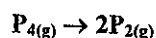


1. A compound Z is known to have a composition of 34.38% Ni, 28.13% C, and 37.48% O. In an experiment 1.00 L of gaseous Z is mixed with 1.00 L of argon, where each gas is at $P=2.00$ atm and $T=25$ °C. When this mixture of gases is put in an effusion chamber, the ratio of Z molecules to Ar molecules in the effused mixture is 0.4837. Using these data, calculate the following.

- the molar mass for Z.
- the molecular formula for Z. (Ni=58.69, C=12.01, O=15.99, Ar=39.95) 16%

2. Consider the reaction



where $K_p=1.00 \times 10^{-1}$ atm at 1325 K. In an experiment where $P_4(g)$ was placed into a container at 1325 K, the equilibrium mixture of $P_4(g)$ and $P_2(g)$ has a total pressure of 1.00 atm.

- Calculate the equilibrium pressures of $P_4(g)$ and $P_2(g)$.
- Calculate the fraction (by moles) of $P_4(g)$ that has dissociated to reach equilibrium. 16%

3. a. If the E_{cell} of the following cell is 0.915 V at 25 °C, what is the pH in the anode compartment?



- What is the cell potential when the Ag^+ ion solution is changed to 0.100 M HCl. Given $E^\circ_{\text{Ag}^+/\text{Ag}} = 0.80$ V and $K_{\text{sp}}(\text{AgCl}) = 1.8 \times 10^{-10}$. 20%

4. The isomerization of glucose-6-phosphate (G6P) to fructose-6-phosphate (F6P):



- Calculate ΔG° (free energy) at 298 K. Given $R=8.314 \text{ JK}^{-1}\text{mol}^{-1}$
 $=0.082 \text{ LatmK}^{-1}\text{mol}^{-1}$.
- Estimate ΔS° (entropy) for this reaction and justify your answer. 16%

5. In each of the following groups of substances, pick the one that has the given property.

- highest freezing point: H_2O , NaCl, or HF.
- lowest vapor pressure at 25 °C: Cl_2 , Br_2 , or I_2 .
- greatest viscosity: H_2S , HF, or H_2O_2 .
- smallest enthalpy of fusion: I_2 , CsBr, or CaO. 16%

6. A solution saturated with a salt of the type M_3X_2 has an osmotic pressure of 2.64×10^{-2} atm at 25 °C. Calculate the K_{sp} value for the salt, assuming ideal behavior. 16%