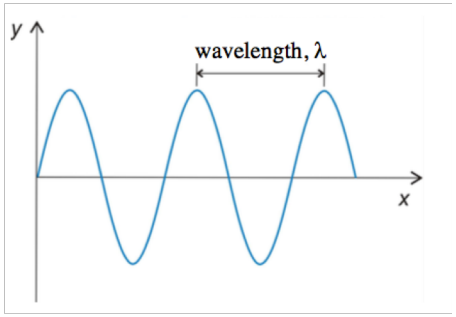
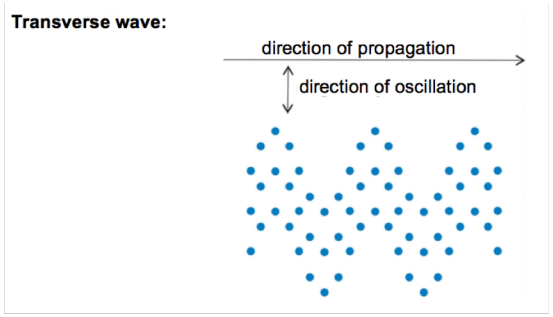
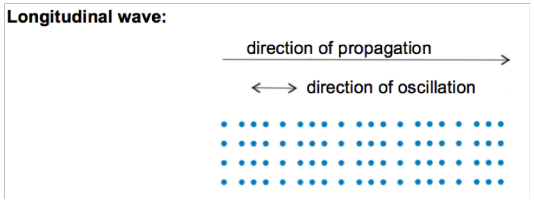
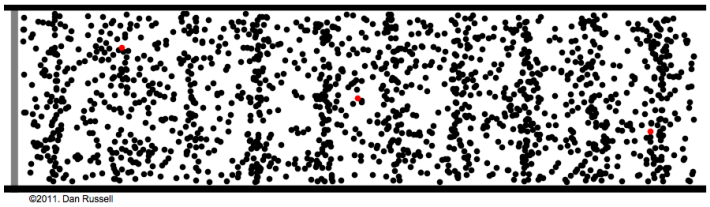
Waves

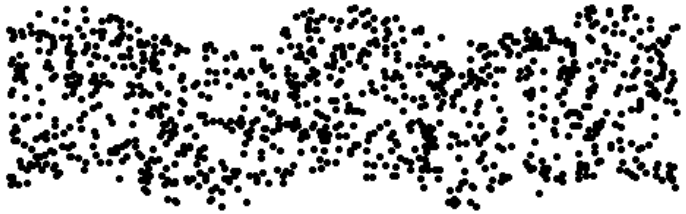


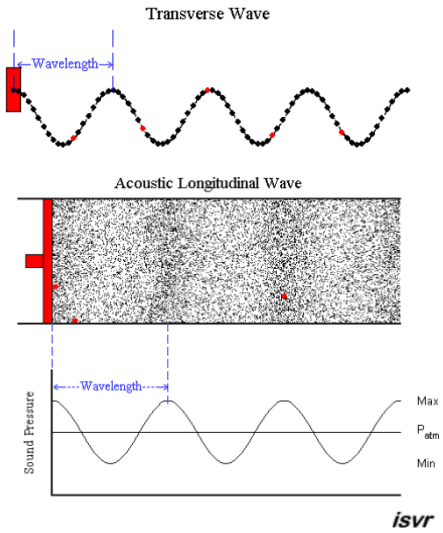
$$c = \frac{\lambda}{T} = \lambda \cdot \frac{1}{T} = \lambda \cdot f$$

