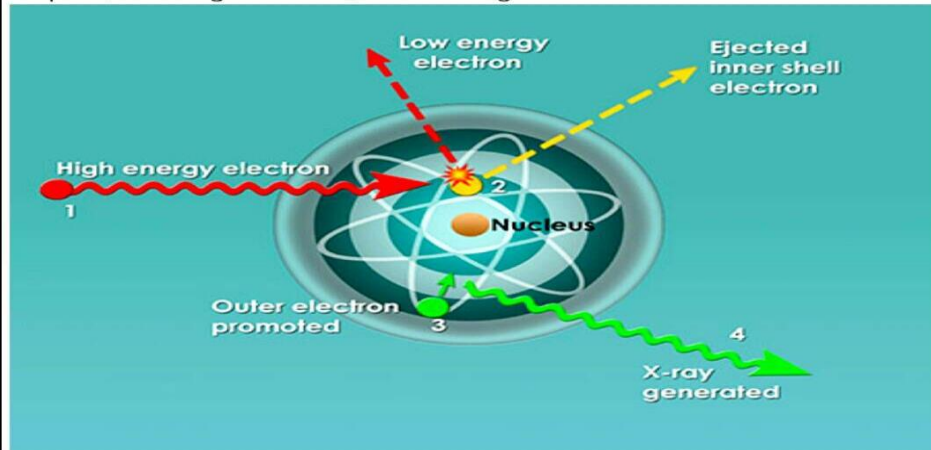
The X-ray tube

- ◆ A small increase in the filament voltage (1) results in a large increase in tube current (2), which accelerates high speed electrons from the very high temperature filament negative cathode (3) within a vacuum, towards a positive tungsten target anode (4). This anode rotates to dissipate heat generated. X-rays are generated within the tungsten anode and an X-ray beam (5) is directed towards the patient.

are two types of X-ray generated:
characteristic radiation and bremsstrahlung
radiation.

Characteristic X-ray generation

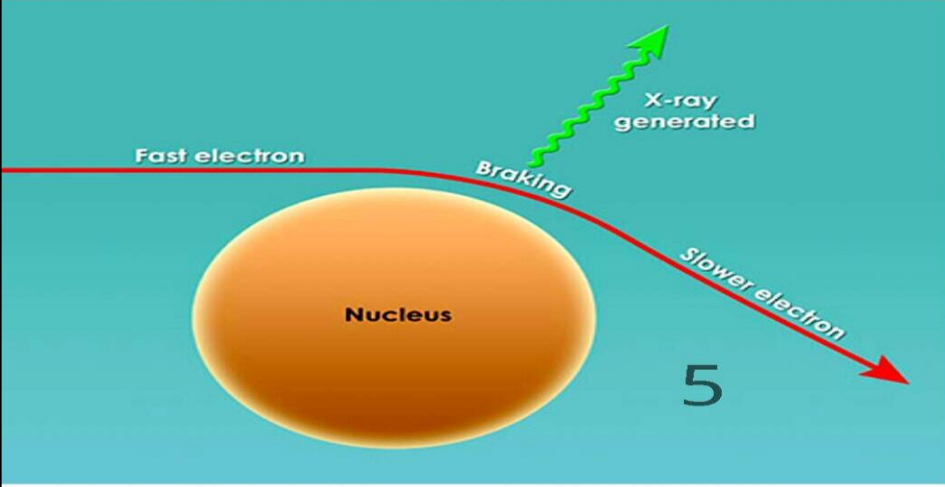
Tap on/off image to show/hide findings



Characteristic X-ray generation

- ◆ When a high energy electron (1) collides with an inner shell electron (2) both are ejected from the tungsten atom leaving a 'hole' in the inner layer. This is filled by an outer shell electron (3) with a loss of energy emitted as an X-ray photon (4).

