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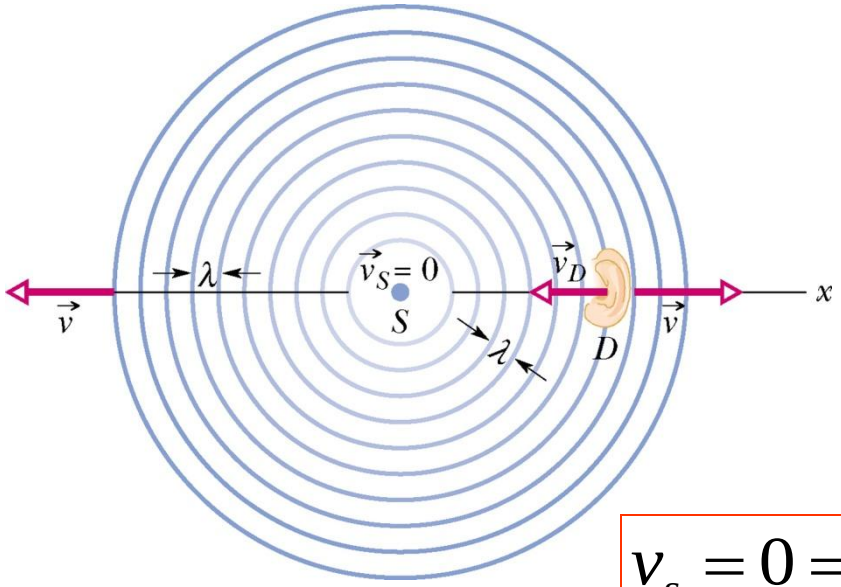
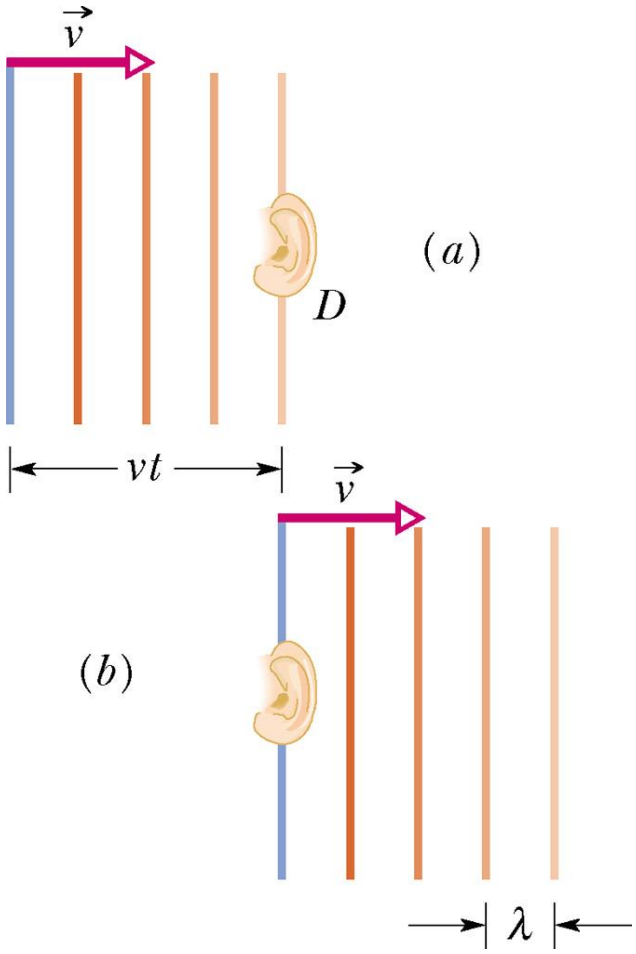
  1. University Physics, Bauer and Westfall, McGraw-Hill, 2011.
  2. Principles of Physics, Halliday, Resnick, and Walker, Wiley, 8^{th} and 9^{th} Ed.
- The rest is made by me.

