Date: ....

Sun Mon Tue Wed Thu Fri Sat

Chapter no: 1 Simple Harmonic motion and waves

SHM,	Definition:	3 example: • mass-spring system • Simple pendulum • ball & bowl system.	mean position, $P.E = mgh$, $mg0 = 0$.
def: $a \propto -x$.	A body has SHM if		$P.E = 0$/min.
a = acceleration	its F is $\propto$ to x	1. Mean position (normal point) = 0.	• Extreme position: (A,B).
$\propto$ = directly	from mean position	2. Extreme positions (A,B).	v = min, K.E = min, h/x = max.
propotional	and always		
x = displacement	directed towards		
-ve sign indicates	mean position.		
motion towards			
mean position.			

Main Points:

So, P.E = max.

① Energies: Kinetic (K.E), Potential (P.E).

• mean position: (0) v = max, $K.E = \frac{1}{2} m v^2_{max}$.

So, K.E = max, whereas, h/x = 0 at

Gain in K.E = Loss in P.E.

mean position: K.E = max, P.E = min
Extreme position: K.E = min, P.E = max.

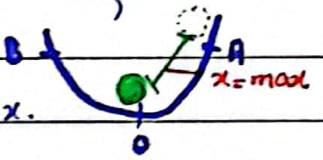
② Acceleration: $\vec{a}$; $a \propto -x$; Net force $\propto$ acceleration

mean position: x = minimum. } ↑F = ↑a.

So, a = min.

extreme position: x = max.

So, a = max.



velocity and acceleration are opposite.

(mean) a↓, v↑ – extreme: a↑, v↓

③ Velocity: (v)

mean position: due to restoring force the body quickly passes the extreme position, So.

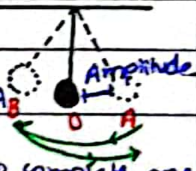
v = max at mean position.

and extreme position = body stops for a nano sec

we consider its velocity to be zero

So, at extreme v = min/0.

Some important definitions:



Vibration: one complete round trip: A to B and back to A

i.e "one complete round trip." Time period: Time required to complete one vibration. Frequency: No. of vibration/time $f = \frac{1}{T}$. Amplitude: max displacement.

Time period & frequency: Time period of simple pendulum.

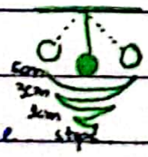
$T = 2\pi\sqrt{\frac{m}{k}}$. but $f = \frac{1}{T}$ So, $f = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$.

Time taken (t): any time, no restrictions.
Time period (T): time in which body completes one vibration. (restriction).

Damped oscillation: Due to some frictional or resistive force, a body will do damped oscillation. i.e the amplitude will decrease with time.

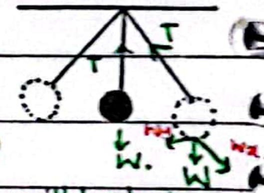
Applications: shock absorber is used in cars, in order to prevent damages to car while moving on bumpy roads.

working: (summarized): When shock is given due to bumpy roads, the shock absorber will compress and oil will come out of pores slowly through the pores. the ~~oil will~~ slowly decrease the amplitude of the shock. Temperature of the oil increases. The impact of force reduces and drive is comfortable.



⇒ Simple pendulum imp point

Forces:



$W_y = mg\sin\theta$
$W_x = mg\cos\theta$

Weight (W) will be broken down in x, y components.

W = F (Fx, Fy); (Wx, Wy);

$W_x = W\cos\theta = mg\cos\theta$.

$W_y = W\sin\theta = mg\sin\theta$.

W = mg.

$F_{restoring} = mg\sin\theta = W_y$.

$T = mg\cos\theta = W_x$.

1. Tension will be balanced by Wx.
2. Wy will help pendulum move back and forth.

Wave.

