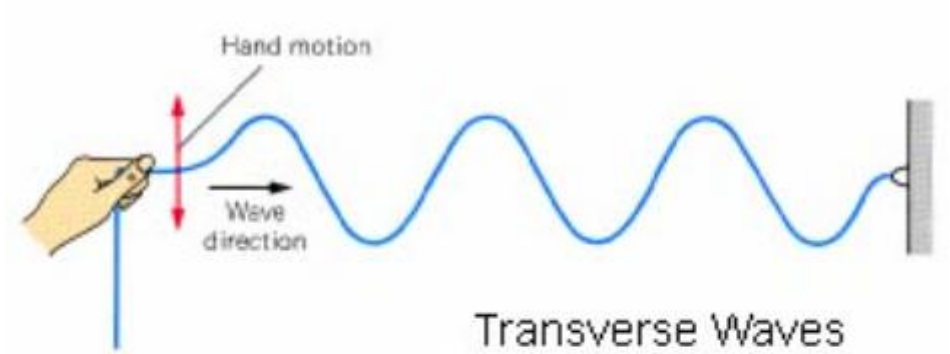
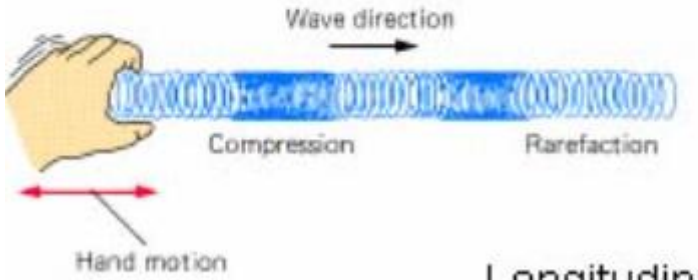
Types of waves

- **Wave** is a disturbance in a medium that transfers energy without a net movement of particles.
- Mechanical and electromagnetic waves are basic types of wave.
- Ocean waves and sound waves are examples of mechanical waves
- Radio, x-rays, visible light, micro waves are example of electromagnetic wave.
- Ocean waves travels thousands of miles across the ocean, but the particles of water do not make that journey
- when you shout, Sound waves may travel across room through air but air molecules do not travel that distance.
- so mechanical waves travel through elastic medium. They originate when some portion of the medium is displaced from normal position and released. Because of elastic medium, the disturbance propagates through the medium. On microscopic level, forces between atoms are responsible for the propagation of waves.

- **Types of mechanical Waves:**
- **1) wave direction:** a) Transverse wave: if the particles motion of the medium in which the wave is traveling is perpendicular to the direction of wave propagation b) Longitudinal waves: if the particles motion of the medium in which the wave is traveling is parallel to the direction of wave propagation
- **2) wave dimension:** a) 1-Dimension: waves travel either to the right or left along straight line b) 2 –dimensional waves: waves that travel over a surface c) 3 dimensional waves: such waves travel in all direction.



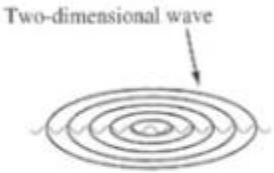
Transverse Waves



Longitudinal Waves

One-dimensional waves (1-D)

Two-dimensional waves (2-D)



