Molecular Physics (Prof. Käs) **WS 2007/08**
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Problem Set 3
Due date: October 29, 2007

Problem 9)
Determine a) $\Delta_r H^o$ and $\Delta_r U^o$ for reaction (3), see below, considering reactions (1) and (2) and b) calculate $\Delta_f H^o$ for both HBr (g) and H_2O (g). For a) and b), assume a temperature of 298 K and that all gases are perfect.

(1) $H_2(g) + Br_2(l) \rightarrow 2\ HBr(g)$ $\Delta_r H^o = -75.63\ kJ\ mol^{-1}$

(2) $2\ H_2(g) + O_2(g) \rightarrow 2\ H_2O\ (g)$ $\Delta_r H^o = -463.6\ kJ\ mol^{-1}$

(3) $4\ HBr(g) + O_2(g) \rightarrow 2\ Br_2(l) + 2\ H_2O(g)$

(4 points)

Problem 10)
Use the virial equation of state up to the second coefficient B = - 29.3 $cm^3\ mol^{-1}$ to calculate w, q, ΔH for a sample of 69.7 mmol Xe(g). This sample is expanded at 372 K from 5.01 cm^3 to 6.18 cm^3 and the internal energy is known to increase 84.1 J.
(4 points)

Problem 11)
Calculate the pressure that must be applied in order to increase the density of bismuth by 0.0700 per cent at 298 K. The isothermal compressibility of bismuth at this temperature is $2.07 \times 10^{-6}\ atm^{-1}$.
(2 points)

Problem 12)
A monatomic perfect gas with $C_{p,m}$ = 5/2 R is heated from 250 K to 700 K and simultaneously expanded from 20.0 L to 60.0 L. Calculate the increase in entropy for 3.50 mol of the perfect gas.
(4 points)