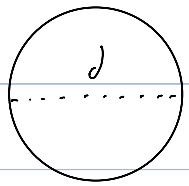
thermal Hw 3)




$d = 1.32$ cm

$T = 25°C = 298°K$

a) $A_0 = \pi r^2 = \pi \left(\frac{1.32}{2}\right)^2$

$A_0 = 1.368$

b) @ 175°C

$\gamma_{steel} = 2\alpha_{steel}$

$\gamma = 2(1.2 \times 10^{-5})$

$\Delta A = A_0 \gamma \Delta T$

$\Delta A = (1.368 \text{ m}^2)(2 \cdot 1.2 \times 10^{-5} \frac{1}{C°})(175 - 25)$

$\Delta A = 0.004925 \text{ m}^2$

$A_f = A_0 + \Delta A$

$A_f = 1.373 \text{ m}^2$

Thermodynamics #1)

$T_i = 26.4°C = 299.4°K$

$n = 6$ mol $\qquad W = \int P\,dV$

$P_f = P_i \qquad W = P\Delta V$

$W = 1800 J \qquad V = \frac{nRT}{P}$

$W = P(V_f - V_i)$

$1800 J = \cancel{P_i}\left(\frac{6(8.314)(T_f)}{\cancel{P_f}} - \frac{6(8.314)(299°K)}{\cancel{P_i}}\right)$

$1800 J = 6(8.314)(T_f - 299°K)$

$(T_f - 299°K) = \frac{1800}{6(8.314)}$

$T_f - 299°K = 36.08$

$T_f = 335°K = 62°C$

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#3)

Isothermal $\qquad W = \int_{V_i}^{V_f} P\,dV$

$n = 0.315$ mol

$T = 22°C = 295°K \qquad W = nRT \int \frac{1}{V}\,dV$

$W = -332 J$

$R = 8.314$ J/mol°K $\qquad W = nRT[\ln(V_f) - \ln(V_i)]$

$P_f = 1.15$ atm $\qquad W = nRT \ln\left(\frac{V_f}{V_i}\right) \qquad PV = nRT$

$V = \frac{nRT}{P}$

$$W = nRT \ln\left(\frac{\frac{nRT}{P_f}}{\frac{nRT}{P_i}}\right)$$

$$\frac{\cancel{nRT}}{P_f} \cdot \frac{P_i}{\cancel{nRT}}$$

$$W = nRT \ln\left(\frac{P_i}{P_f}\right)$$

$$W = nRT\left[\ln(P_i) - \ln(P_f)\right]$$

$$\ln(P_i) = \frac{W}{nRT} + \ln(P_f)$$

$$\ln(P_i) = \frac{-332J}{(0.315)(8.314)(295)} + \ln(1.76)$$

$$\ln(P_i) = 0.1356$$

$$P_i = e^{0.1356}$$

$$P_i = 1.145 atm$$

| |
|---|
| $-\Delta V \therefore -W$ |
| $+\Delta V \therefore +W$ |

| For Solids |
|---|
| Linear: $\alpha$ |
| Area: $\gamma = 2\alpha$ |
| Volume: $\beta = 3\alpha$ |

Isobaric - constant Pressure

$Q = \Delta U + W = \Delta U = P\Delta V$

Isovolumetric - constant Volume

$W = \emptyset \quad \Delta U = Q$

Isothermal - constant Temp

$\Delta U = \emptyset \quad \Delta T = \emptyset \quad W = Q$

Adiabatic - No energy entering/leaving

$Q = \emptyset \quad \Delta U = -W$