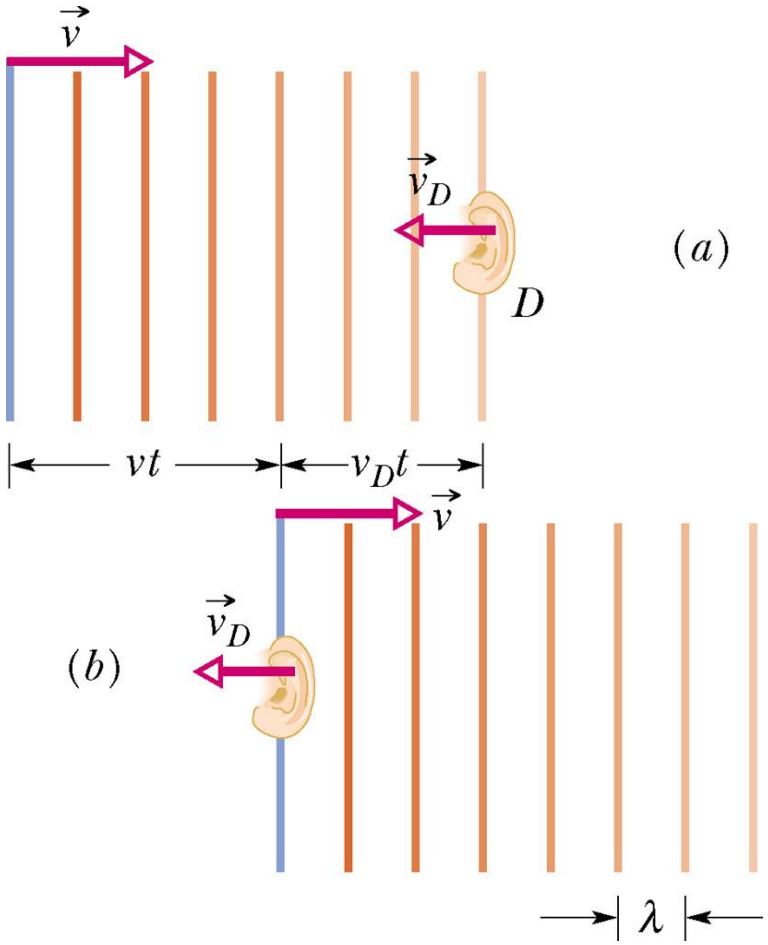
Doppler effect



$$v_s = 0 = v_D$$



$$f = \frac{vt/\lambda}{t} = \frac{v}{\lambda}$$



$$v_s = 0, \; v_D \neq 0$$

$$f' = \frac{(vt \pm v_D t)/\lambda}{t}$$

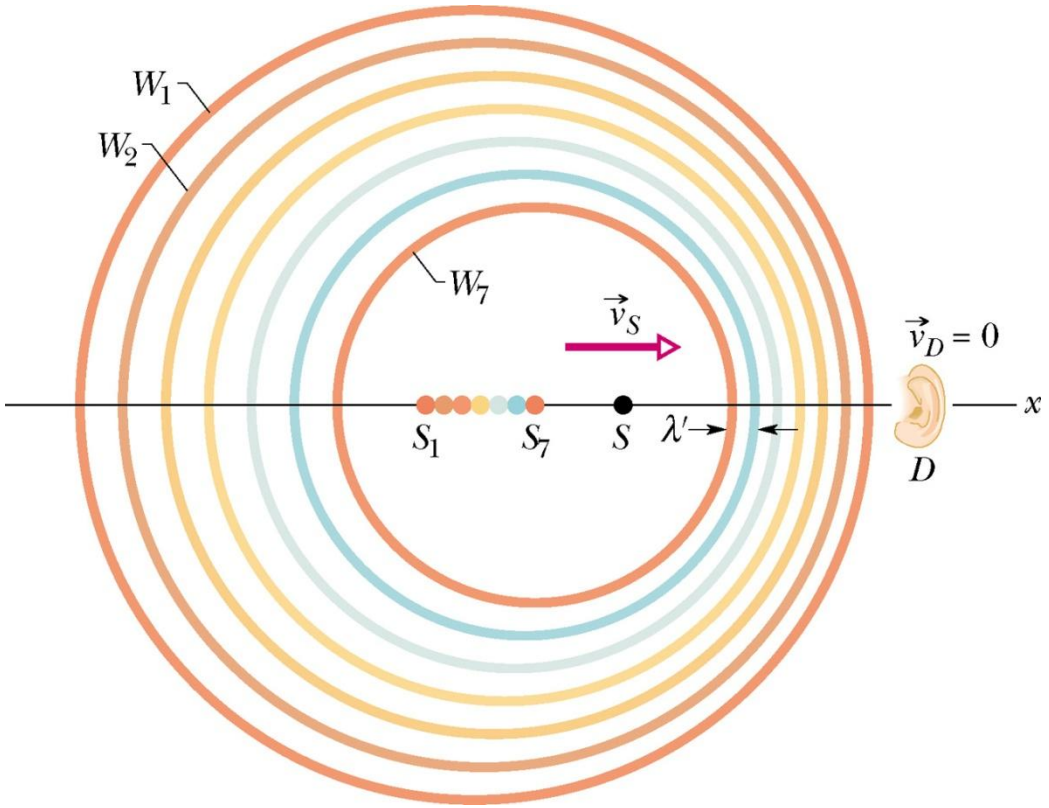
$$= \frac{v \pm v_D}{\lambda}$$