Bremsstrahlung/Braking X-ray generation
Tap on/off image to show/hide findings



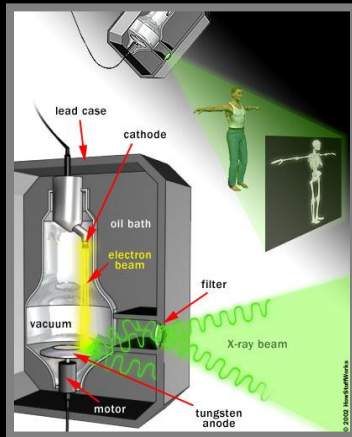
Bremsstrahlung/Braking X-ray generation

- ◆ When an electron passes near the nucleus it is slowed and its path is deflected.

Energy lost is emitted as a bremsstrahlung X-ray photon.

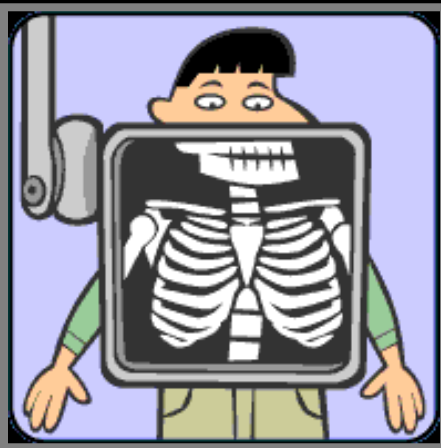
- ◆ Bremsstrahlung = Braking radiation
- ◆ Approximately 80% of the population of X-rays within the X-ray beam consists of X-rays generated in this way.

How an X-ray Machine Works



- Lead case holds machine to keep X-rays from going in all directions
- Machine can weigh 80 pounds

How X-rays Machines Work



- X-rays come out of little window facing the patient
- X-rays pass harmlessly through the patient

How X-ray Machines Work

- “Heart” of machine is the electrode - a cathode and an anode
- Cathode is a heated filament



How X-rays Machines Work

- First, current passes through the filament which heats it up.



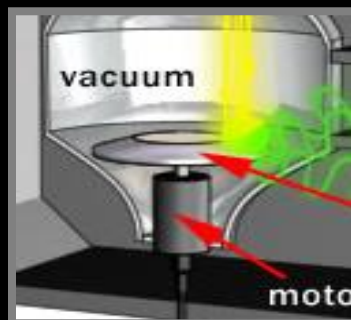
How X-ray Machines Work

- Heat caused by current sputter electrons off the surface and the beam of electrons is attracted by a positively charged anode



How X-ray Machines Work

- The anode is a positively charged disc made of tungsten.



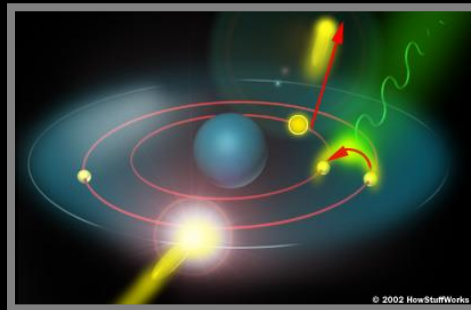
How X-ray Machines Work

- The difference between the anode and the cathode is extremely different so the electrons fly through the tube with a very powerful force.



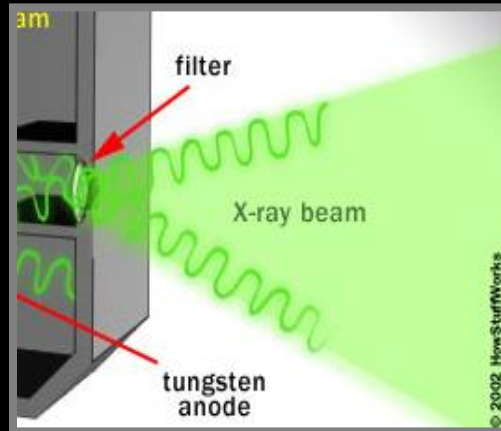
How an X-ray machine works

- Then the speeding electrons strikes a tungsten atom
- An electron is knocked loose and falls a level of energy
- Then the electron releases extra



