10-29 to 10-31

* Quiz 7 - Ch17, 18

due next Thurs.

* Lab Thurs.

* today: Ch18, 19, 20

w/ video assistance

* Notes Posted ASAP!

* Special writing project

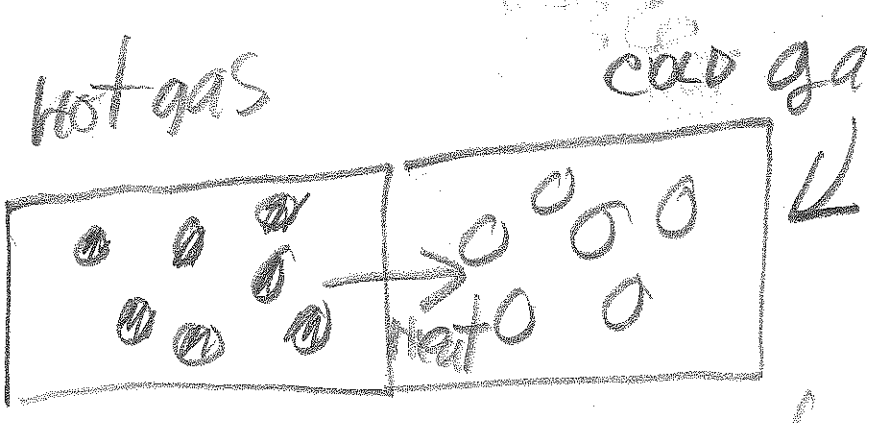
CH 18

2ND of THERMODYNAMICS

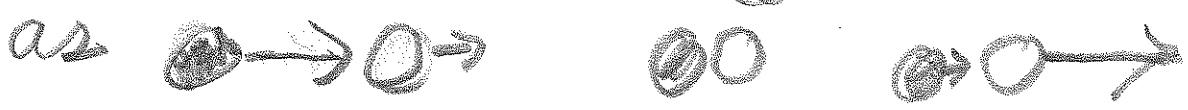
(A) HEAT NEVER FLOWS from cold to hot

p522

(B) systems in contact naturally go from ORDER TO DISORDER



HIGHLY ORDERED

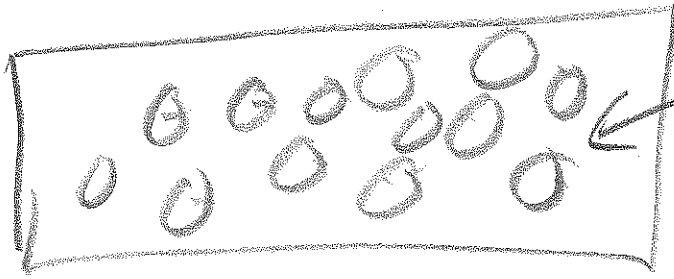


Heat moves from

HOT TO COLD via

collisions

AFTER heat stops flowing



ALL MOLECULES HAVE SAME speed

MORE DISORDERED

without the left-

right separation

of hot and cold

2ND LAW SAYS

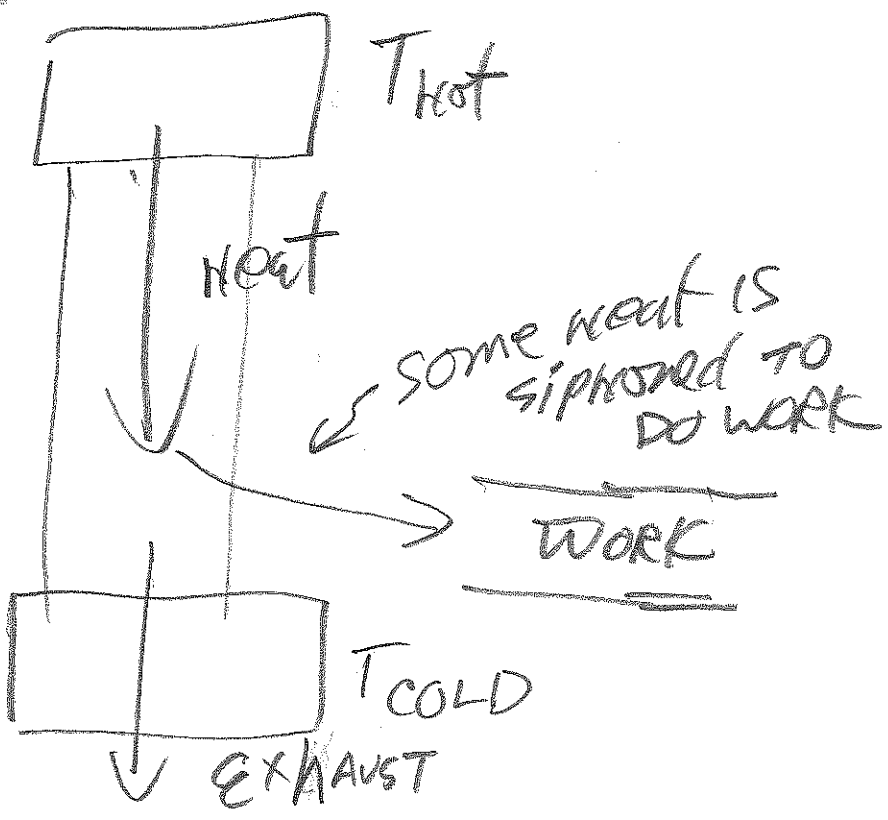
HEAT ALWAYS

FLOWS FROM

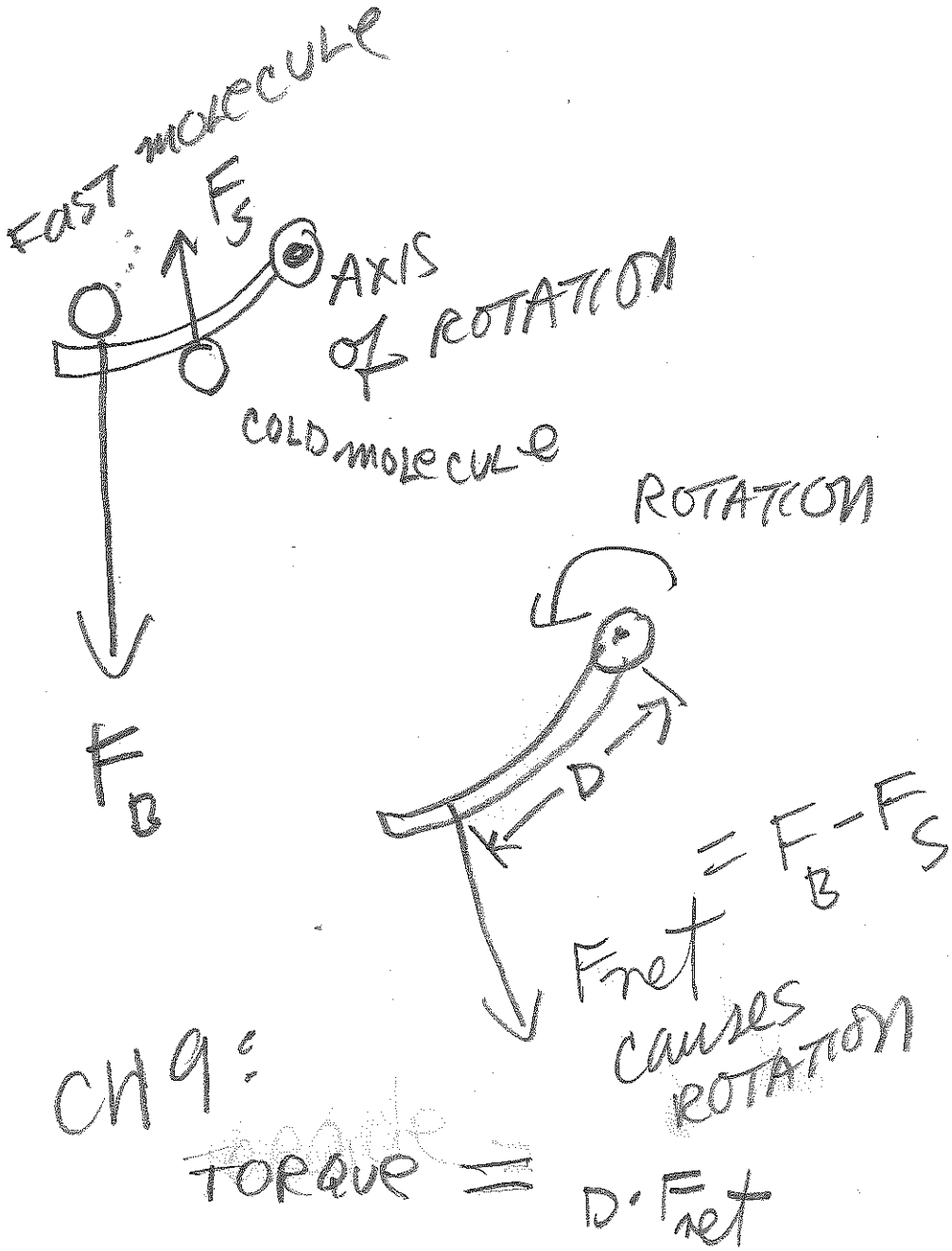
HOT TO COLD.

