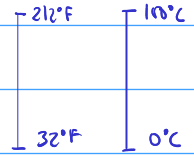
Problema 1

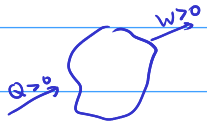


$°F = 1{,}8\ °C + 32°F$

$x = 1{,}8\,x + 32 \Rightarrow x(1-1{,}8) = 32 \quad x = \frac{32}{-0{,}8} = -40$

$-40°F = -40°C$

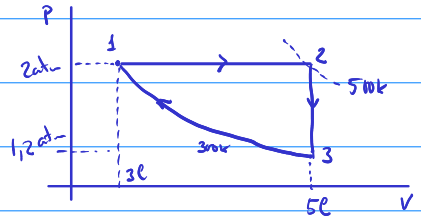
Problema 2



$\Delta U = Q - W = 800\,cal - 2000\,J = 800\,cal \cdot \frac{4{,}19\,J}{1\,cal} - 2000\,J =$

$= 1352\,J$

Problema 3



$p_1 = 2atm \quad T_1 = 300k \quad V_1 = 3l$

$C_v = 3\,cal/mk \qquad R = 2\,\frac{cal}{mk} = 0{,}082\,\frac{atm\,l}{mk}$

	atm p	l V	k T
1	2	3	300
2	2	5	500
3	1,2	5l	300k

A) Del punto 1.

$n = \frac{PV}{RT} = \frac{2atm \cdot 3l}{0{,}082\,\frac{atm\,l}{mk} \cdot 300k} = 0{,}2439\ moles$

Punto 2 $\quad V_2 = \frac{nRT_2}{P_2} = \frac{0{,}2439\,mol \cdot 0{,}082\,\frac{atm\,l}{mk} \cdot 500k}{2atm} = 5l$

Punto 3 $\quad p_3 = \frac{nRT_3}{V_3} = \frac{0{,}2439\,mol \cdot 0{,}082\,atm\,l/mk \cdot 300k}{5l} = 1{,}2\,atm$

B) isobárica $p = cte$ $\quad W_{12} = p \cdot \Delta V = 2atm \cdot (5l - 3l) = 4\,atm\,l \cdot \frac{2\,cal}{0.082\,atm\,l} = 97{,}6\,cal$

isocora $V = cte$ $\quad W_{23} = 0\,cal$

isoterma $T = cte$ $\quad W_{31} = nRT \ln\left(V_1/V_3\right) = p_1 V_1 \cdot \ln\left(V_1/V_3\right) = 2atm \cdot 3l \cdot \ln\left(3/5\right) = -3.065\,atm\,l \cdot \frac{2\,cal}{0.082\,atm\,l} = -74{,}75\,cal$

$W_{11} = W_{12} + W_{23} + W_{31} = 97{,}6\,cal - 74{,}75\,cal = 22.85\,cal = 95{,}7\,J$

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c) isobárica $\Delta U_{12} = nC_v \cdot \Delta T = nC_v \cdot (T_2 - T_1) = nC_v \cdot (500k - 300k) = nC_v \cdot 200k = 613{,}16\,J$

isocora $\Delta U_{23} = nC_v \cdot \Delta T = nC_v (T_3 - T_2) = nC_v (300k - 500k) = -nC_v\,200k = -613.16\,J$

$\Delta U_{11} = 0\,J$

isoterma $\Delta U = 0$

$nC_v \cdot 200k = 0.2439\,mol \cdot \frac{3\,cal}{mk} \cdot 200k = 146{,}34\,cal = 613{,}16\,J$

$C_p - C_v = R \Rightarrow C_p = R + C_v = 2\,cal/mol\,K + 3\,cal/mol\,K = 5\,cal/mol\,K.$

D) isobárica $Q_{12} = n\,C_p\,\Delta T = 0{,}2439\,mol \cdot 5\,\frac{cal}{mol\,K} \cdot (500K - 300K) = 243{,}9\,cal.$

