**AQA Chemistry** 

## 19 Equilibrium constant $K_p$ Practice questions

Question number	Answer	Marks	Guidance
1			1 mark for numerical answer with
1	$p^2 SO_3(g)_{eqm}$	1	unit.
	$K_{p} = \frac{p^{2}SO_{3}(g)_{\text{eqm}}}{p^{2}SO_{2}(g)_{\text{eqm}} \times pO_{2}(g)_{\text{eqm}}}$	1	1 mark for correct s.f.
	P 502 (S) eqm \ P 02 (S) eqm		I mark for correct s.i.
	$_{\nu}$ 5.0 <sup>2</sup>	1	
	$K_{\rm p} = \frac{5.0^2}{0.08^2 \times 0.9}$	1	
	$K_{\rm p} = 4340.2  \rm atm^{-1}$		
	$K_p = 4300 \text{ atm}^{-1} \text{ (to 2 s.f.)}$	1	
2	$pN_2O_4(g)_{eqm}$		
	$K_{p} = \frac{pN_{2}O_{4}(g)_{\text{eqm}}}{p^{2}NO_{2}(g)_{\text{eqm}}}$	1	
	-		
	$K_{\rm p} = \frac{0.25}{0.80^2}$	1	
		*	
	$K_{\rm p} = 0.3906 \ {\rm atm}^{-1}$		
	$K_p = 0.391 \text{ atm}^{-1} \text{ to 3 s.f.}$	1	
3 (i)	no. of moles of a given gas	1	
3 (.)	Mole fraction = $\frac{\text{no. of indes of a given gas}}{\text{total no. of moles in the mixture}}$	_	
	Mole fraction NH <sub>3</sub> = $\frac{26.0}{104.0}$ = 0.25		
	104.0		
	Mole fraction $H_2 = \frac{13.0}{104.0} = 0.125$		
	$\frac{104.0}{104.0}$		
	65.0		
	Mole fraction $N_2 = \frac{65.0}{104.0} = 0.625$		
3 (ii)	Partial pressure = mole fraction × total pressure	1	
J ()	Partial pressure $NH_3 = 0.25 \times 12.0 = 3.00$ atm	_	
	Partial pressure $H_2 = 0.125 \times 12.0 = 1.50$ atm		
	Partial pressure $N_2 = 0.625 \times 12.0 = 7.50$ atm		
3 (iii)			1 mark including unit
- (	$K_{\rm p} = \frac{p^{-1/11} (g)_{\rm eqm}}{2}$	1	
	$K_{p} = \frac{p^{2} \text{NH}_{3}(g)_{\text{eqm}}}{p^{2} \text{H}_{2}(g)_{\text{eqm}} \times p \text{N}_{2}(g)_{\text{eqm}}}$		
	9.00		
	$K_{\rm p} = \frac{3.00}{3.375 \times 7.50}$	1	
	$K_{\rm p} = 0.355  {\rm atm}^{-1}$	1	
4		-	
7	$K_{p} = \frac{p^{2} HI(g)_{eqm}}{pH_{2}(g)_{eqm} \times pI_{2}(g)_{eqm}}$	1	
	$pH_2(g)_{\text{eqm}} \times pI_2(g)_{\text{eqm}}$	1	
	There are the same number of moles of gas on each	1	
	side of the equilibrium, therefore no need to	_	
	calculate the partial pressures. The units cancel.		
	$1.40^{2}$		
	$K_{\rm p} = \frac{1.40^2}{0.30 \times 0.40} = 16.33 = 16 \text{ to 2 s.f. (no units)}$	1	
5		1	
J	$K_{p} = \frac{pPCl_{3}(g)_{\text{eqm}} \times pCl_{2}(g)_{\text{eqm}}}{pPCl_{5}(g)_{\text{eqm}}}$	*	
	$pPCl_5(g)_{eqm}$		
	Mole fraction = $\frac{\text{no. of moles of a given gas}}{\text{total no. of moles in the mixture}}$		
	Mole fraction = $\frac{\text{Mole finites of a given gas}}{\text{total no. of moles in the mixture}}$		
	total no. of moles in the mixture		
	Mole fraction $PCl_3 = \frac{0.75}{2.05} = 0.3658$	1	
	2.05		

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	Mole fraction $PCl_5 = \frac{0.40}{2.05} = 0.1951$		
	Mole fraction $Cl_2 = \frac{0.90}{2.05} = 0.4390$		
	Partial pressure = mole fraction × total pressure		
	Partial pressure $PCl_3 = 0.3658 \times 12.0 = 4.389$ atm	1	
	Partial pressure CL = 0.1351 × 12.0 = 2.341 atm		
	Partial pressure $Cl_2 = 0.4390 \times 12.0 = 5.268$ atm		
	$K_p = \frac{4.389 \times 5.268}{2.341} = 9.876 \text{ atm}$		
	$K_p = 9.9 \text{ atm (to 2 s.f.)}$	2	2 marks including unit
6	$p^2 NH_3(g)_{eam}$	1	
	$K_{p} = \frac{p^{2} \text{NH}_{3}(g)_{\text{eqm}}}{p^{2} \text{H}_{2}(g)_{\text{eqm}} \times p \text{N}_{2}(g)_{\text{eqm}}}$		
	$K_{\rm p} = \frac{0.35^2}{3}$		
	$K_{\rm p} = \frac{1}{0.80^3 \times 0.25}$	1	
	$K_p = 0.952 \text{ atm}^{-2} = 0.95 \text{ atm}^{-2} \text{ (to 2 s.f.)}$	1	