THIS MECHANISM EXPLAINS

ENGINES:



Blow up of fig 18.14 (steam-engine)

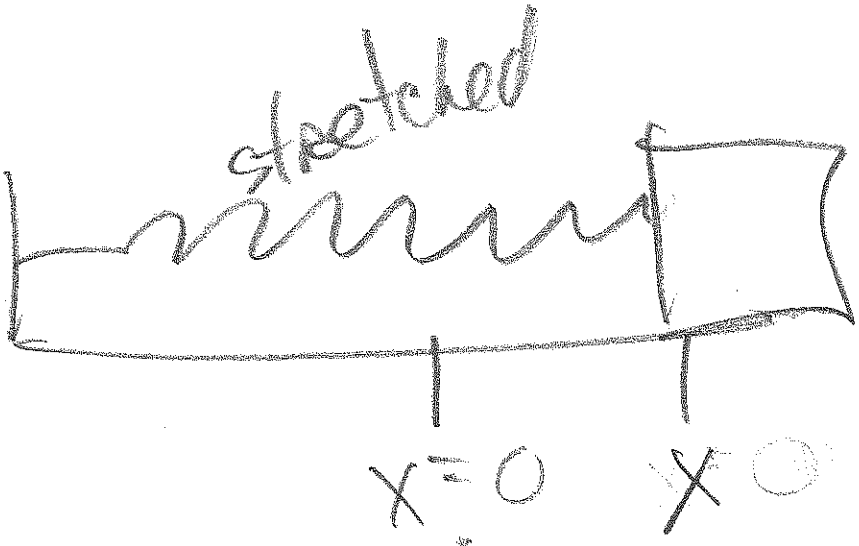


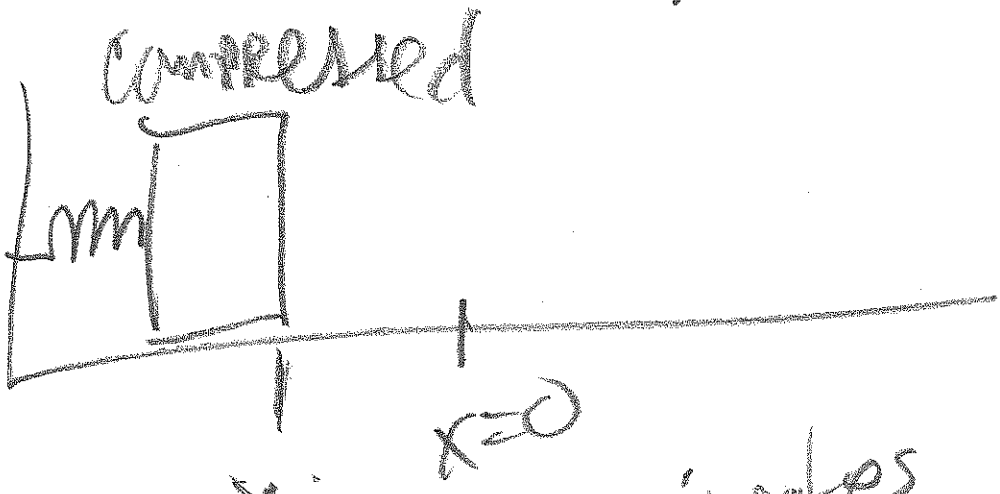
CH 9:

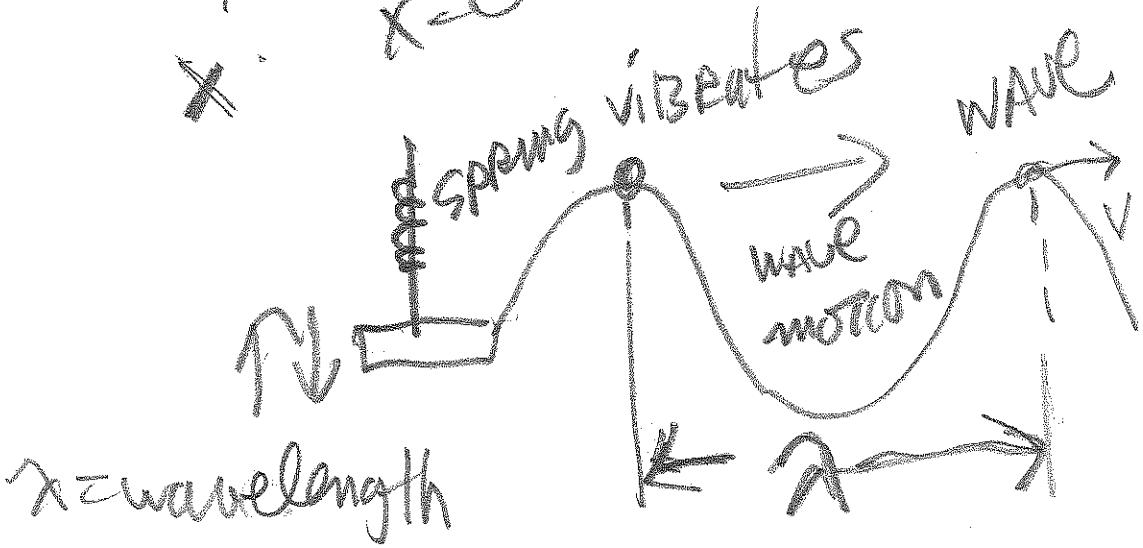
TORQUE = D · F_{net}

CH19 Review

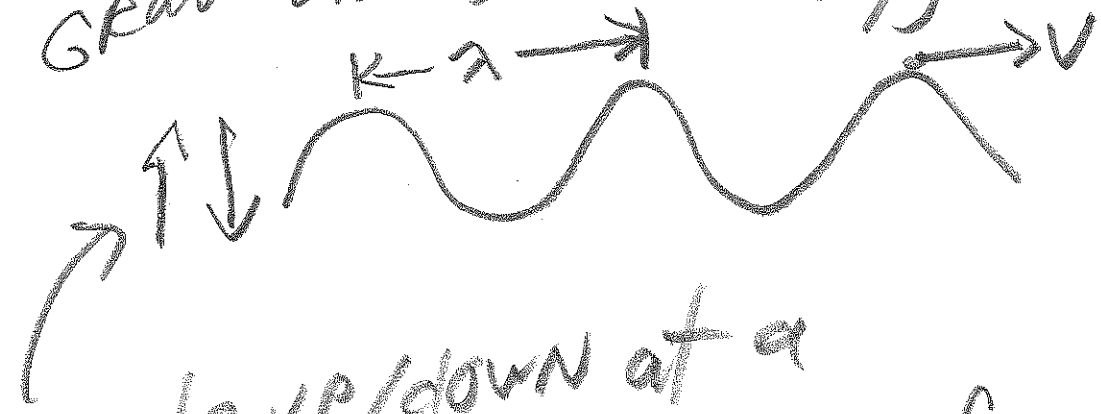
P.E. = potential of spring $= \frac{1}{2}kx^2$







Grab string (or slinky)



vibrate up/down at a certain frequency f and period (call T.

