Duggan

Allt fram till torsd förra veckan
Inte entropi
Man får ha med: Räknare
Formelsamling
Tabell
Fusklapp

Repetition

$PV = nRT$

$dQ = dE^{int} + dW_{gas} \Rightarrow Q = \Delta E^{int} + W_{gas}$

$W > 0$, gasen expanderar

$W < 0$, gasen komprimeras

$Q > 0$, energi tillförs till gasen

Isoterm: $W_{gas} = nRT \cdot \ln\left(\frac{V_f}{V_i}\right)$, T konst. $Q = nRT \cdot \ln\left(\frac{V_f}{V_i}\right)$ ty $E^{int} = 0$

Isokor: $Q = nC_V \Delta T$

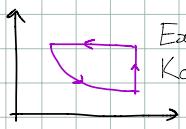
Isobar: $Q = nC_P \Delta T$

$$\boxed{\Delta E^{int} = nC_V \cdot \Delta T}$$ ← Alltid!

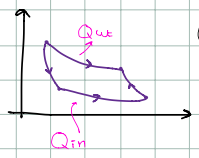
Kretsprocesser: Medurs => Tillverka mekaniskt arbete. Verkningsgrad: $e = \frac{\sum W_{gas}}{\sum Q_{pos}} = \frac{\sum Q}{\sum Q_{pos}}$

Kylmaskin

Värmepump

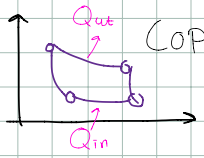


Expanderar kall gas
Komprimerar varm gas

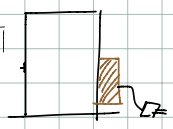


$$COP = \frac{|Q_{ut}|}{|W_{gas}|}$$

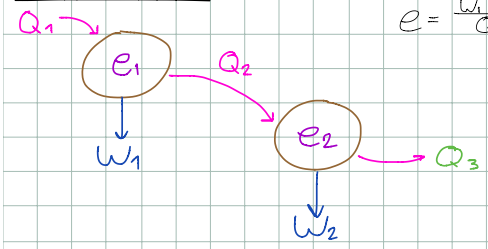
Kylskåp



$$COP = \frac{|Q_{in}|}{|W_{gas}|}$$



Verkningsgrad



$e = \frac{W_1 + W_2}{Q_1}$, $e_1 = \frac{W_1}{Q_1}$, $e_2 = \frac{W_2}{Q_2}$

$W_1 = e_1 Q_1$, $W_2 = e_2 Q_2$

$Q_2 = Q_1 - W_1$

$e = \frac{e_1 Q_1 + e_2 Q_2}{Q_1} = \frac{e_1 Q_1 + e_2 (Q_1 - e_1 Q_1)}{Q_1} = e_1 + e_2 - e_1 e_2$

Ex

$e_1 = 40\%$, $e_2 = 20\%$, $Q_1 = 100$ J

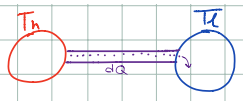
$W_1 = 40$ J $\Rightarrow |Q_2| = 60$ J $\Rightarrow W_2 = 12$ J $\Rightarrow e = \frac{52}{100} = 0.52$

$e = 0.40 + 0.2 - 0.40 \cdot 0.2 = 0.60 - 0.08 = 0.52$

Entropi: S

$dS = \frac{dQ}{T}$

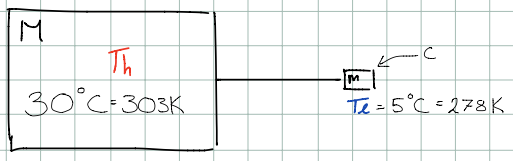
för ett slutet system: $\Delta S \geq 0$



$dS_\ell = \frac{dQ}{T_\ell}$

$dS_h = \frac{-dQ}{T_h}$ (ty laminar system)

$$dS_{h\ell} = dS_h + dS_\ell = dQ\left[\frac{1}{T_\ell} - \frac{1}{T_h}\right] > 0$$



$$\Delta S_{sist} = \int_i^f \frac{dQ}{T_h} = \frac{1}{T_h}\int_i^f dQ = \frac{-1}{T_h}\int_i^f mc\,dT = -\frac{1}{T_h}mc(T_h - T_\ell) = -\frac{mc\Delta T}{T_h}$$

$$= -1 \cdot 4{,}18\cdot 10^3 \cdot \frac{25}{303}\ \frac{J}{K}$$

$$\Delta S_{Entorn} = \int_i^f \frac{dQ}{T} = \int_i^f \frac{mc\,dT}{T} = mc\int_i^f \frac{dT}{T} = mc\ln\frac{T_f}{T_i} = 1\cdot 4{,}18\cdot 10^3 \ln\frac{303}{278}$$