$\lambda f = v$

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

$$f' = f\frac{v \pm v_D}{v}$$

$$v_S \neq 0,\ v_D = 0$$



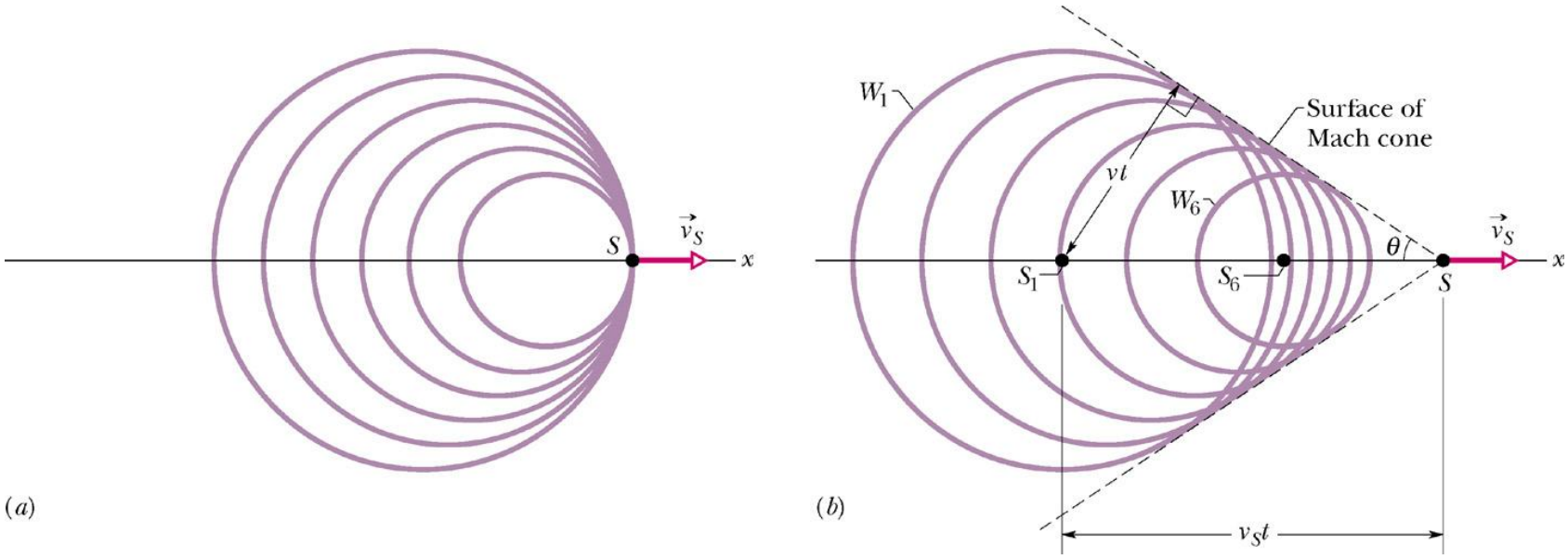
$$f' = \frac{v}{\lambda'} = \frac{v}{vT - v_S T} = \frac{v}{v/f - v_S/f} = f\frac{v}{v - v_S}$$