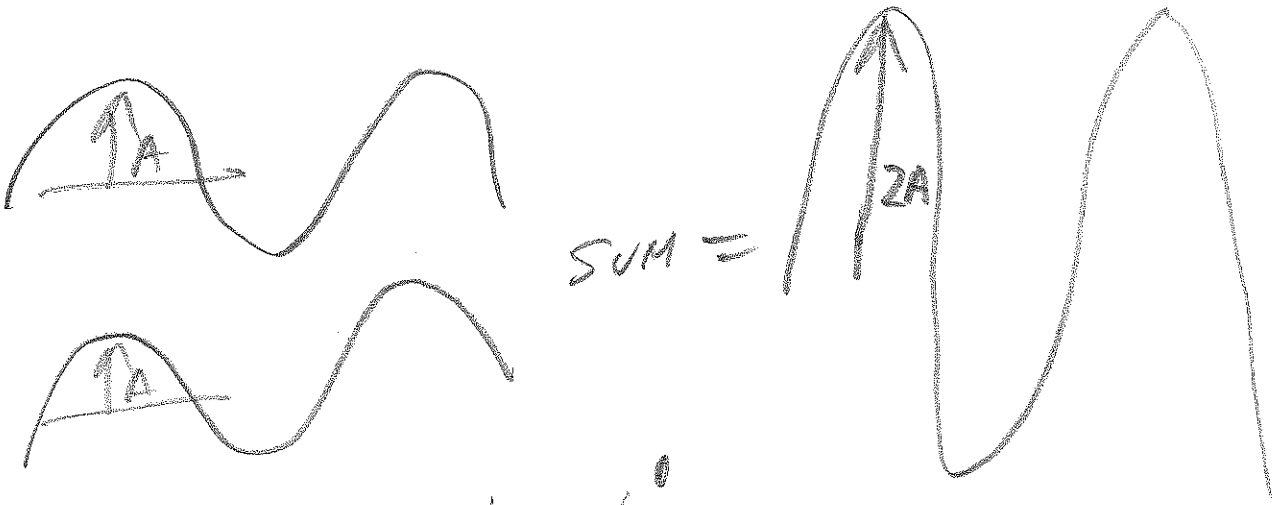
v = wave speed

λ = wavelength

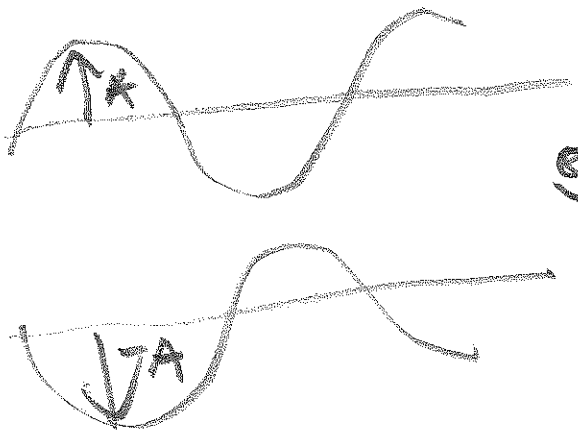
= v · T

v = speed of a peak moving right.

