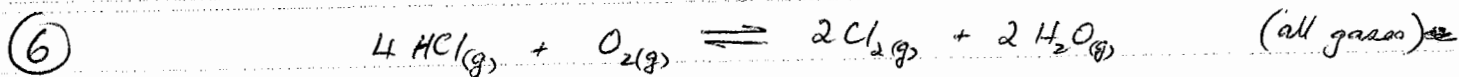
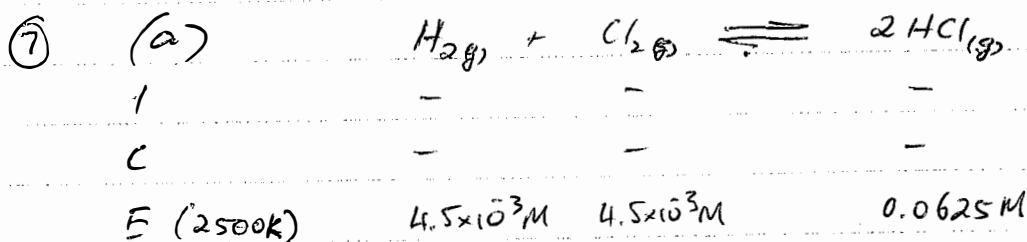


- ① It doesn't. The relative concentrations of the reagents at equilibrium (the "position of equilibrium") is only dependent on the value of the K_{eq} .
- ② Substances which exist as solids or liquids at the temperature stated in the Q. Solids & liquids have constant concentrations and these values will not vary as equilibrium shifts. [The technical answer is that these values are actually part of the K_{eq} expression, but being constant they are numerically incorporated into the K_{eq} value, so do not appear as "concentrations" in the expression - they are part of the K_{eq} value - you do not have to know this!]
- ③ (a) $K_{eq} = 1$; Equilibrium favours neither reactants or products
 (b) $K_{eq} \ll 1$; Equilibrium favours reactant
 (c) $K_{eq} \gg 1$; Equilibrium favours products.
- ④ (a) $K_{eq} = \frac{[O_3]^2}{[O_2]^3}$ (b) $K_{eq} = \frac{[H^+]^3 [PO_4^{3-}]}{[H_3PO_4]}$ (c) $K_{eq} = \frac{[NH_3]^2}{[NO_2]^2 [H_2]^7}$
- (d) $K_{eq} = [CO_2][H_2O]$
- ⑤ (a) appreciable amounts of both. arguable but K_{eq} is not really $\gg 1$.
 (b) only reactants (essentially)
 (c) Borderline, my answer is essentially only products (arguable)
 (d) essentially only products



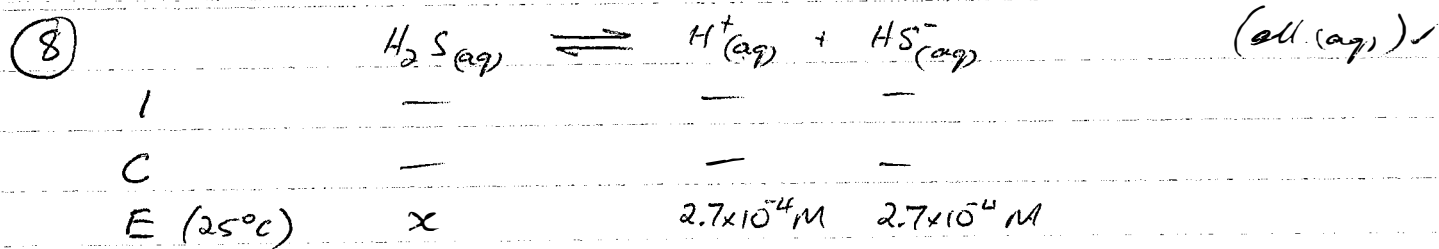
I	—	—	—	—
C	—	—	—	—
E (temp const)	0.0012 M	3.8×10^{-4} M	0.058 M	0.058 M

$$K_{eq} = \frac{[\text{Cl}_2]^2 [\text{H}_2\text{O}]^2}{[\text{HCl}]^4 [\text{O}_2]} = \frac{0.058^2 \times 0.058^2}{0.0012^4 \times 3.8 \times 10^{-4}} = 1.44 \times 10^{10}$$



$$K_{eq} = \frac{[\text{HCl}]^2}{[\text{H}_2][\text{Cl}_2]} = \frac{0.0625 \text{ M}}{4.5 \times 10^{-3} \times 4.5 \times 10^{-3}} = \underline{3086}$$