종합

$$f' = f\frac{v \pm v_D}{v \pm v_S}$$

$$f' = f\frac{v}{v \pm v_S}$$

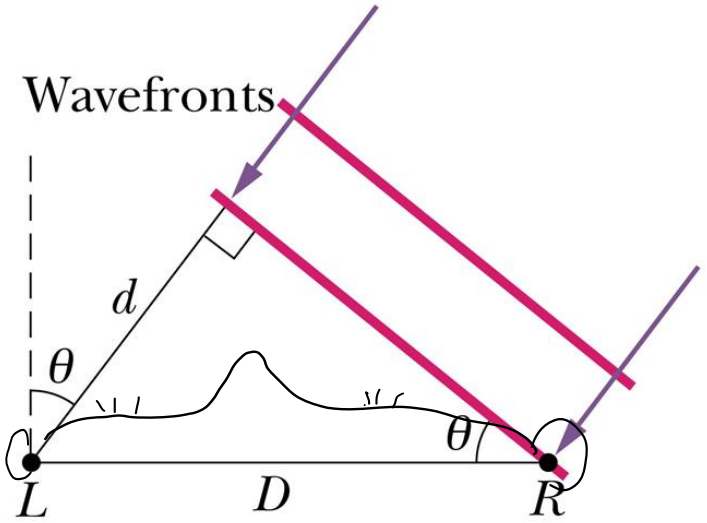
Shock wave



Mach number $\sin\theta = \dfrac{vt}{v_S t} = \dfrac{v}{v_S}$

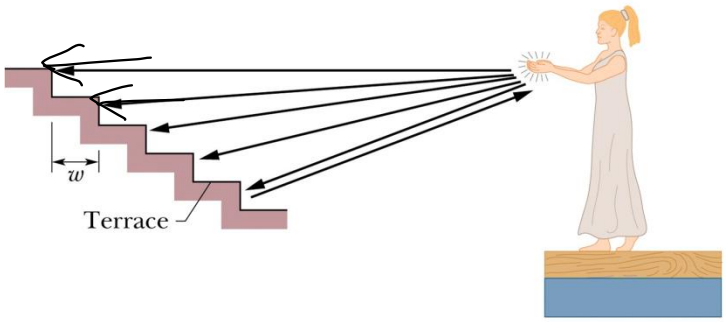
$v_S = \dfrac{v}{\sin\theta}$

Prob. 1



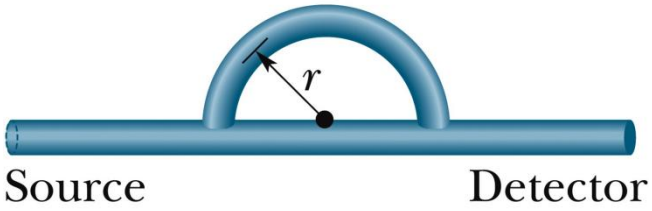
$$\Delta t = \frac{d}{v} = \frac{D\sin\theta}{v}$$

