

**Radiology Techniques
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Theoretical Radiation Physics

Third stage- Radiology Techniques Department

Lecture 1

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Radiation Physics precise specialization

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Contents:

1.1 :The wave

1.2 : The mechanical wave

1.2.1 : The mechanical transvers wave

1.2.2 : The mechanical longitudinal wave

1.3 : The audible sound wave

1.4 : The inaudible sound waves

1.4.1 : The ultrasound (ultrasonic) wave

1.4.2 : The infrasound wave

1.5 : The diagnostic ultrasound wave

1.6 : The mechanical longitudinal wave motion

1.1:The wave: it is any disturbance transmitted energy.

1.2 :The mechanical wave: it is the wave travel through some material medium .

1.2.1:The mechanical transvers wave: the wave in which the particles of the media vibrate vertically on the direction of the propagation.

1.2.2 :The mechanical longitudinal wave: The wave in which the particles of the media vibrate parallel to the direction of the propagation, like the wave of the cord .

1.3 :The audible sound wave: it is a mechanical longitudinal wave with frequency between (20HZ) to (20000HZ).

1.4: The inaudible sound waves: there are two types

1.4.1:The ultrasound (ultrasonic) wave : it is a mechanical longitudinal wave has frequency greater than (20000HZ).

1.4.2:The infrasound wave : it is a mechanical longitudinal wave has frequency less than (20HZ).

1.5 :The diagnostic ultrasound wave : it is ultrasound wave with frequency between (1MHZ) to (20MHZ) ,and in which used for clinical diagnoses.

1.6 : The mechanical longitudinal wave motion

1- consider we have along tube filled with a fluid medium (liquid or gas), and provided with a piston at the left end of the tube as shown in figure (1),and the dots in the figure represent the molecules of the fluid.

In the beginning the piston at rest , and the fluid said to be in equilibrium state, and the pressure (p_0) of the fluid is called the equilibrium pressure, then the density(ρ_0)of the molecules in equilibrium state.

2- when we move the piston from left to right as shown in figure(2) ,the molecules are concentrated in front of the piston, resulting in an increased pressure at that location, the region of increased pressure is called **compression region** , in which the pressure (p_1) above the equilibrium pressure, and the density (ρ_1) above the equilibrium density .

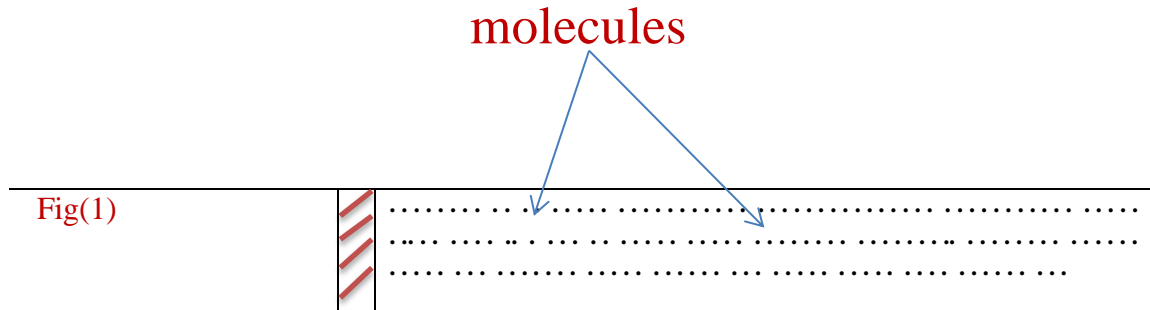
3- because the transfer of energy from the molecules of the compression region to the molecules of the neighbor region by the collisions ,

the compression region begin to migrate away from the piston to the right through the medium ,as shown in figure(3) , and the region close to piston return to equilibrium state , And where the movement of the compression region represents a mechanical disturbance of the transfer energy, which is travel through the medium in away from the source of the disturbance (piston).

4- When we pull the piston from right to left as shown the figure (4), the region near the piston will enlarge and this helps the molecules to diffuse and separate from each other, so the density of the fluid(ρ_2) becomes less than the equilibrium density (ρ_0) and the fluid pressure (p_2) is less than the equilibrium pressure (p_0), and where the region in which there is a decrease in pressure is called the **rarefaction region** ,and then this region begin to migrate away from the piston. that is the compression region is followed by rarefaction region also moving through the medium.

5- If the piston oscillates continuously , alternate regions of compression and rarefaction are propagated through the medium,as shown in figure (5) , The propagation of these regions establishes a wave disturbance in the medium. This disturbance

is termed a **longitudinal wave** because the motion of the molecules in the medium is parallel to the direction of wave propagation.

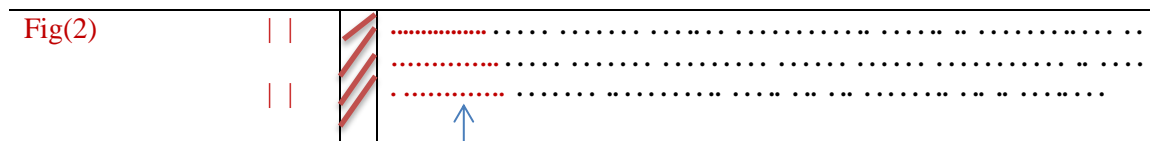


the piston at rest

p_0 : equilibrium pressure , ρ_0 : equilibrium density

$$\rho_1 > \rho_0$$

$$p_1 > p_0$$

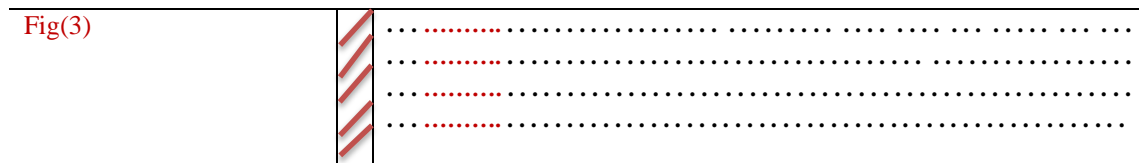


the piston move from left to right

p_0, ρ_1

p_1, ρ_1

p_0, ρ_0



migrate the compression region