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"disturbance in the medium which causes the particles of the medium to undergo oscillatory motion about their mean position in equal intervals of time"

Types : Mechanical & electromagnetic

"waves donot transfer matter. they transfer energy"

difference between mechanical and electromagnetic waves:

Mechanical	Electromagnetic
Definition:	
waves that require medium for their propagation.	waves that donot require medium.
medium:	
medium is needed	medium not required.
Example:	
water, sound waves.	x-ray, heat waves.

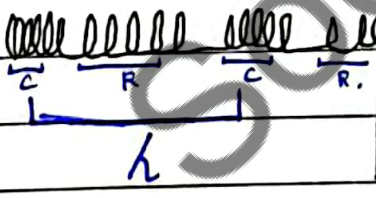
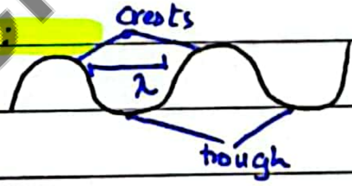
Relation b/w v, f, λ.

$velocity = \frac{d}{t}$. $T = \frac{1}{f}$.

$d = \lambda$.

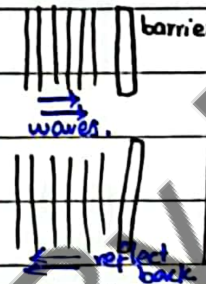
So, $v = \frac{\lambda}{t}$ $v = f\lambda$.

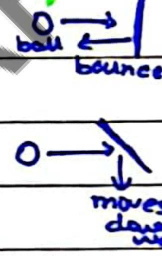
Difference b/w Types of Mechanical waves.

LONGITUDINAL.	TRASVERSE.
Def:	
The particles of medium move back and forth along the direction of propagation of wave.	the vibratory motion of particles of medium is perpendicular to direction of propagation of wave.
Production of wave:	
longitudinal waves can be produced on a spring (slinky) fix one end & hold the other now move it back & forth. i.e push it and pull it.	·Here we need slinky too, fix one end, hold the other, Move the slinky or spring up & down A wave in the form of crest & trough will move toward fixpoint
speed of wave in different materials:	
move faster in solids than gas or liquid	Transverse move through solids at a speed of less than half of speed of longitudinal waves.
compression & Rarefaction.	Crest and Trough.
Parts of waves :	
compression: loops of spring are close together. Rarefaction: loops are spaced apart. ⇒ The compression & rarefaction move back and forth along direction of motion of wave.	·crest : highest points ·trough: lowest points of wave.
wave length:	
The distance b/w two consecutive compressions is wavelength	The distance b/w two consecutive crests or trough is wavelength
Diagram:	
	

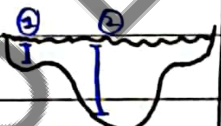
Ripple Tank:

Reflection:





Depth:



point② is more deep, more depth

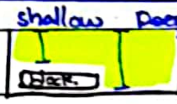
Imp points:

Speed ∝ No. of particles

more depth = more no. of particles

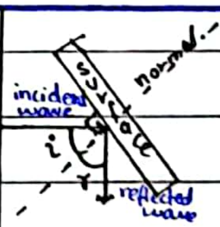
So, depth ∝ speed of the wave

λ ∝ v.



speed & λ changes where as frequency remains unchanged.

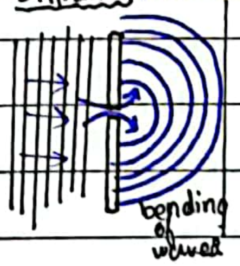
Refraction:

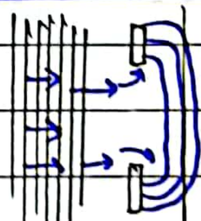


(normal) is just a ⊥ line that passes through surface and forms 90° angle.

$\angle i = \angle r$.

Diffraction:





·small opening more bending of waves

·big opening/gap less bending of waves.

2. Conditions:

① lambda should be greater than length. $(\lambda > L)$.

② lambda should be equal to length $(\lambda = L)$.