Worksheet 6.2: Solutions

Equilibrium constant calculations

No.	Answer
1	**a** $K = \dfrac{[NF_3]^2}{[N_2][F_2]^3}$ **b** $K = \dfrac{[Sn(NO_3)_2][HCl]^2}{[SnCl_2][HNO_3]^2}$ **c** $K = \dfrac{[VO^{2+}]^2\,[SO_4^{2-}]}{[VO_3^-]^2[H^+]^6[SO_3^{2-}]}$ **d** $K = \dfrac{[SO_2]^2[H_2O]^2}{[H_2S]^2[O_2]^3}$
2	**a** Reactants favoured. **b** Products favoured. **c** Not strong in either direction, but products somewhat favoured.
3	**a** $K = \dfrac{1}{9.24 \times 10^{-3}} = 108$ **b** $K = (9.24 \times 10^{-3})^2 = 8.54 \times 10^{-5}$
4	$K = \dfrac{[NH_3]^2}{[NO_2]^2[H_2]^7} = \dfrac{(1.52)^2}{(0.056)^2(0.335)^7} = 1.56 \times 10^6$
5	$K = \dfrac{[NO]^2[Cl_2]}{[NOCl]^2} = 1.60 \times 10^{-5}$ $\therefore [NO]^2 = \dfrac{(1.60 \times 10^{-5})(0.746)^2}{1.89 \times 10^{-3}} = 0.004\,71$ $\therefore [NO] = 0.0686$ mol L^{-1}
6	$K = [Ba^{2+}][SO_4^{2-}] = 1 \times 10^{-10}$ $\therefore [Ba^{2+}] = [SO_4^{2-}] = 1 \times 10^{-5}$ mol L^{-1}
7	$K = \dfrac{[C]}{[A][B]^2} = 0.0812$ $\therefore [B]^2 = \dfrac{0.0394}{0.722 \times 0.0812} = 0.672$ $\therefore [B] = 0.820$ mol L^{-1}

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Equilibrium constant calculations

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	Reactants	Products
Mole ratio in the equation	N_2O_4	$2NO_2$
n_i	0.600	0
change	–0.460	+0.920
n_{eq}	0.140	0.920
$[\ ]_{eq}$, V = 2.00 L	0.0700 mol L^{-1}	0.460 mol L^{-1}

$$K = \frac{[NO_2]^2}{[N_2O_4]} = \frac{(0.460)^2}{0.0700} = 3.02$$

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	Reactants	Products	
Mole ratio in the equation	PCl_5	PCl_3	Cl_2
n_i	1.85	0	0
change	–1.48	+1.48	+1.48
n_{eq}	0.370	1.48	1.48
$[\ ]_{eq}$, V = 2.00 L	0.185 mol L^{-1}	0.740 mol L^{-1}	0.740 mol L^{-1}

$$K = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{(0.740)^2}{0.185} = 2.96$$

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	Reactants	Products	
Mole ratio in the equation	NOBr	NO	Br_2
n_i	2.30	0	0
change	–1.80	+1.80	+0.900
n_{eq}	0.503	1.80	0.900
$[\ ]_{eq}$, V = 6.50 L	0.0774 mol L^{-1}	0.277 mol L^{-1}	0.138 mol L^{-1}

$$K = \frac{[NO]^2[Br_2]}{[NOBr]} = \frac{(0.277)^2 \times 0.138}{0.0774} = 0.137$$

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