Prob. 2



$$\Delta t = \frac{2w}{v} = T \qquad f = \frac{1}{T} = \frac{v}{2w}$$

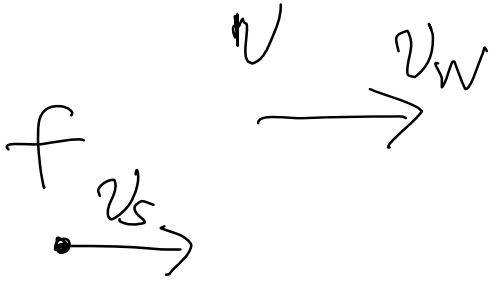
Prob. 3



$$\Delta L = (\pi - 2)r = \left(n + \frac{1}{2}\right)\lambda$$

$$r_{min} = \frac{\frac{\lambda}{2}}{(\pi - 2)} = \frac{\lambda}{2(\pi - 2)}$$

Prob. 4



$$f_1 = f\frac{v}{v - v_s}$$

$$f_2 = f_1\frac{v+v_s}{v} = f\frac{v}{v-v_s}\,\frac{v+v_s}{v} = f\frac{v+v_s}{v-v_s}$$

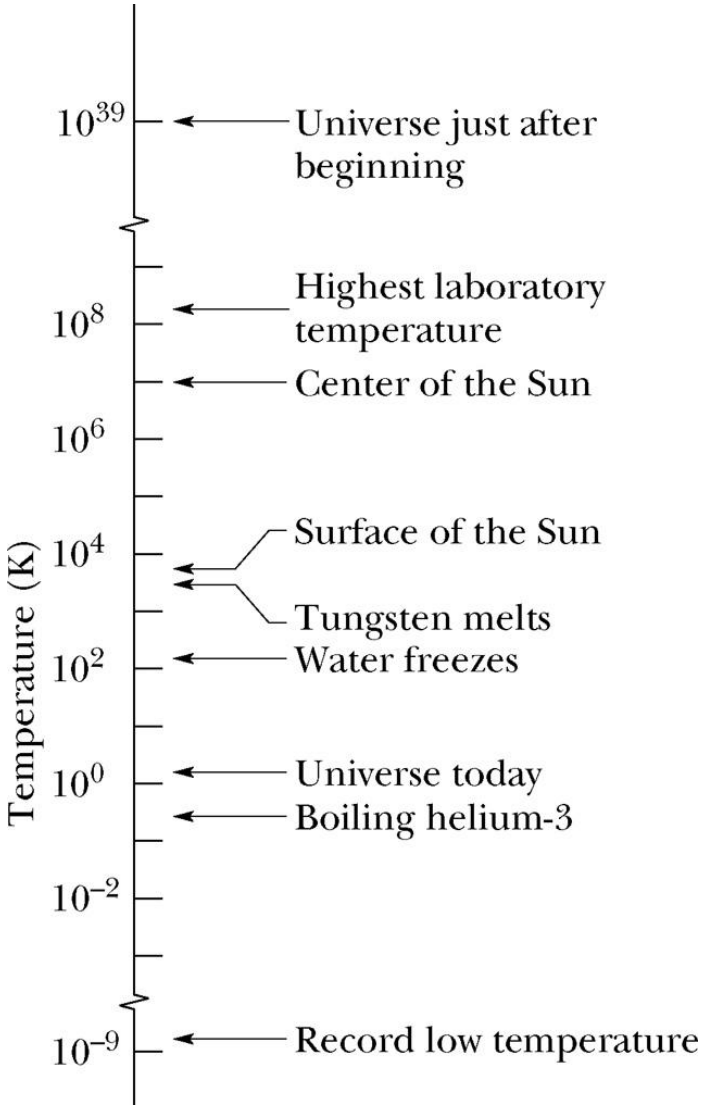
$$f_{beat} = f_2 - f = f\,\frac{2v_s}{v-v_s}$$

$$f_1 = f\,\frac{v+v_w}{v+v_w-v_s}$$

$$f_2 = f_1\,\frac{v-v_w+v_s}{v-v_w} = f\,\frac{v+v_w}{v-v_w}\,\frac{v-v_w+v_s}{v+v_w-v_s}$$