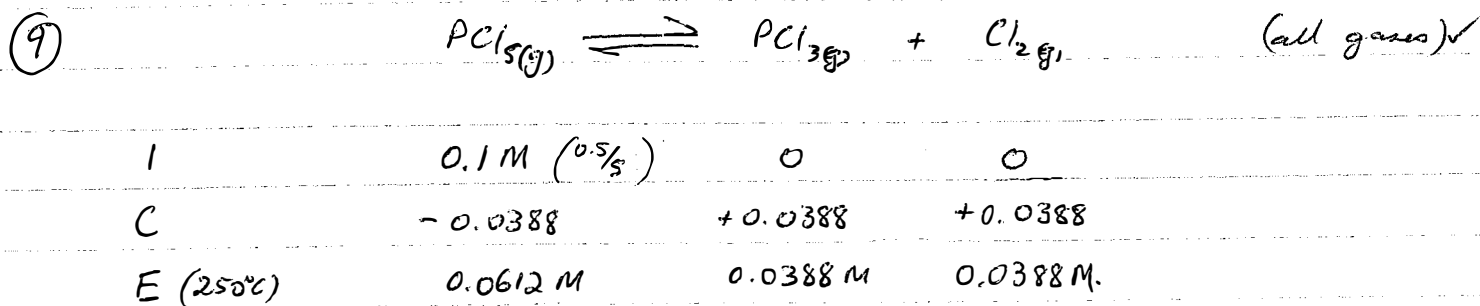
(b) $K_{eq} = 3.24 \times 10^{-4}$. The two K_{eq} values are inverses of each other $K_{eq}(a) = \frac{1}{K_{eq}(b)}$ as equilibriums are identical but reversed.



$$K_{eq} = 9.5 \times 10^{-8} = \frac{[H^+][HS^-]}{[H_2S]} \Rightarrow [H_2S] = \frac{[H^+][HS^-]}{9.5 \times 10^{-8}}$$

$$= \frac{2.7 \times 10^{-4} \times 2.7 \times 10^{-4}}{9.5 \times 10^{-8}}$$

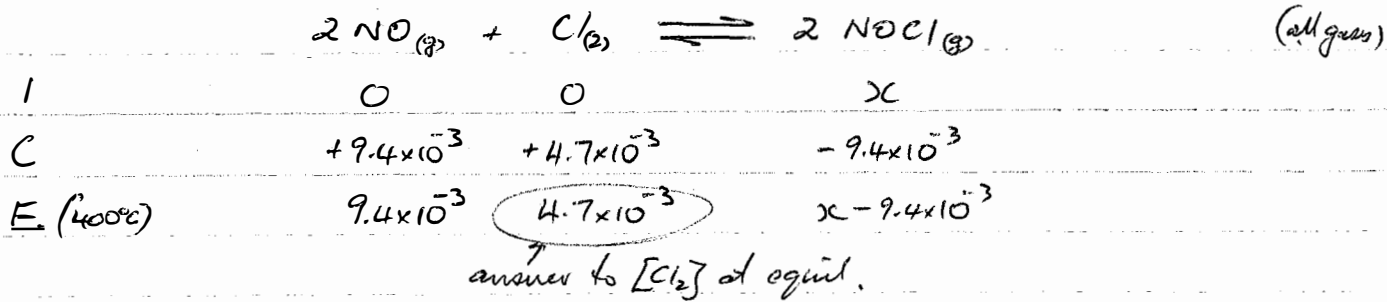
$$= \underline{0.77}$$



$$K_{eq} = \frac{[PCl_3][Cl_2]}{[PCl_5]} = \frac{0.0388 \times 0.0388}{0.0612}$$

$$= \underline{0.0245}$$

10



$$K_{eq} = 28.1 = \frac{[\text{NOCl}]^2}{[\text{NO}]^2 [\text{Cl}_2]} = \frac{(x - 9.4)^2}{(9.4 \times 10^{-3})^2 (4.7 \times 10^{-3})}$$

$$28.1 \times (9.4 \times 10^{-3})^2 \times 4.7 \times 10^{-3} = (x - 9.4 \times 10^{-3})^2$$

$$1.17 \times 10^{-5} = (x - 9.4 \times 10^{-3})^2$$

Now this looks like you have to solve for x, but this question is a little tricky - you have been asked to calculate the equilibrium conc of NOCl, which is represented by $x - 9.4 \times 10^{-3}$; you do not actually have to calculate for x itself, which is the initial conc of NOCl.

so $\sqrt{1.17 \times 10^{-5}} = x - 9.4 \times 10^{-3}$

$$\underline{3.42 \times 10^{-3} \text{ M}} = [\text{NOCl}] \text{ at equil.}$$

from earlier $4.7 \times 10^{-3} \text{ M} = [\text{Cl}_2] \text{ at equil}$