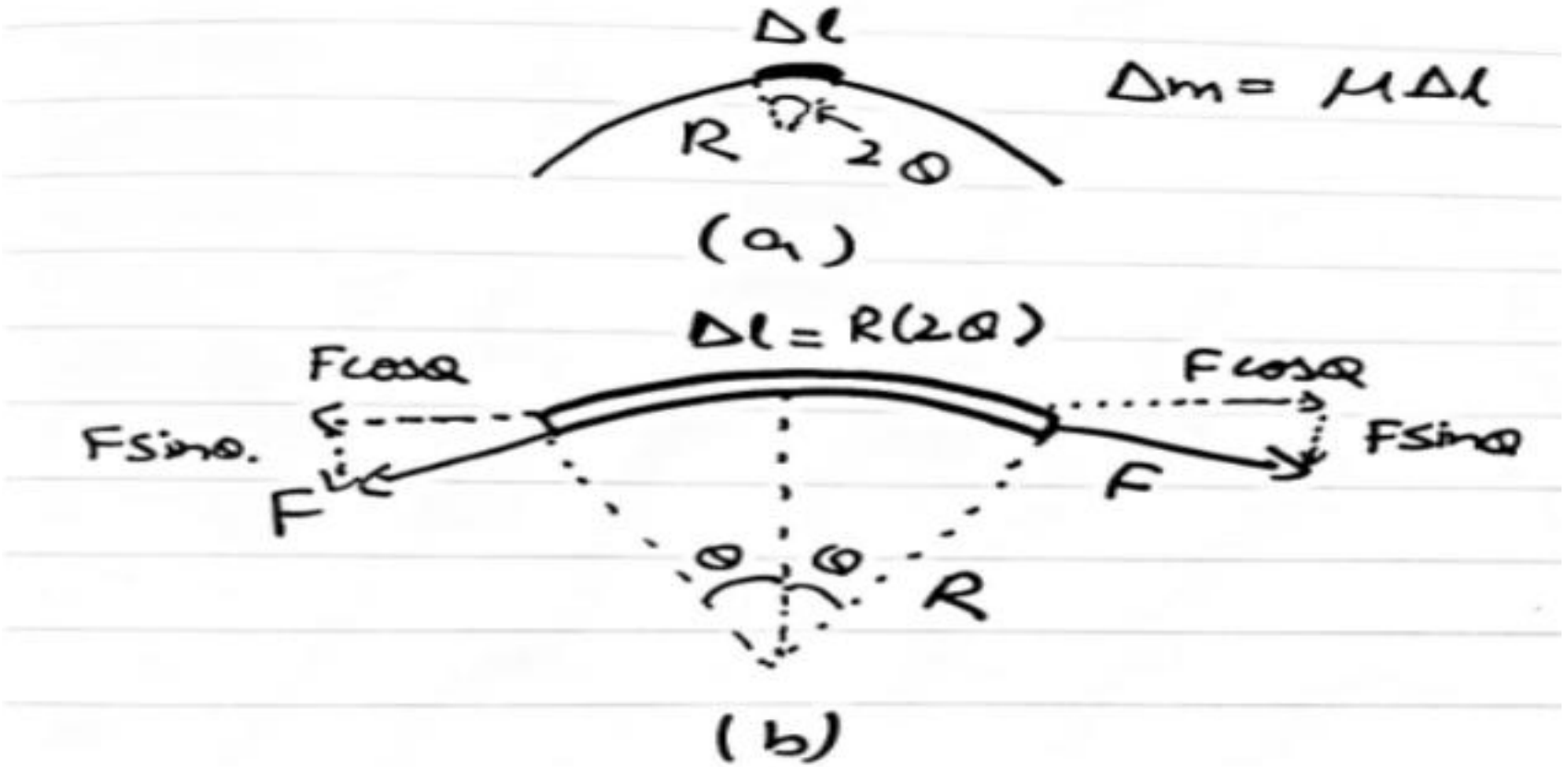
Three-dimensional waves (3-D)

- 3) Particle Behavior in Time:

Pulse waves : Disturbance is momentary and suddenly

Periodic waves : Disturbance repeats at regular intervals

- **Wave pulse:** if the motion of a particle within a restoring medium follows a time sequence that consists of equilibrium followed in time by some type of motion and return a equilibrium, the wave is said to consist of a pulse.
- **Wave train:** in a wave train the wave travels through the medium and the medium's particles undergo periodic motions. If the periodic motions are simple harmonic oscillations, the disturbance is called sinusoidal wave train.


Δl
Δm = μΔl
R
2θ
(a)
Δl = R(2θ)
Fcosθ
Fcosθ
Fsinθ.
Fsinθ
F
F
θ
θ
R
(b)

- a/c to Newton's second la w $\Sigma F = ma$.....4
- By equating 3 and 4
- 2 F(θ)= $\triangle$m v^2/R.....5. (a_c=v^2/R)
- $\mu = \triangle m / \triangle l$.....6
- 5) becomes 2 F(θ)=(μ $\triangle$l) v^2/R.....7
- Put $\triangle l = R(2\theta)$
- 7) becomes 2 F(θ)= μ R (2θ) v^2/R
- F = μ v^2
- $V = \sqrt{F}/\mu$

- CONCLUSION: Velocity of wave is proportional to square root of the tension F and inversely proportional to the square root of the mass per length.
- This equation is valid for for wave pulses and trains of any shape.

- Superposition principle:
- Instantaneous displacement of each particle of the medium is the vector sum of the displacements due to each wave.
- It holds only for waves propagating through media in which restoring obeys hook’s law.
- It applies to small amplitude waves only

- When two waves overlap in space the displacement of the wave is the sum of the individual displacements.