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Where Minds Pollinate

Class 12
Physics

Chapter 25
Handwritten
Notes

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Chapter no 25:

Medical Imaging :

X-rays:

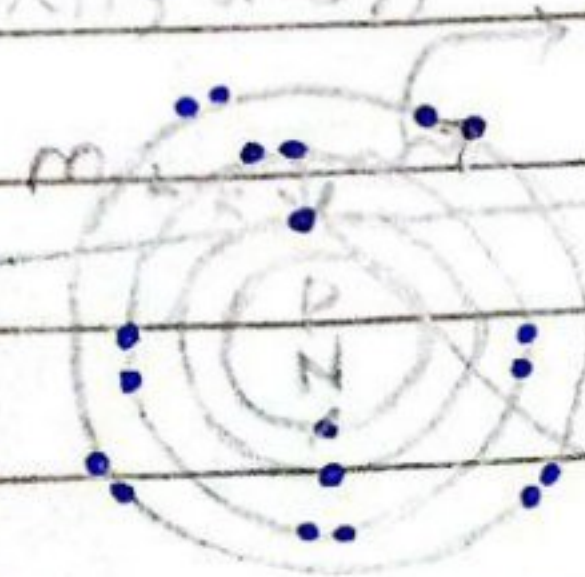
- Röntgen Scientist observed rays called X-rays.
- Discovered by Scientist Röntgen.
- frequency range 10^{16} to 10^{18} Hz.
- Energy range $\approx 100 \text{ eV}$ to 10 KeV .
- Wavelength $\approx 1 \text{ \AA} = 10^{-10} \text{ m}$
- X-rays are emitted from some heavy metal like tungsten.
- X-rays are of two types:
 - 1 Characteristic X-rays
 - 2 Continuous X-rays

1 Characteristic X-rays:

if e^- is removed from L to K shell, then it is $K\alpha$. X-ray photon scattered e^-

incident e^-

if e^- is removed from M to K, then it is $K\beta$.