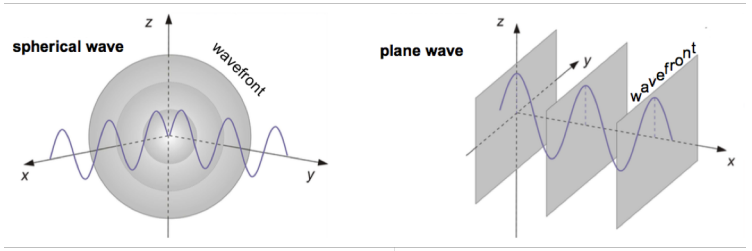


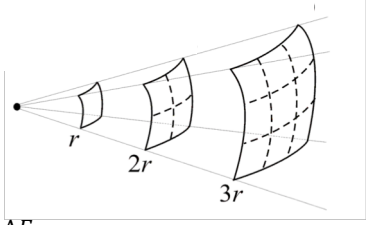








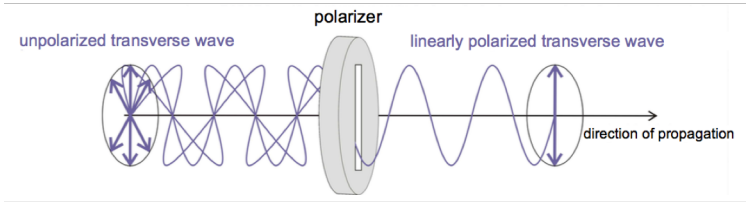




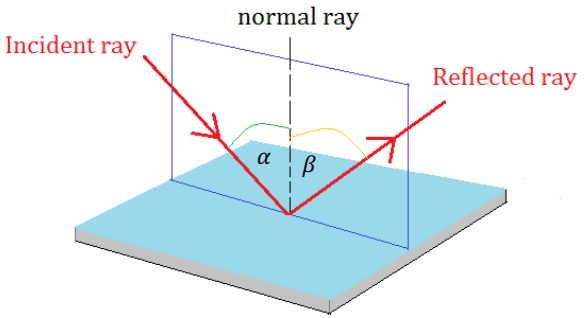
$\frac{\Delta E}{\Delta A}$ decreases with increasing distance from source

$\frac{\Delta E}{\Delta A}$ stays the same with increasing distance from source

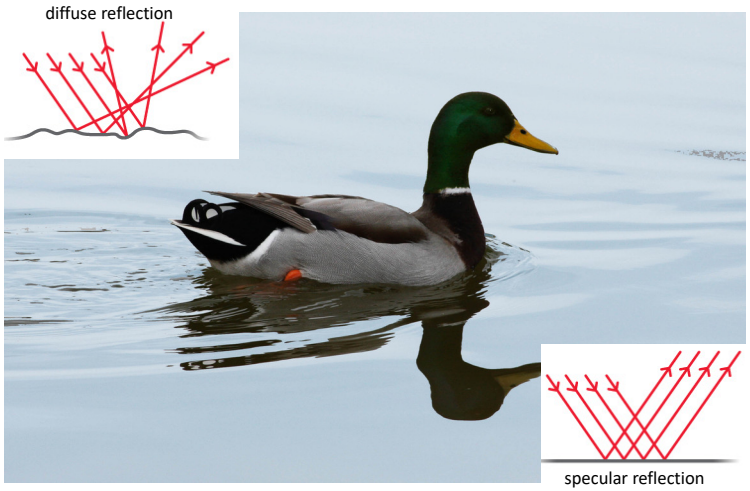
Polarization

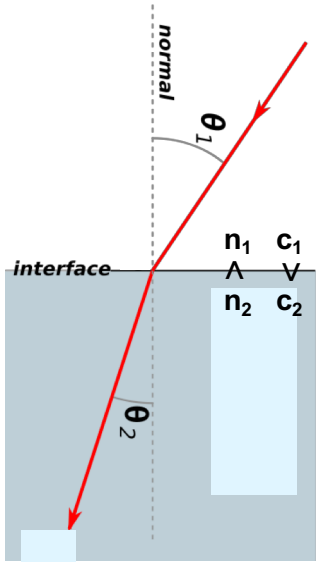


Reflection



$\alpha = \beta$

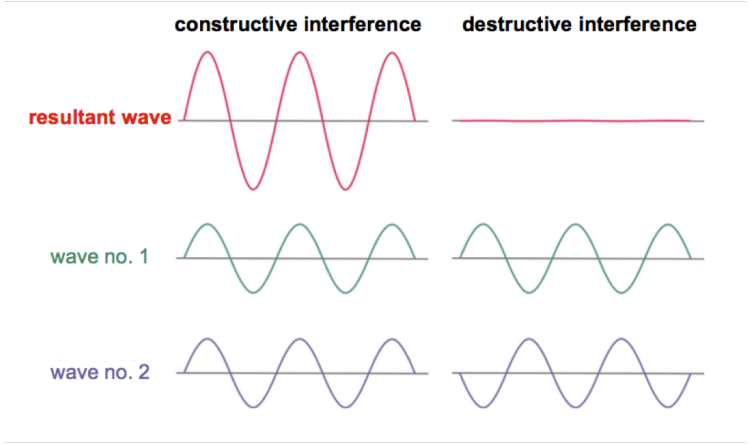


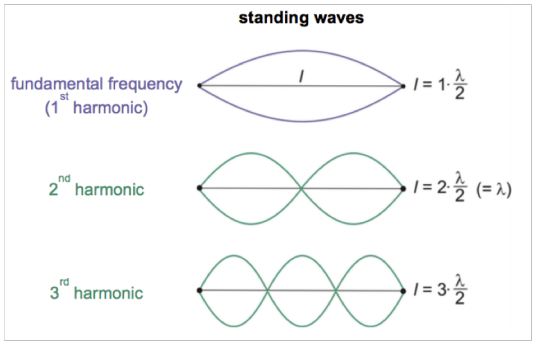


Refraction

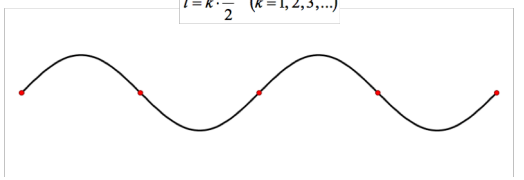
$$\frac{\sin\alpha}{\sin\beta} = \frac{c_1}{c_2}$$