See class demo of fig 19.8



constructive interference



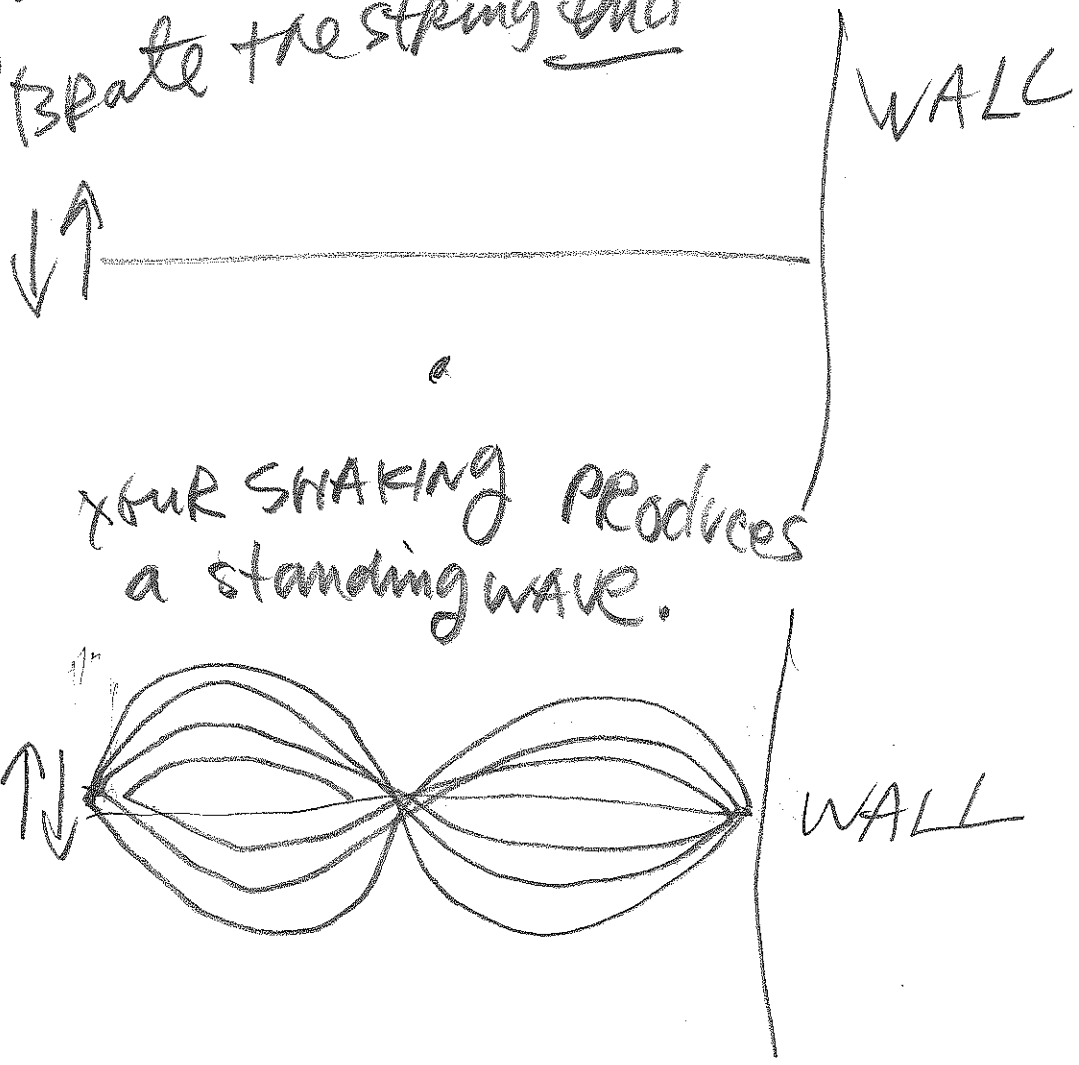
SUM = zero

A + (-A) = zero

destructive interference

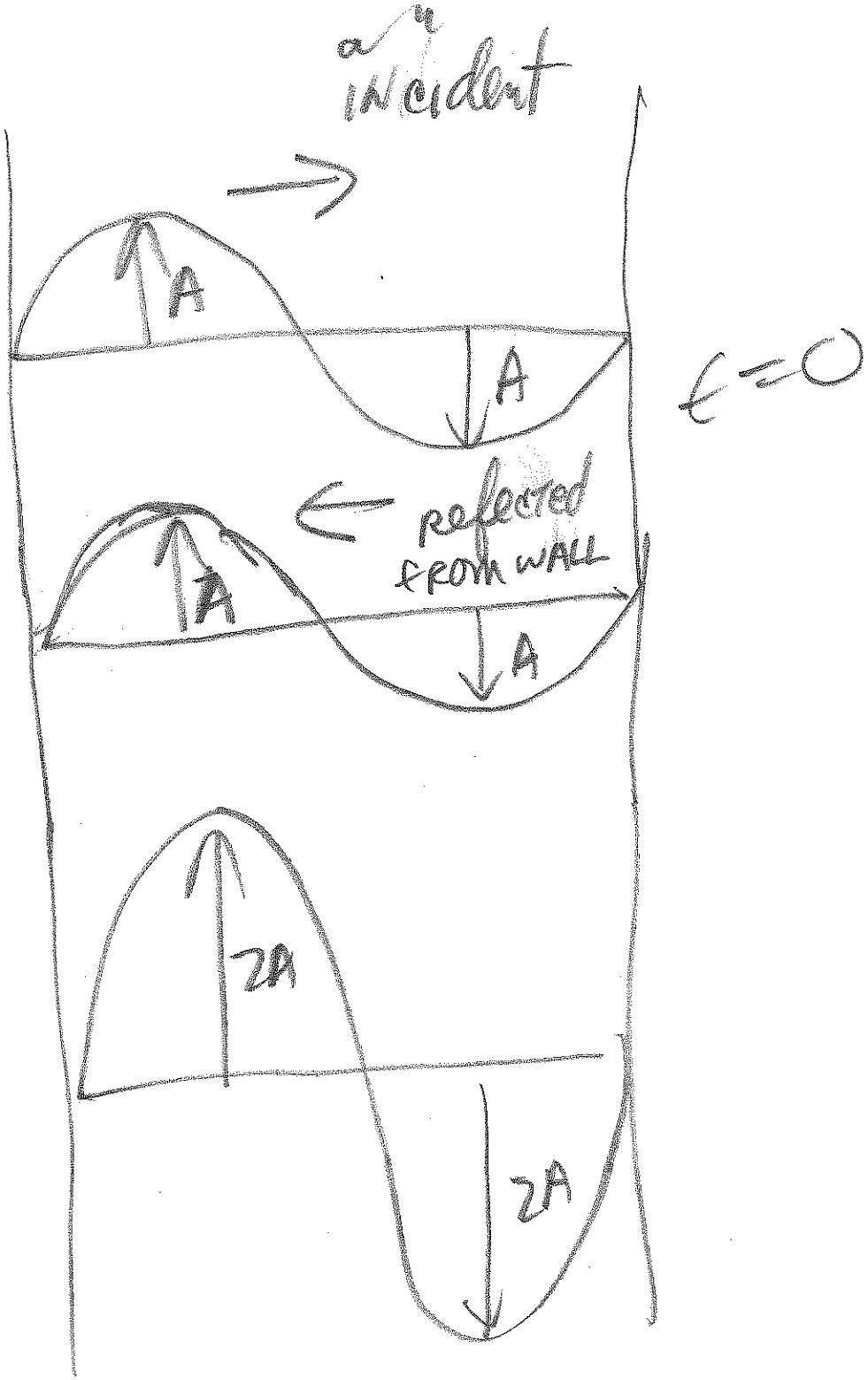
Standing wave

vibrate the string end

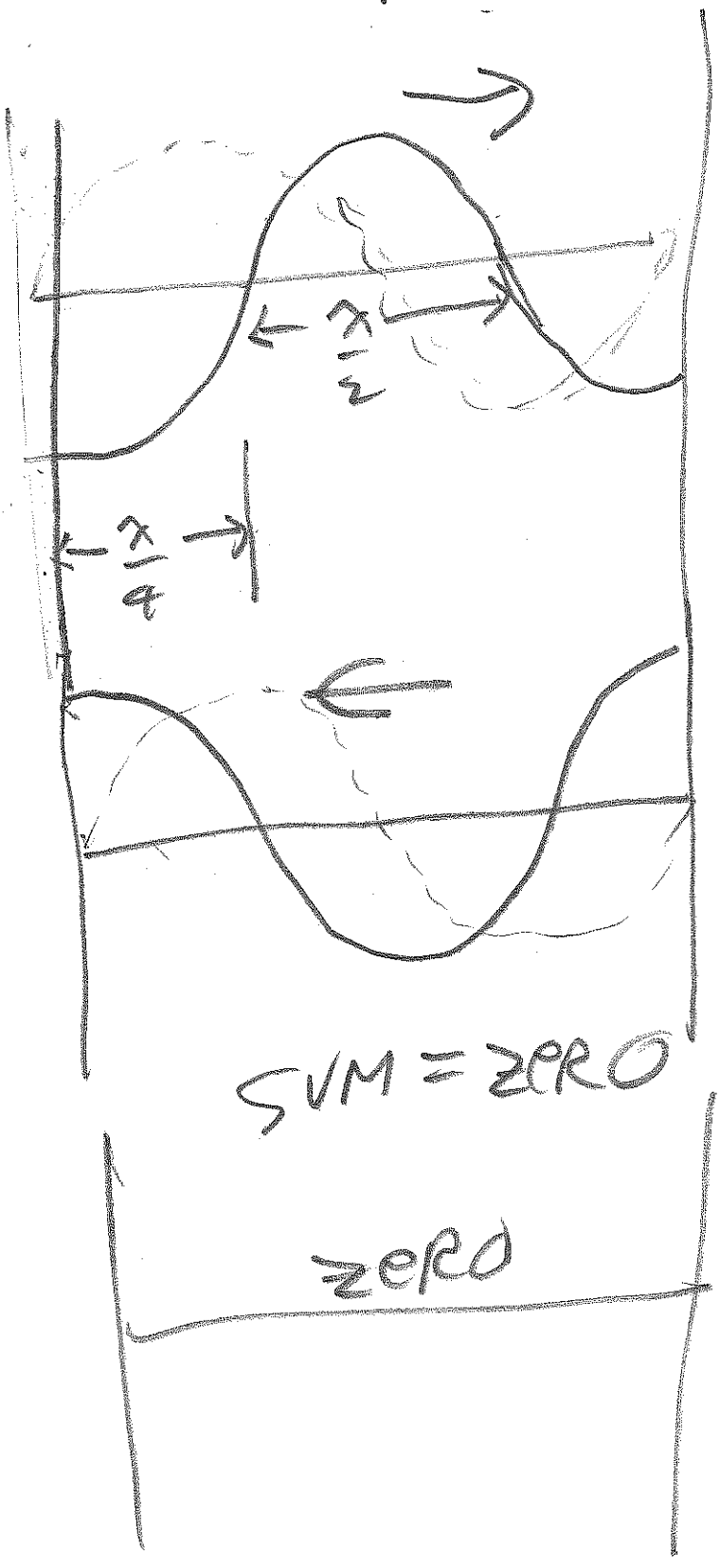


YOUR SHAKING produces a standing wave.

