Review Thermal Physics

Ch 13, 14, 15

$$\langle K\rangle = 3\frac{1}{2}kT$$

$$\frac{dU}{dT} = mc$$

$$Q = m\ell$$

$$\frac{dQ}{dt} = kA\frac{dT}{dx}$$

$$\frac{dQ}{dt} = \sigma\epsilon AT^4$$

$$W = P\Delta V$$

$$\Delta U = Q - W$$

Air has both oxygen and nitrogen. Is the average kinetic energy of an oxygen molecule higher, lower, or the same as the average kinetic energy of a nitrogen molecule? Why?

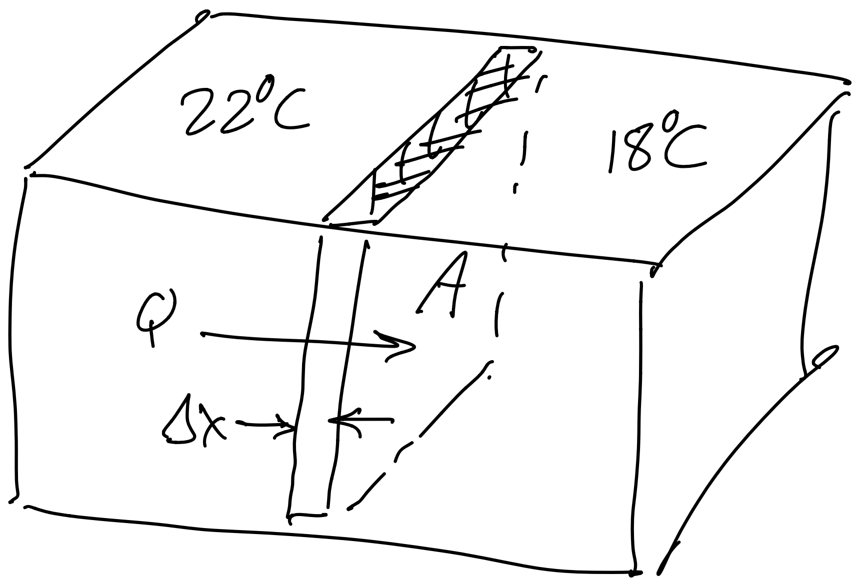
$$\langle K \rangle = \frac{3}{2} kT$$

only depends on temperature

A gas is initialy at a temperature of 130 K. The temperature changes to 360 K. What is the ratio of the final and initial average kinetic energy of the gas molecules?

$$\frac{\langle K_f \rangle}{\langle K_i \rangle} = \frac{\frac{3}{2} k T_f}{\frac{3}{2} k T_i} = \frac{T_f}{T_i} = \frac{360}{130}$$

A fish tank is divided into two sections by a glass partition. The glass is 0.007m thick, 0.40m wide and 0.50m tall. The temperature on one side of the tank is 18℃ while the temperature on the other side is 22℃ How much enery passes through the partition in 3 seconds?



$$\frac{dE}{dt} = -kA\frac{\Delta T}{\Delta x}$$

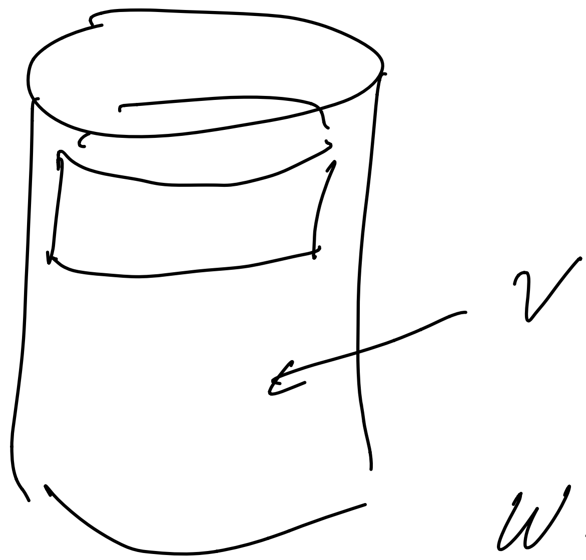
$$= k\,W\,H\,\frac{22°C - 18°C}{0.007m}$$

$$\Delta E = \frac{dE}{dt}\Delta t = k\,W\,H\,\frac{\Delta T}{\Delta x}\Delta t$$

A gas expands from a volume of $3m^3$ to $4m^3$ at a constant pressure of 180 Pascal. While the gas is expanding 600 Joules of heat is added.

(a) How much work does the gas do while expaning?

(b) By how much does the internal energy of the gas change?



$V_i = 3\,m^3$

$V_f = 4\,m^3$

$$W = P\Delta V$$
$$= P(V_f - V_i)$$
$$= 180\,J$$

$$\Delta U = Q - W$$
$$= 600\,J - 180\,J = 420\,J$$

$$\langle K \rangle = 3\tfrac{1}{2}kT$$

$$\frac{dU}{dT} = mc$$ specific heat

$$Q = m\ell$$ latent heat

$$\frac{dQ}{dt} = kA\frac{dT}{dx}$$

$$\frac{dQ}{dt} = \sigma\epsilon AT^4$$ radiation

$$W = P\Delta V$$

$$\Delta U = Q - W$$