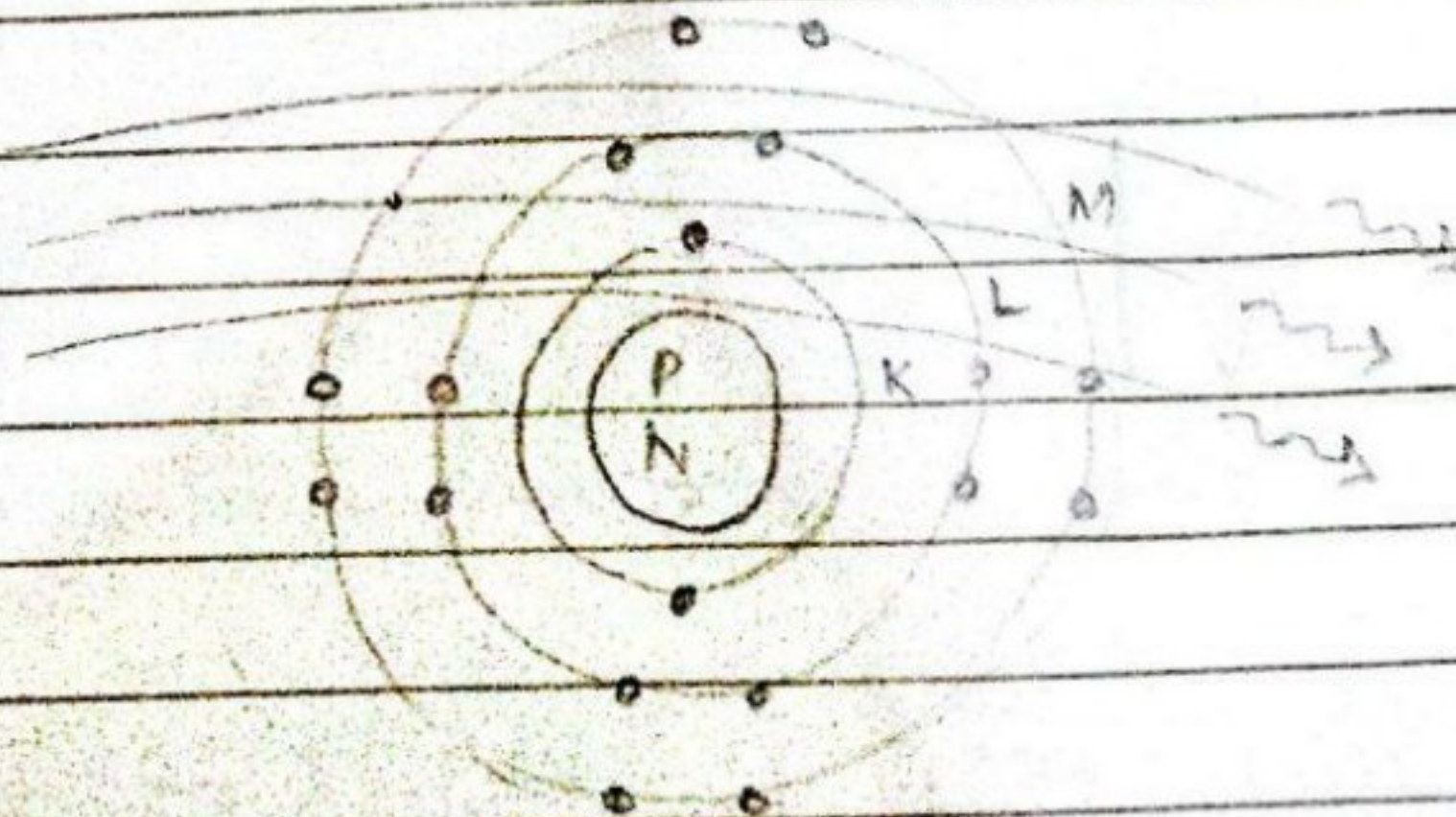
ejected e^-

Prince

- These X-rays are emitted due to inner shell transition of electrons.
- Energy of these X-rays is independent of applied potential difference.
- Energy of these X-rays depends upon gap b/w the shells, so are called characteristic X-rays because they explain the character of element.
- These X-rays have particular frequency and energy.
- Moseley law is based upon these X-rays.
- If ejected electron is filled by electron from k shell, it is called k -alpha ($k-\alpha$) and if it is filled from n shell, it is called k -beta ($k-\beta$).

2

Continuous X-rays:



Prince

- These X-rays consists of wide range of frequencies of radiation.
- These X-rays are emitted due to deceleration. (Aany wala e^- jb decelerate ho jata hai (slow in speed)) of incident electron due to impact of nucleus.
- Energy of these X-rays depends upon applied potential difference. Maximum energy and minimum wavelength is possessed by such X-ray photon which is emitted due to deceleration of electron nearest to nucleus.
- These radiations are called braking radiations.