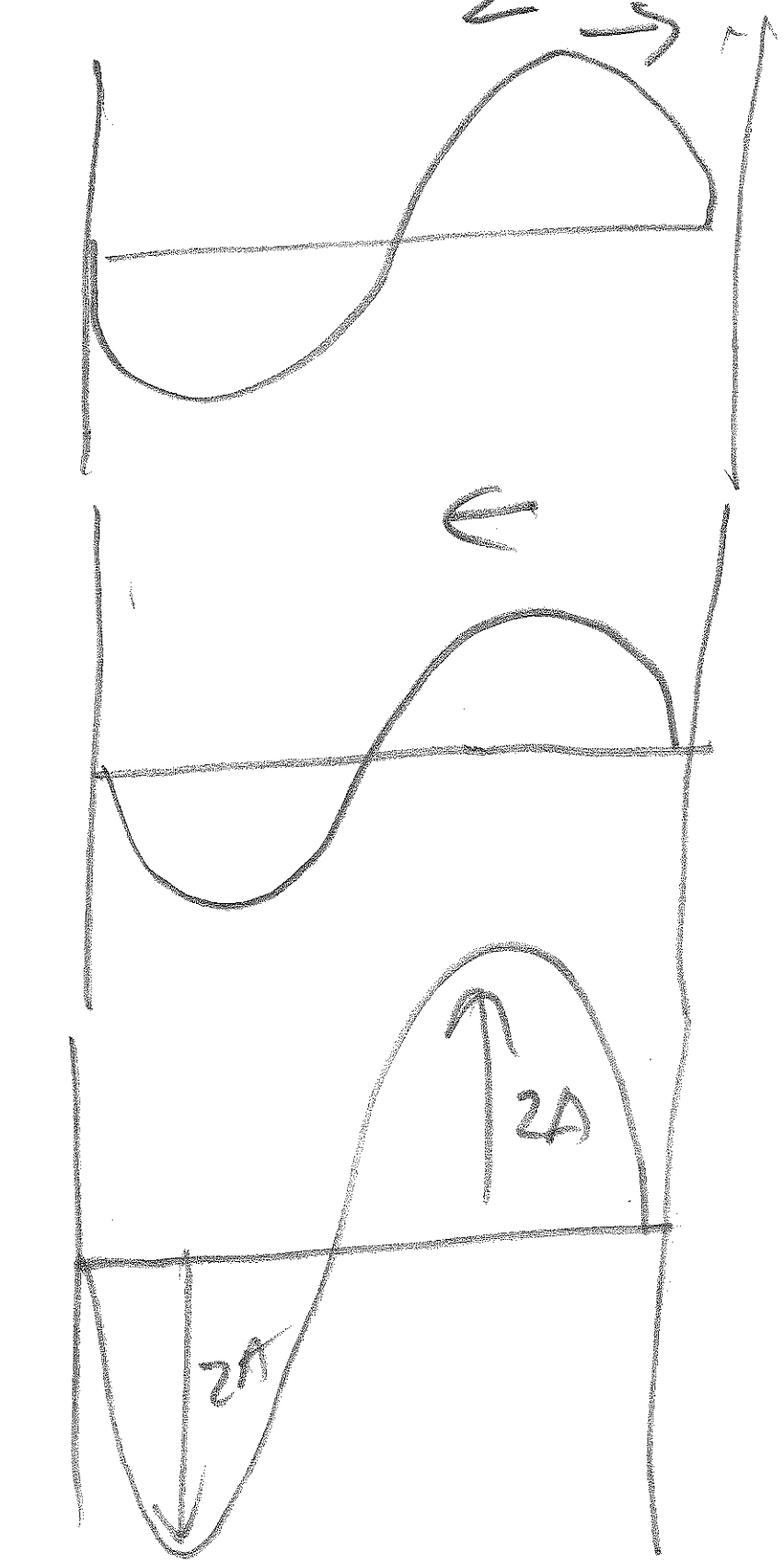
standing wave = special SUM of incident wave and reflected wave from WALL

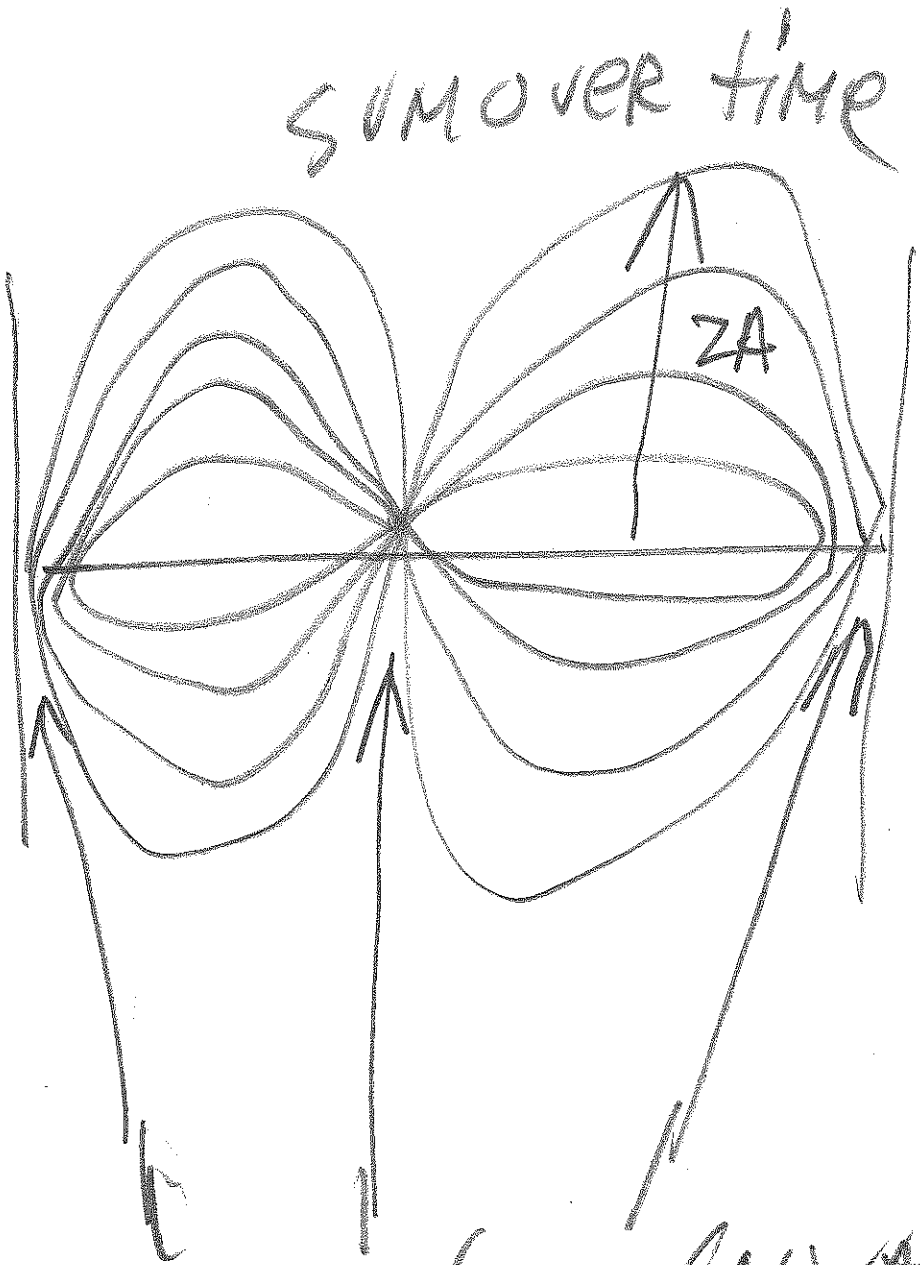

incident
A
A
x = 0
reflected
from wall
A
A
2A
2A

at $t = \frac{T}{4}$.