Ch. 17 Temperature

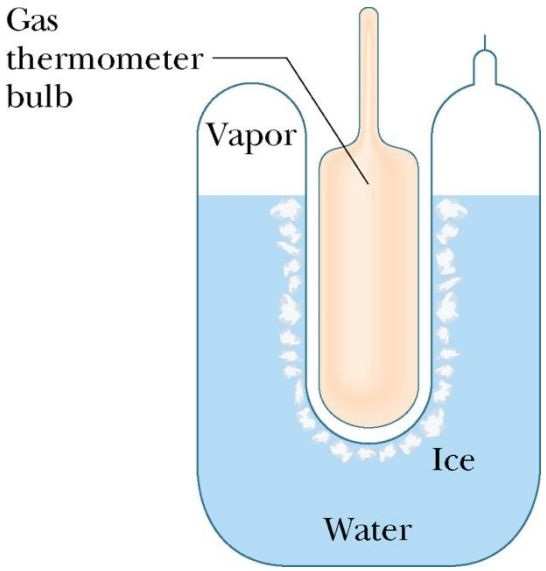
Temperature



SI 단위: Kelvin (K)

29°C 300K

Measurement of temperature



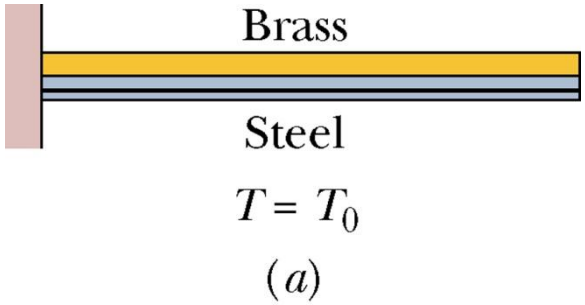
물의 triple point 온도: 273.16K

Celcius와 Fahrenheit temperature

$$T_C = T - 273.15^\circ$$

$$T_F = \frac{9}{5}T_C + 32^\circ$$

Thermal expansion



선팽창 $\Delta L = L\alpha\Delta T$

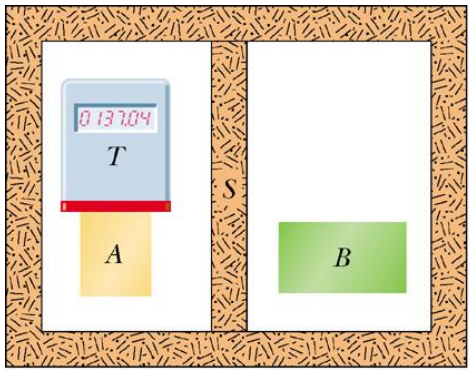
부피팽창 $\Delta V = V\beta\Delta T$

$\beta = 3\alpha$

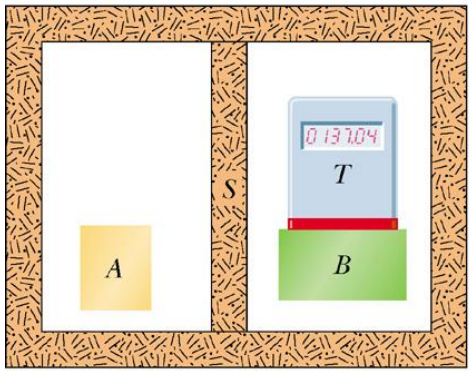
$$\Delta V = (L + \Delta L)^3 - L^3 \approx 3L^2\Delta L = 3\frac{\Delta L}{L}V = 3\alpha V\Delta T = V\beta\Delta T$$