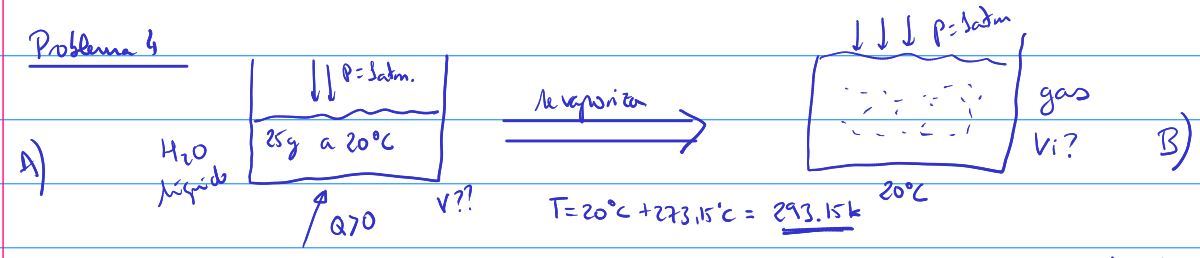
isocora $Q_{23} = n\,C_v\,\Delta T = 0{,}2439\,mol \cdot 3\,\frac{cal}{mol\,K} \cdot (300 - 500K) = -146{,}34\,cal.$

isoterma $Q_{31} = W_{31}\ (\Delta U_{31} = 0) \quad Q_{31} = -74{,}75\,cal$

$Q_{11} = Q_{12} + Q_{23} + Q_{31} = 22{,}81\,cal \qquad W_{11} = 22{,}85\,cal$

Como en el ciclo total $\Delta U = 0 \Rightarrow Q = W$ y efectivamente, salvo decimales $Q_{11} = W_{11} = 22{,}81\,cal. \approx 95{,}6\,J.$

Problema 4



$T = 20°C + 273{,}15°C = 293.15K$

$n = \frac{25g}{18g/mol} = 1{,}389\,moles.$ $L = 580\,cal/g$ calor de vaporización

$Q = m \cdot L = 25g \cdot 580\,cal/g = 14500\,cal.$

Calor que absorbe para cambiar de estado

$\rho = \frac{m}{V} \Rightarrow V = \frac{m}{\rho} = \frac{25g}{1kg/l} = 0{,}025\,l$

Al convertirse en calor se expande de $V = 0.025l$ a ... ?? Ahora es gas, luego.

$V = \frac{nRT}{P} = \frac{1{,}389\,mol \cdot 0{,}082\,\frac{atm\,l}{mol\,K} \cdot 293{,}15K}{1atm} = 33{,}386\,l$

El trabajo que hace el gas es (p = cte).

$W = p \cdot \Delta V = 1atm \cdot (33{,}386l - 0{,}025l) = 33{,}361\,atm \cdot l =$

$= 813.76\,cal$

$\Delta U = Q - W = 14500\,cal - 813{,}76\,cal = 13\,686{,}24\,cal.$

Problema 5 $\quad Q = m \cdot c \cdot \Delta T = \rho \cdot V \cdot c \cdot \Delta T = \frac{1kg}{dm^3} \cdot 5dm^3 \cdot \frac{1cal}{g \cdot °C} \cdot 25°C \cdot \frac{1000g}{1kg} =$

$\Delta T = 25°C = 25K$ $\quad \rho = \frac{m}{V} \quad m = \rho \cdot V$ $\quad = 125000\,cal = 125\,kcal.$

¡Ojo! Agua líquida.

Problema 6

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

$Q_{metal} = m \cdot c_{metal} \cdot \Delta T_{metal}$

$Q_{agua} = m \cdot c_{agua} \cdot \Delta T_{agua}$

$$\frac{Q_{metal}}{Q_{agua}} = \frac{c_{metal}}{c_{agua}} \cdot \frac{\Delta T_{metal}}{\Delta T_{agua}} = 1 \qquad \frac{\Delta T_{metal}}{\Delta T_{agua}} = \frac{c_{agua}}{c_{metal}} > 1$$

1, misma cantidad, 1000 cal.

$\Delta T_{metal} > \Delta T_{agua}$.

Problema 7

$$c_{agua} = \frac{Q_{agua}}{m \cdot \Delta T} = \frac{16\,kcal}{320g \cdot 50°C} = 1\,cal/g°C$$

$$c_{cloro.} = \frac{Q_{cloro.}}{m \cdot \Delta T} = \frac{3{,}74\,kcal}{320g \cdot 50°C} = 0{,}234\,\frac{cal}{g°C}$$

$$c_{gli.} = \frac{Q_{glic.}}{m \cdot \Delta T} = \frac{9{,}28\,kcal}{320g \cdot 50°C} = 0{,}58\,cal/g°C$$

Problema 8

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

$m = 250\,g$

$c = 0.2\,cal/g°C$

$T_i = 5°C \qquad T_F = 59°F = 15°C$

$F = 1.8\,C + 32 \Rightarrow C = \frac{F-32}{1.8} = \frac{59°F - 32°F}{1.8\,°F/°C} = 15°C$

$Q = 250g \cdot 0.2\,\frac{cal}{g°C} \cdot (15°C - 5°C) = 500\,cal$