at $t = \frac{T}{2}$

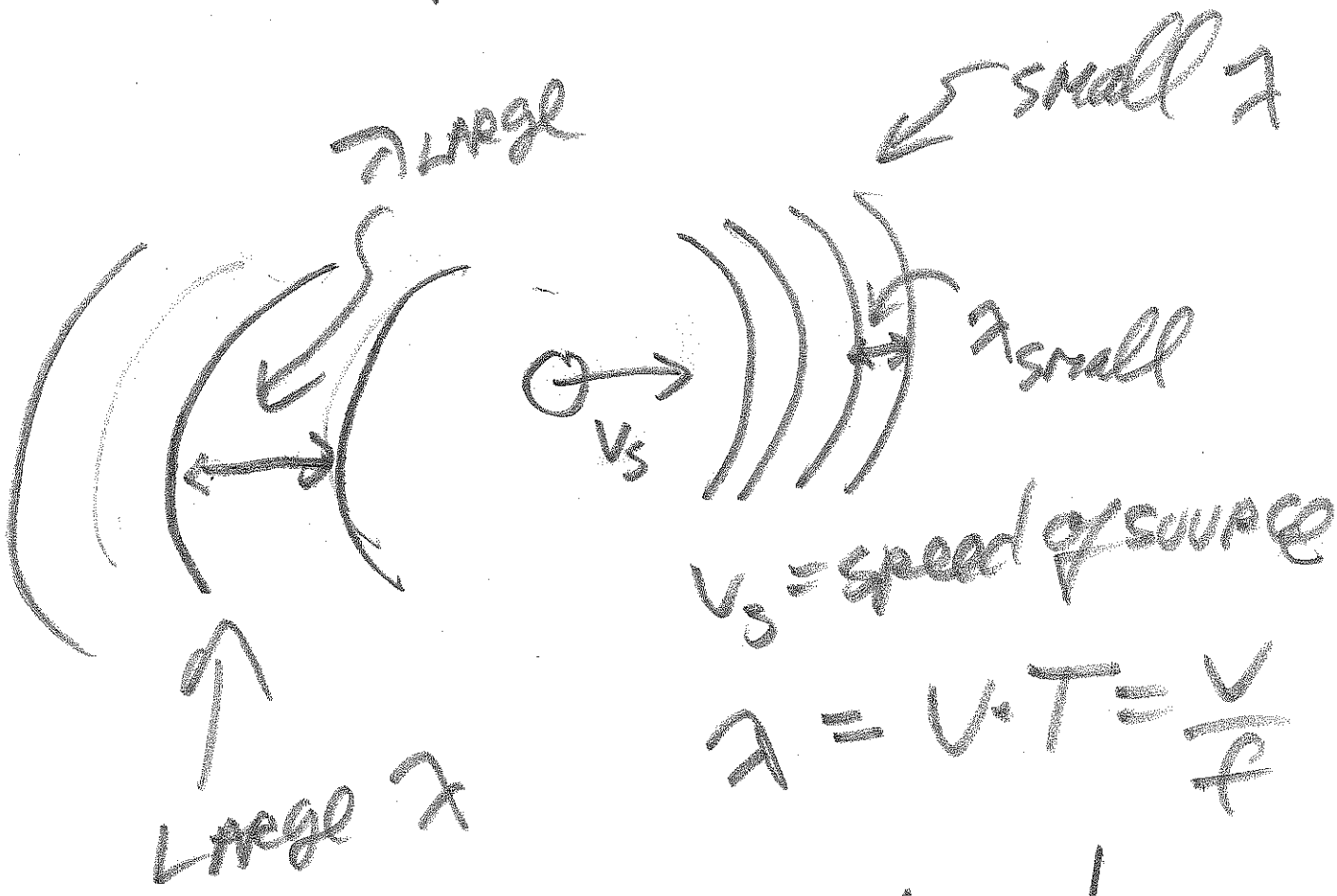




nodes (always zero)

standing wave:
LASERS, GUITARS, VIOLINS

Doppler Effect:

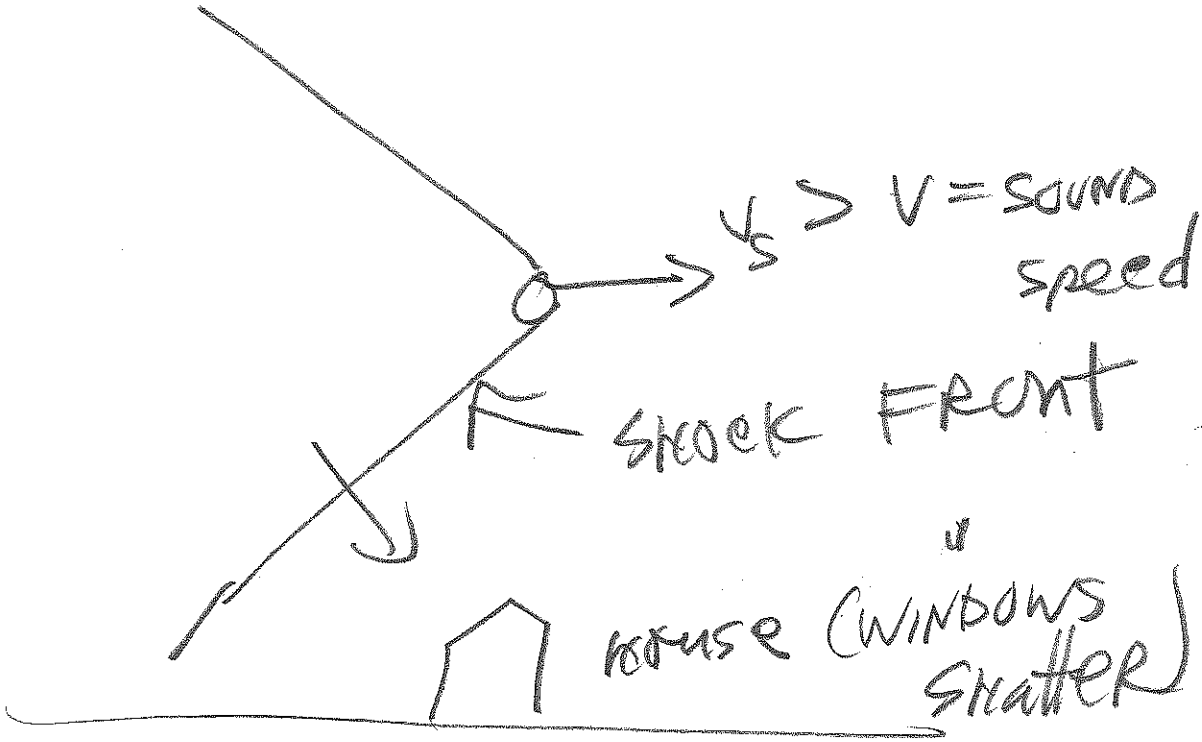


$$\lambda = v \cdot T = \frac{v}{f}$$

$$f = v \cdot \frac{1}{\lambda}$$

$$f = \frac{v}{\lambda}$$

IF λ IS SMALL f IS LARGE
IF λ IS LARGE f IS SMALL



CH 20

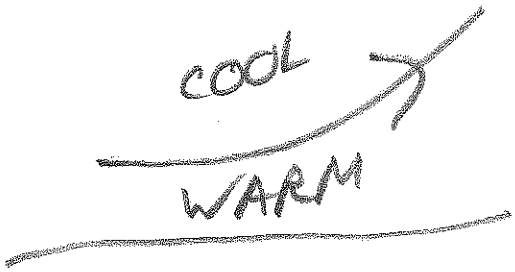
Read "speed of sound in air"
"reflection" and "refraction of sound"
"resonance"
"Interference"
"Beats"