$$\sin\alpha \cdot n_1 = \sin\beta \cdot n_2$$

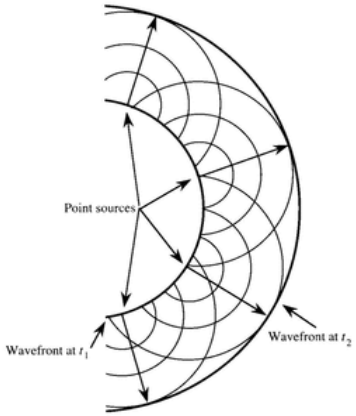




$$l = k \cdot \frac{\lambda}{2} \quad (k = 1, 2, 3, \ldots)$$



Huygens–principle



Problems: 8/4 and 8/10

Soundwaves

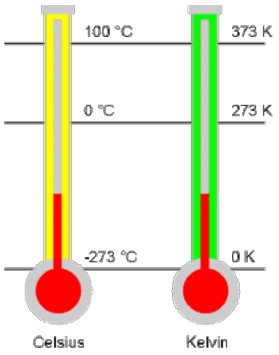
Range of sounds

sound range	infrasound	audible sound	ultrasound	hypersound
frequency (Hz)	< 20	20–20 000	20 000–10^9	10^9 <

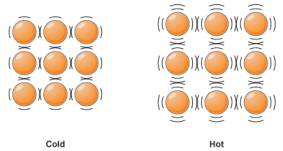
Speed of sound in various media

medium	c_{sound} (m/s)
air (0°C, 101 kPa)	330
helium gas (0°C, 101 kPa)	965
water (20°C)	1483
fatty tissue	1470
muscle	1568
bone (compact)	3600
iron	5950

Termodynamics



$$\frac{T}{\mathrm{K}} = \frac{t}{°\mathrm{C}} + 273 \qquad \frac{t}{°\mathrm{C}} = \frac{T}{\mathrm{K}} - 273.$$



Heat capacity (C) and specific heat capacity(c)

$$C = \frac{Q}{\Delta T} = \left[\frac{J}{K}\right] \qquad c = \frac{C}{m} = \left[\frac{J}{kg \cdot K}\right]$$

$$Q = c \cdot m \cdot \Delta T$$

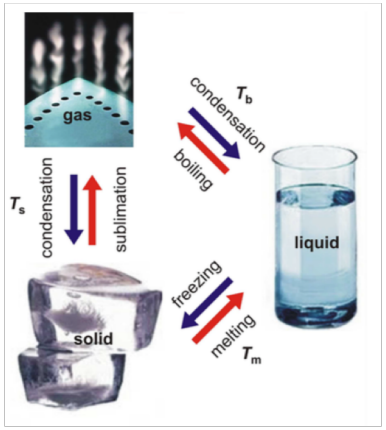
The specific heat capacity of some materials

material	c (J/(kg·K))
silver	234
glass	840
water	4180
body tissue (average)	3500

Phase transitions

Specific latent heat

$$L = \frac{Q}{m} = \left[\frac{J}{kg}\right]$$



Gas Laws

Boyle's Law $pV = constant_I$

Charle's Law. $\frac{V}{T} = constant_{II}$

Gay-Lussac's Law $\frac{p}{T} = conatsnt_{III}$

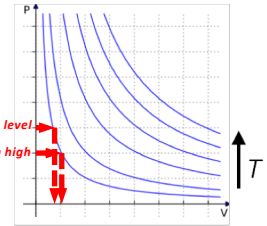
Avogadro's Law $\frac{V}{N} = constant_{IV}$

$\frac{p}{T} \cdot \frac{V}{N} = k_{III} \cdot k_{IV}$ $\qquad k_{III} \cdot k_{IV} = k_B = 1{,}38 \cdot 10^{-23}\ J/K$

$pV = Nk_BT$ $\qquad pV = \frac{N}{N_A} k_B N_A T$

$(k_B \cdot N_A = R)$ $\qquad \left(n = \frac{N}{N_A}\right)$

$\boxed{pV = nRT}$



isobaric process – **pressure** stays constant

isothermal process – **temperature** stays constant

isochoric process – **volume** stays constant

Problems: 9/7 és 9/12

The specific heat capacity of some materials

material	c (J/(kg·K))
silver	234
glass	840
water	4180
body tissue (average)	3500

Specific latent heat of some materials

material	L (kJ/kg)
gold — *heat of fusion*	67
aluminum — *heat of fusion*	396
table salt (NaCl) — *heat of fusion*	517
ice — *heat of fusion*	334.4
water — *heat of vaporization (at 30 °C and 101 kPa)*	2400
water — *heat of vaporization (at 100 °C and 101 kPa)*	2257