The 0th law of thermodynamics

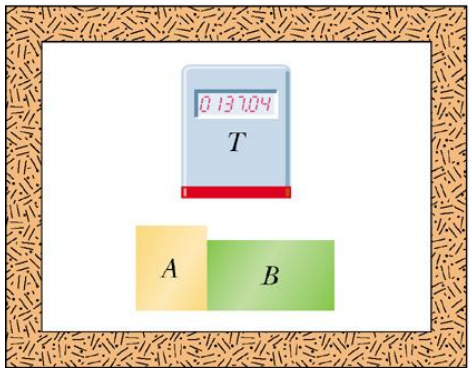
thermal equilibrium



(a)



(b)

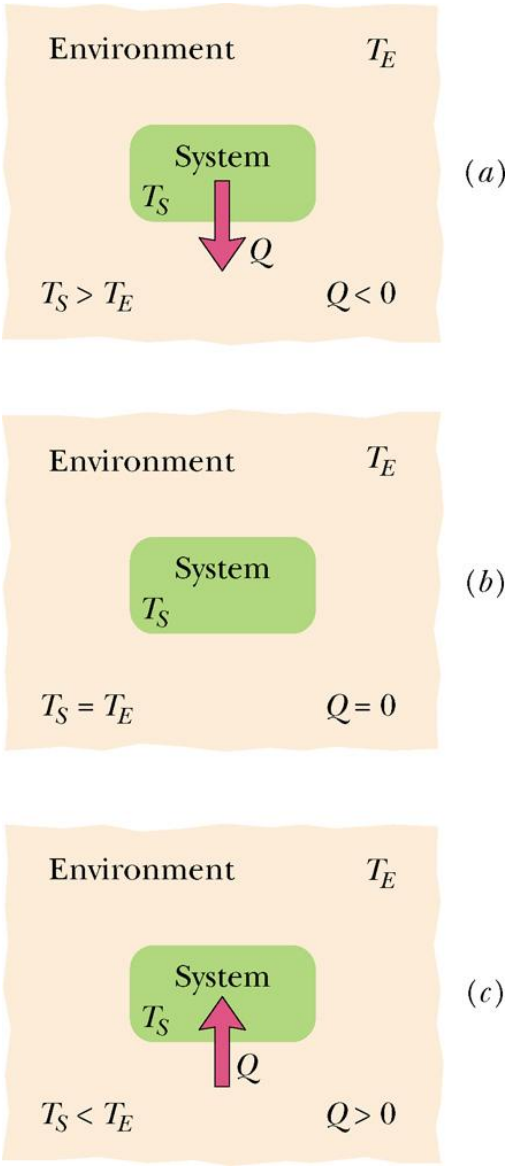


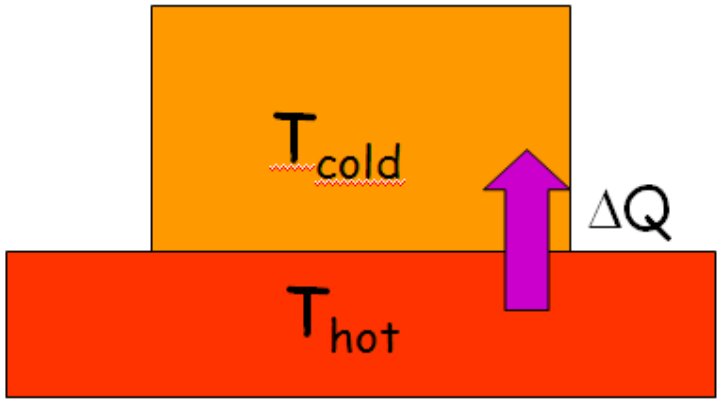
(c)

물체 A와 B가 다른 물체 T와 열평형을 이루면 A와 B도 열평형을 이룬다.

Chap 18. Heat and the 1st law of Thermodynamics

Temperature and heat





열 (heat): 온도가 높은 물체에서 온도가 낮은 물체로 전달되는 에너지