1. Compute the change in entropy when one mole of an ideal gas expands freely to twice its volume.

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2. Calculate the change in the enthalpy and the change in entropy when one mole of SiC is heated from 25°C to 1000 °C. The constant pressure molar heat capacity of SiC varies with temperature as

$$C_p = 50.79 + 1.97 \cdot 10^{-3} T - 4.92 \cdot 10^{6} T^{-2} + 8.20 \cdot 10^{8} T^{-3} \text{ J/mole.K}$$ 20%

3. The vapor pressure of zinc has been written as

$$\ln p(\text{atm}) = -\frac{15780}{T} - 0.755 \ln T + 19.25$$

and

$$\ln p(\text{atm}) = -\frac{15250}{T} - 1.255 \ln T + 21.79$$

which of the two equation is for solid zinc

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4. Use the Gibb's-Duhem equation to show that, if the activity coefficient of the components of a binary solution can be expressed as

$$\ln \gamma_A = \alpha_1 X_B + \frac{1}{2}\alpha_2 X_B^2 + \frac{1}{3}\alpha_3 X_B^3 + \cdots$$

and

$$\ln \gamma_B = \beta_1 X_A + \frac{1}{2}\beta_2 X_A^2 + \frac{1}{3}\beta_3 X_A^3 + \cdots$$

over the entire range of compositions, then $\alpha_1 = \beta_1 = 0$, and if the variation can be represented by the quadratic terms alone, then

$\alpha_2 = \beta_2$

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5. Using the standard Gibb's free energies of formation of NiO from solid Ni and liquid Ni, calculating the melting temperature, molar heat of melting and the molar entropy of melting of nickel.

For

$$2Ni_s + O_2 = 2NiO \qquad \Delta G^0 = -471200 + 172T \quad \text{Joule}$$

$$2NiO = O_2 + 2Ni_l \qquad \Delta G^0 = 506180 - 192.2T \quad \text{Joule}$$

20%

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