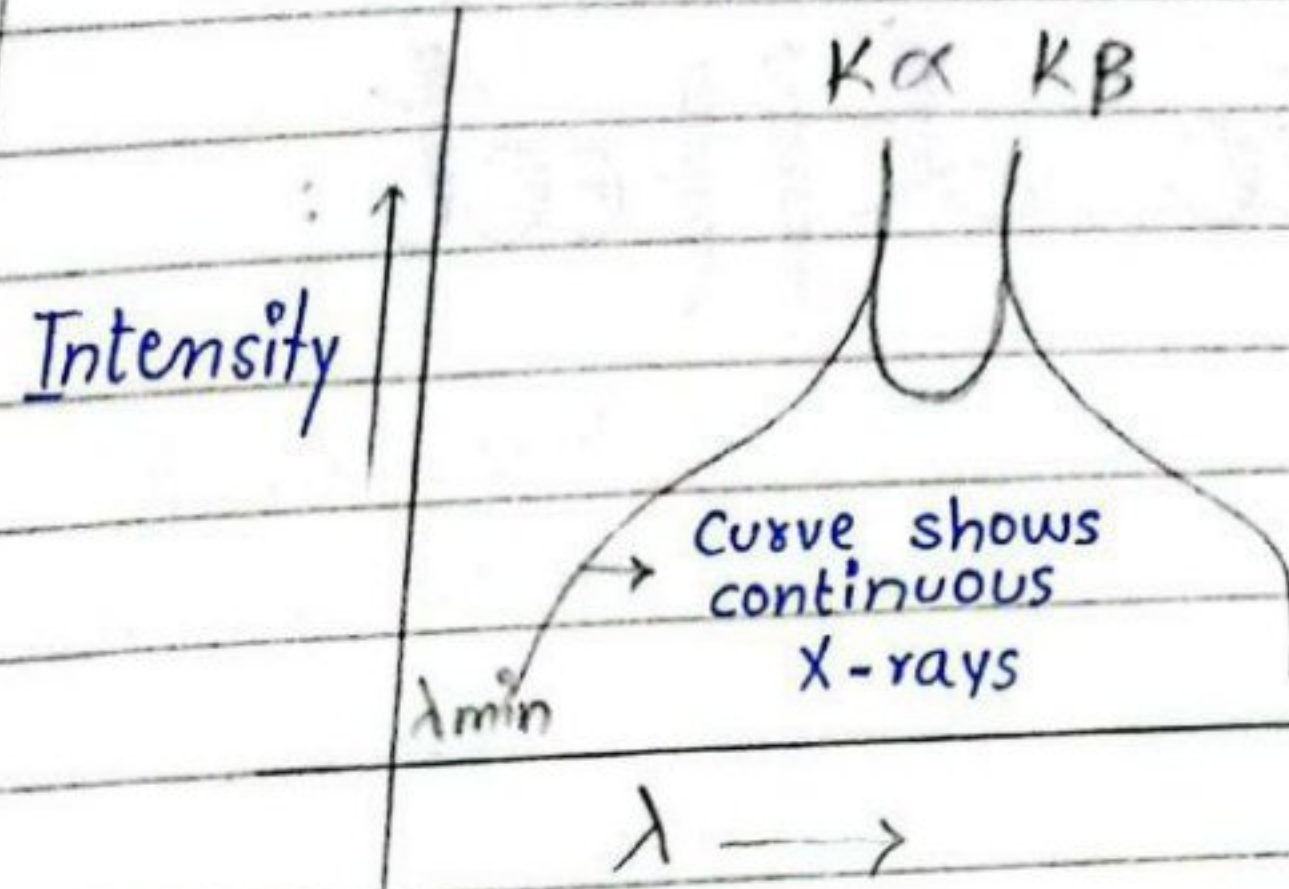
$$W = QV$$

$$\text{Energy Provided} = eV$$

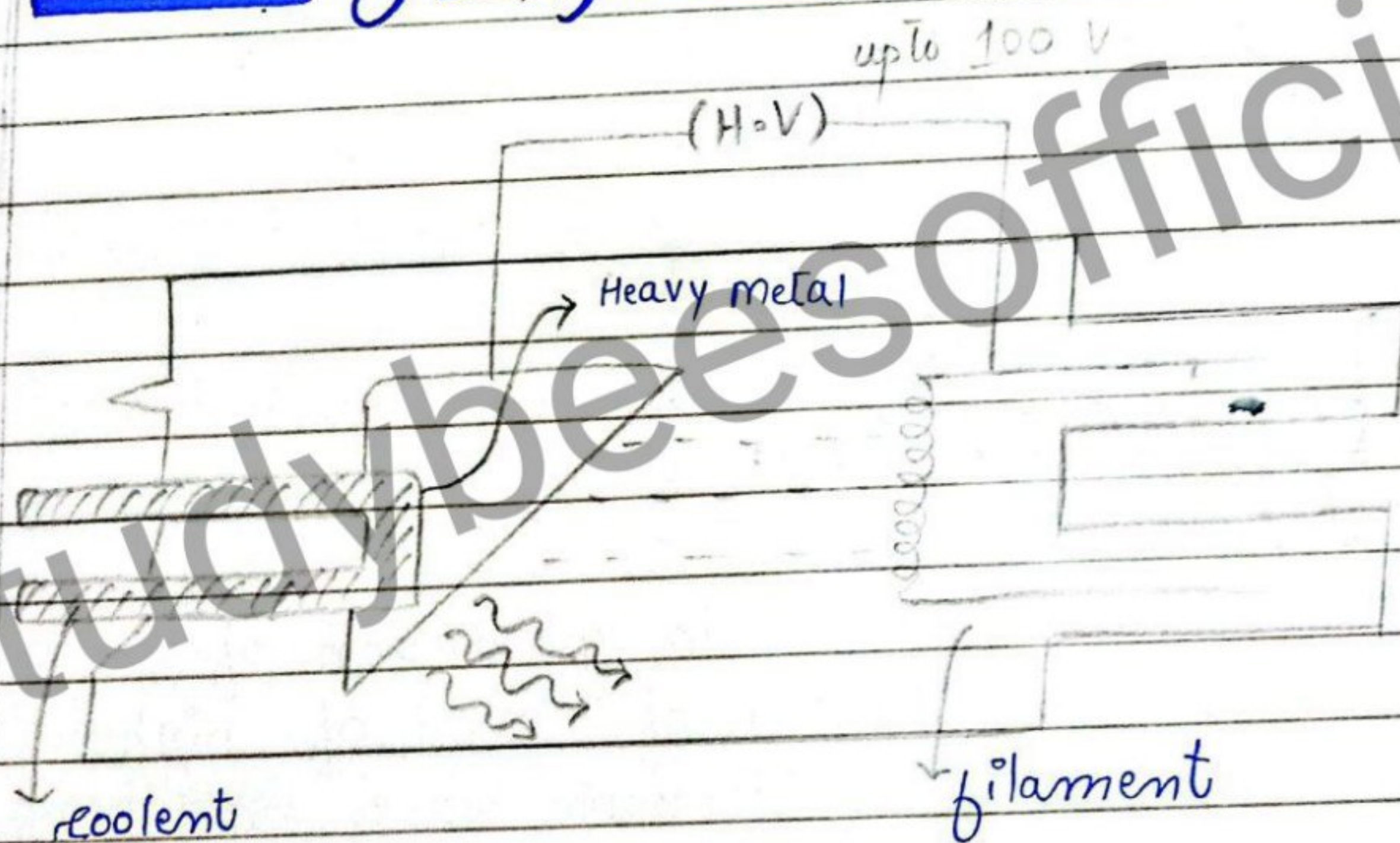
$$eV = hf_{\max}$$

$$eV = \frac{hc}{\lambda_{\max}(\min)}$$

$$\lambda_{\min} = \frac{hc}{eV}$$



X-rays production:



(from Book Pg 205).

Applications of X-rays in medical field:

(from Prince)

• Piezoelectric Effect:

Piezo = Greek letter which means pressure.

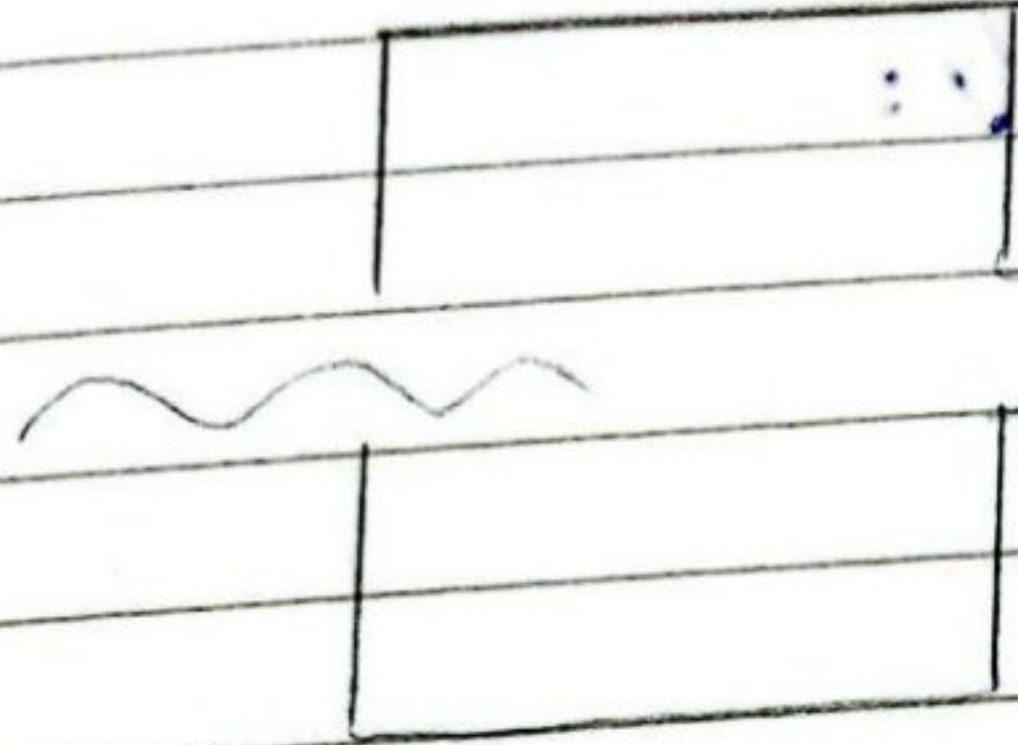
It is the ability of certain material to convert mechanical pressure / stress into electrical voltage.

Application:

Such effect is useful in generation of high voltage, detection of sound of high frequency such as Ultrasonic waves and also for atomic resolution.

• Inverse Piezoelectric Effect:

The conversion of electrical voltage into stress/pressure by specific materials is called inverse piezoelectric effect.



Such process is used in generation of ultrasound. Because electrical energy is converted into rapid vibration. This vibration is at such high frequency that ultrasonic waves are produced.

Ultrasonic Waves:

Such waves which have frequency more than 20,000 Hz (audible range) are called ultrasonic waves.

Transducers:

Such materials which can convert one form of energy into other form such as Piezomaterial.

Applications of Ultrasound in medical:

Sonography/Ecography:

This technique is used to generate images of tissues and organs. It is less harmful and even be used for unborn babies.

Neurosurgery:

It is used in treatment of arthritis and also even sensitive parts involved in neuro

Ultrasonic flow metre:

By phenomena of Doppler shift, Ultrasonic waves are used to calculate flow rate. This technique is used to monitor blood flow through arteries in the body and also provide information on blood