ch 20

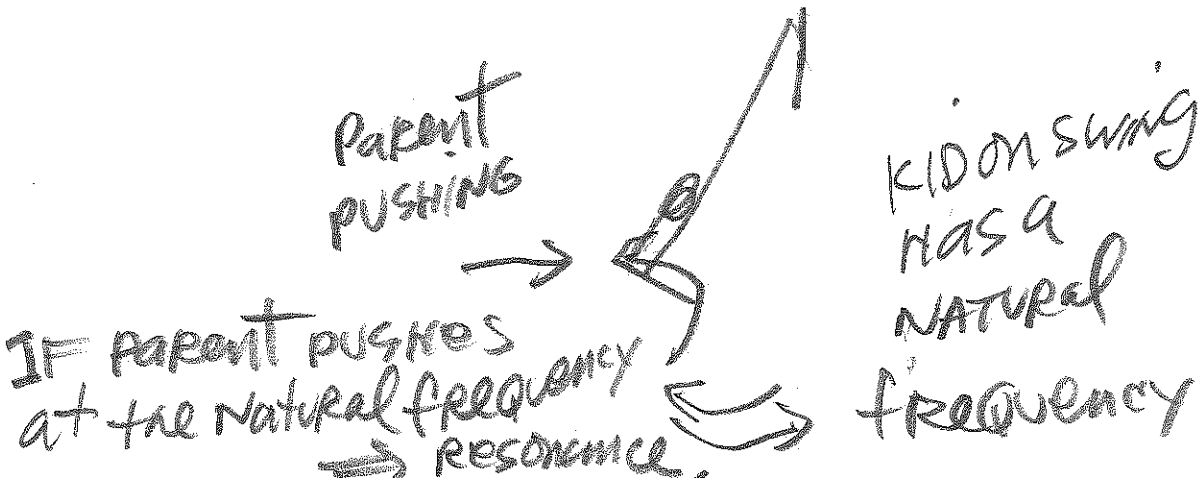
EQUAL angles

fig 20.9 on reflection

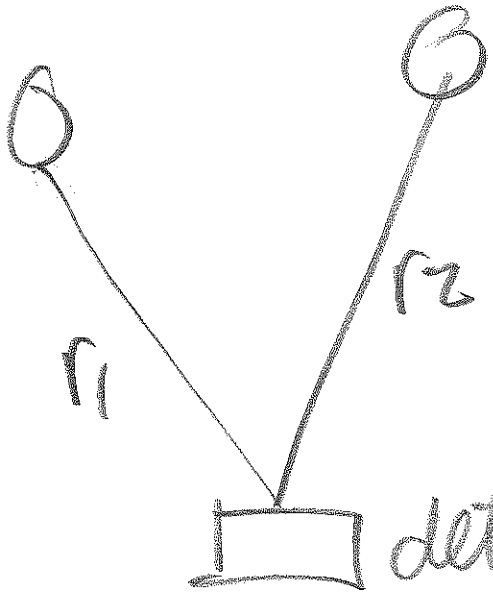
IN WARMER AIR



Resonance : KID on swing at PARK



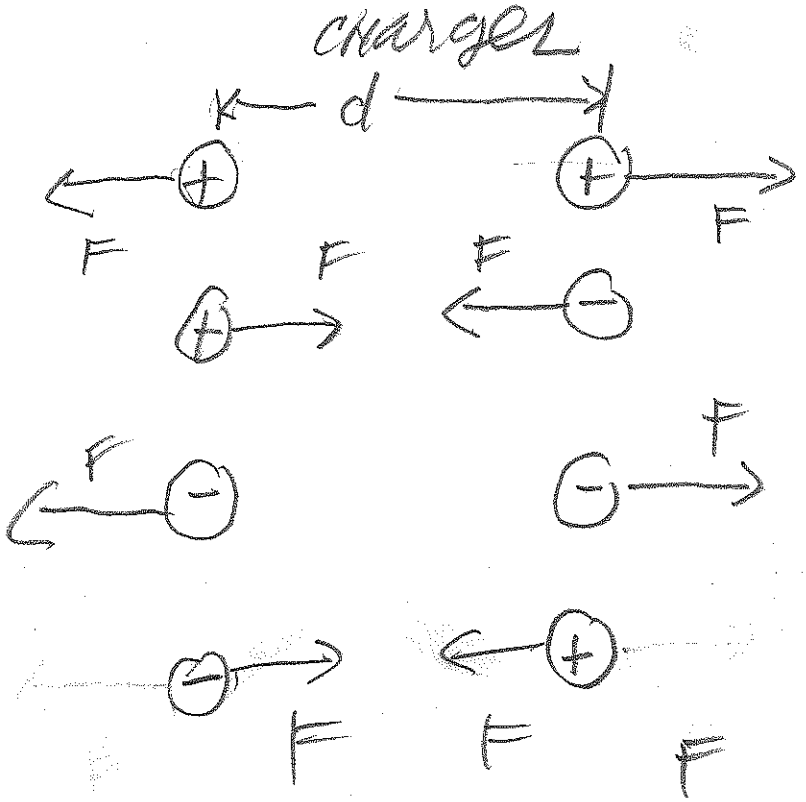
Interference



$r_2 - r_1 = \lambda$ constructive

$r_2 - r_1 = \frac{\lambda}{2}$ destructive

ch 22



$$F = \frac{k \cdot |q_1 \cdot q_2|}{d^2}$$

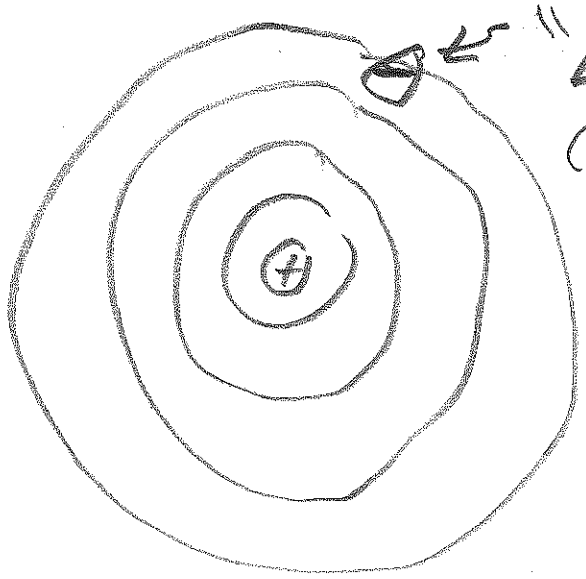
$$k = 9 \times 10^9 \frac{N \cdot m^2}{C^2}$$

C = coulomb = charge unit

Conductors:

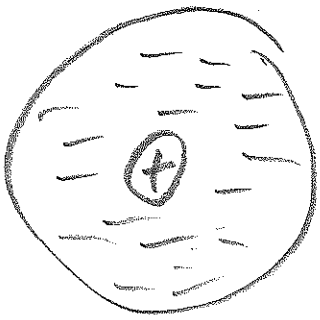
Good electrical conduction means good heat conduction.

"Loose" outer atomic shell electrons:

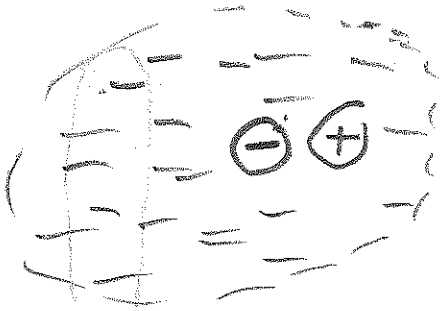


Polarization

negative rod
ROD



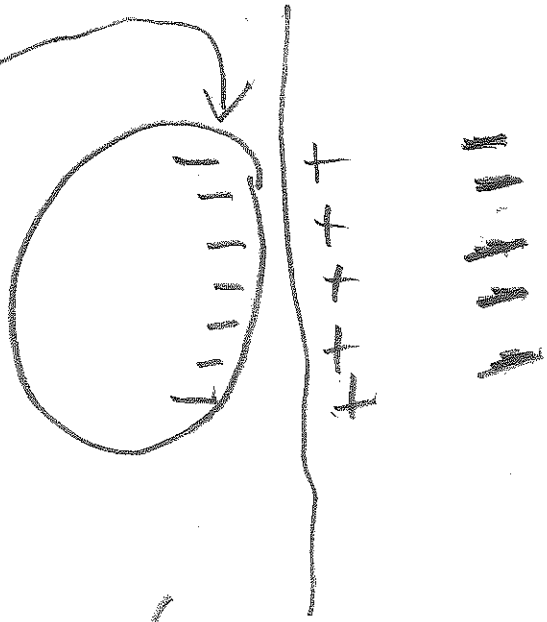
ATOM



POLARIZED ATOM

fig 22.11

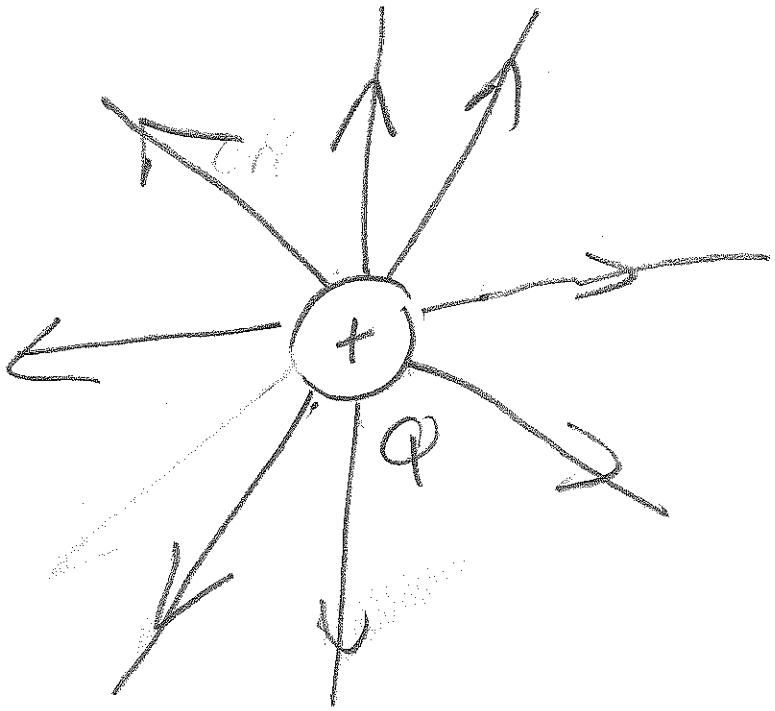
MAKE BALLOON negative by RUBBING it with FUR or with YOUR HAIR.