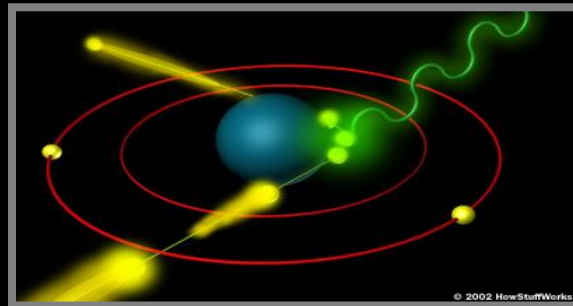
How X-ray Machines Work

- Since the drop is a big one, the energy released is very high
- The released energy forms into X-ray photons



How X-ray Machines Work

- An alternative way that x-rays can be formed is when the loose electron beam is heading toward the tungsten anode.



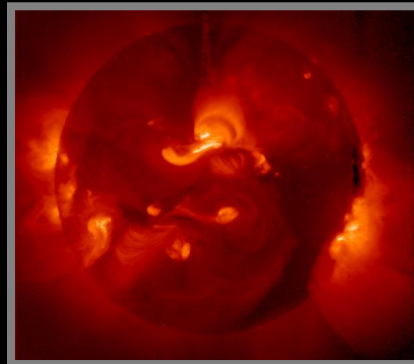
How X-ray Machines Work

- Then when the electrons reach the tungsten atoms, it travels around the nucleus of the atom, like a comet's path being changed by a planet or star.
- As the electrons course is rapidly changed, it loses a lot of power causing x-ray photons



How X-ray Machines Work

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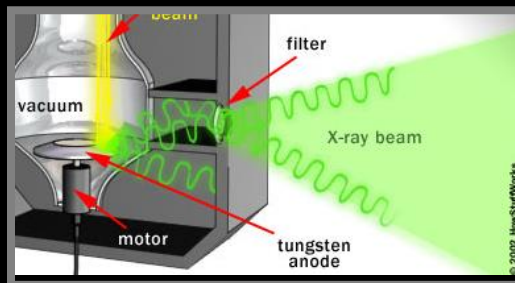
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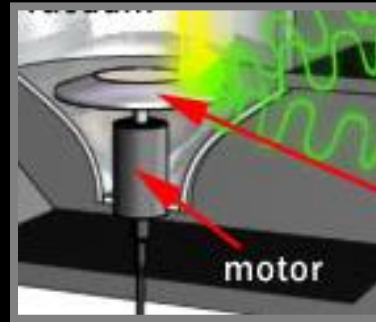
How an X-ray Machine works

- When the very powerful collision with the electrons and the tungsten anode occurs, a lot of heat is produced and could melt the machine



How an X-ray Machine works

- A small engine spins the anode at a very fast so the anode wont melt
- Cool oil on the tungsten anode is also used to control the heat temperature.



How an X-ray Machine Works

- When the X-rays go through the human or object, the x-ray beam continues
- An the other side there is a camera that takes the picture
- The camera is just like any other camera we use



X-ray Protection

- X-rays can be helpful but overexposure can cause fatal diseases
- X-rays cause radiation that cause radiation sickness. Long ago, doctors and patients that didn't wear protection got the sickness and many died.



X-ray Protection

- X-rays are a form of ionizing radiation
- They knock electrons off the atom to create an ion, an electrically-charged atom. Free electrons then collide with other atoms to create more ions. Ionization breaks DNA strands which causes mutation or kill the DNA



Contrast Media

- Contrast media is used to make organs or blood vessels that don't show up on normal X-rays show up
- Then can be injected or swallowed as liquids
- Is very dense so it absorbs x-rays and shows up on X-ray pictures



Thanks For Listening