Balloon POLARIZES WALL.

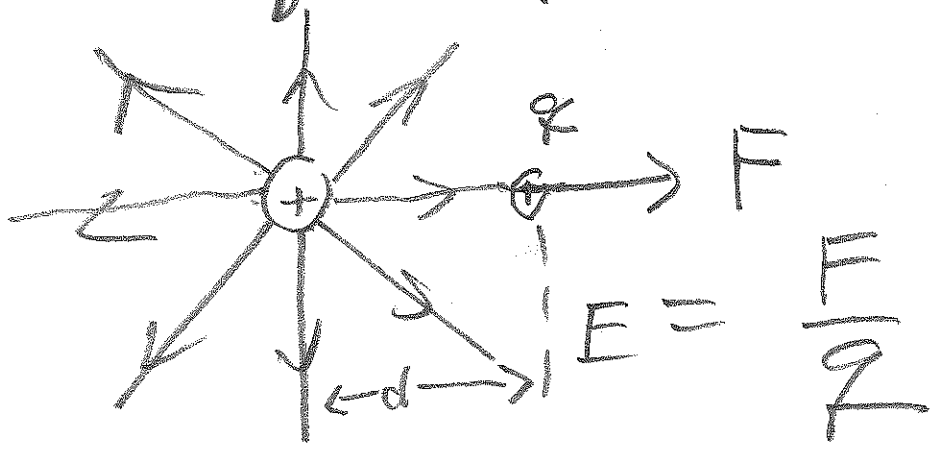
Balloon ATTRACTED TO positive CHARGES IN WALL.

Electric FIELD.



charge modifies space with $\vec{E}$ - field.

Force on $q = q \cdot E$

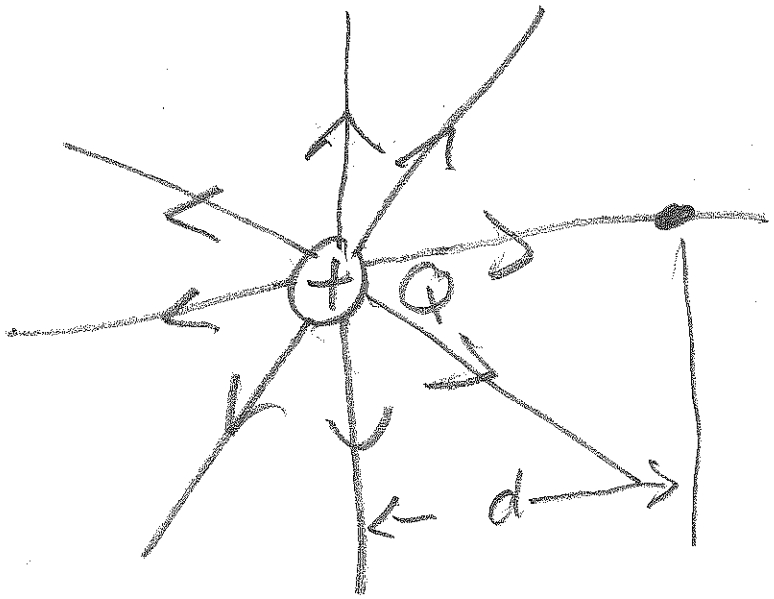


$E = \frac{F}{q}$

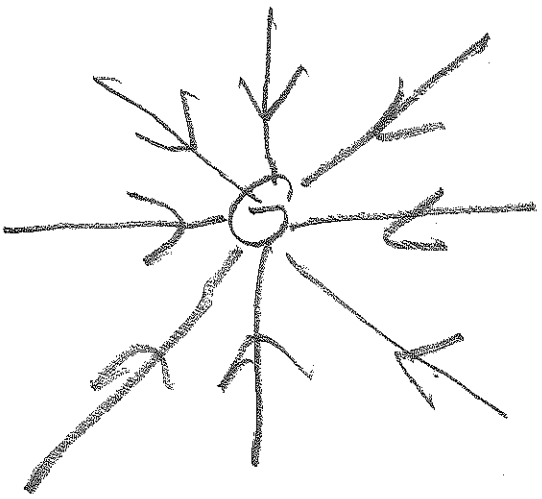
note:

$$F = \frac{kQq}{d^2}$$

$$E = \frac{F}{q} = \frac{kQ}{d^2}$$ due to a point charge Q.



Note:



Electric potential:

Electric potential

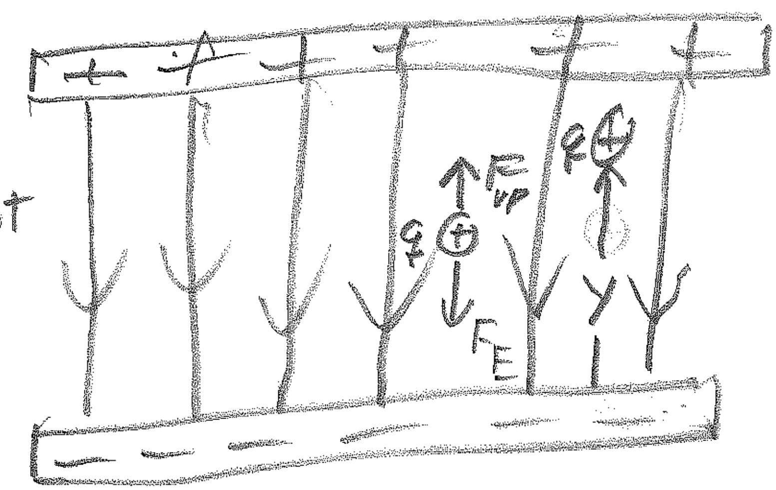
Electric potential ENERGY

$$\text{unit: } \frac{\text{Joule}}{\text{C}} = \text{Volt}$$

CHARGE

Example

2 plates



$\vec{E}$ = CONSTANT between plates

fig 22.18 (c)

$$F_E = qE$$

Potential energy

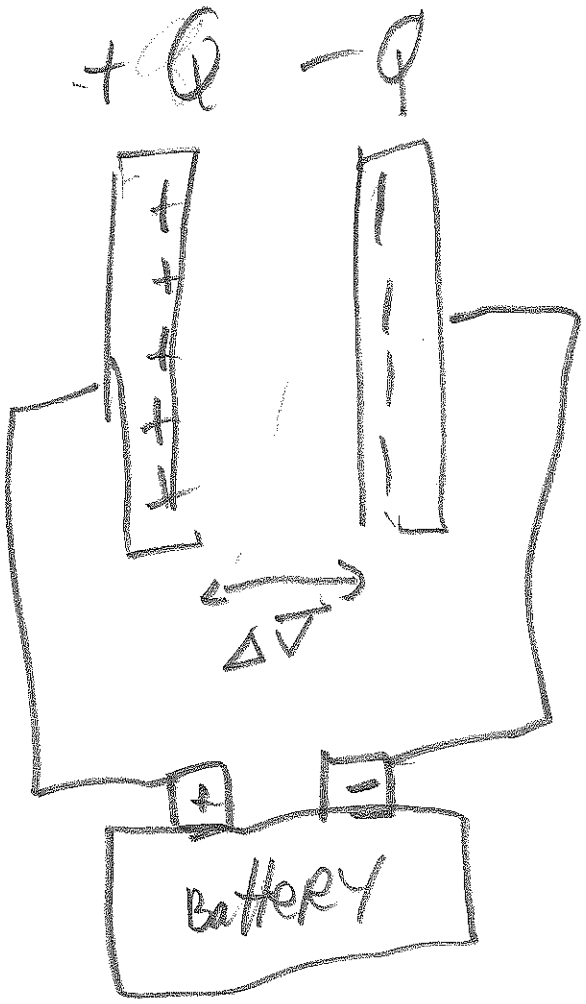
= WORK ← work to lift charge Y above negative plate

$$= qE \cdot Y$$

Electric Potential $= \frac{qEY}{q} = E \cdot Y$

Y = distance above − plate.

Energy storage



$\Delta V = V_+ - V_-$

= Battery voltage

$$\text{Energy} = \frac{Q^2}{2C}$$

C = capacitance