(1) It doesn't. The relative concentrations of the reagents at equilibrium (the "position of equilibrium") is only dependent on the value of the Keq.

(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 Keq expression, but being constant they are numerically incorporated into the Keq value, so do not appear as "concenentrations" 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) $K_{eq} << 1$; Equilibrium favours reactant
(c) $K_{eq} >>$; 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 Keq is not really >>1.
(b) only reactants (essentially)
(c) Border line, my answer is essentially only products (arguable)
(d) essentially only products

(6) $4\,HCl_{(g)} + O_{2(g)} \rightleftharpoons 2\,Cl_{2(g)} + 2\,H_2O_{(g)}$ (all gases)

	$4\,HCl_{(g)}$	$O_{2(g)}$	$2\,Cl_{2(g)}$	$2\,H_2O_{(g)}$
I	—	—	—	—
C	—	—	—	—
E (temp const)	0.0012M	3.8×10^{-4}M.	0.058M	0.058M

$$K_{eq} = \frac{[Cl_2]^2[H_2O]^2}{[HCl]^4[O_2]} = \frac{0.058^2 \times 0.058^2}{0.0012^4 \times 3.8\times10^{-4}}$$

$$= 1.44 \times 10^{10}$$

(7) (a) $H_{2(g)} + Cl_{2(g)} \rightleftharpoons 2\,HCl_{(g)}$

	$H_{2(g)}$	$Cl_{2(g)}$	$2\,HCl_{(g)}$
I	—	—	—
C	—	—	—
E (2500K)	4.5×10^{-3}M	4.5×10^{-3}M	0.0625M

$$K_{eq} = \frac{[HCl]^2}{[H_2][Cl_2]} = \frac{0.0625\,M}{4.5\times10^{-3}\times4.5\times10^{-3}} = \underline{3086}$$

(b) $K_{eq} = 3.24\times10^{-4}$. The two Keq value are inverses of each other $K_{eq}(a) = \frac{1}{K_{eq}(b)}$ as equilibriums are identical but reversed.

(8) $H_2S_{(aq)} \rightleftharpoons H^+_{(aq)} + HS^-_{(aq)}$ (all (aq)) ✓

	H_2S	H^+	HS^-
I	—	—	—
C	—	—	—
E (25°C)	x	2.7×10^{-4} M	2.7×10^{-4} M

$$K_{eq} = 9.5\times10^{-8} = \frac{[H^+][HS^-]}{[H_2S]} \Rightarrow [H_2S] = \frac{[H^+][HS^-]}{9.5\times10^{-8}}$$

$$= \frac{2.7\times10^{-4} \times 2.7\times10^{-4}}{9.5\times10^{-8}}$$

$$= \underline{0.77}$$

(9) $PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$ (all gases) ✓

	PCl_5	PCl_3	Cl_2
I	0.1 M ($0.5/5$)	0	0
C	− 0.0388	+ 0.0388	+ 0.0388
E (250°C)	0.0612 M	0.0388 M	0.0388 M.

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

$$= \underline{0.0245.}$$

(10)

$$2NO_{(g)} + Cl_{2(g)} \rightleftharpoons 2NOCl_{(g)}$$ (all gases)

	$2NO_{(g)}$	$Cl_{2(g)}$	$2NOCl_{(g)}$
I	0	0	x
C	$+9.4\times10^{-3}$	$+4.7\times10^{-3}$	-9.4×10^{-3}
E (400°C)	9.4×10^{-3}	4.7×10^{-3}	$x-9.4\times10^{-3}$

↑ answer to $[Cl_2]$ at equil.

$$K_{eq} = 28.1 = \frac{[NOCl]^2}{[NO]^2[Cl_2]} = \frac{(x-9.4)^2}{(9.4\times10^{-3})^2(4.7\times10^{-3})}$$

$$28.1\times(9.4\times10^{-3})^2\times4.7\times10^{-3} = (x-9.4\times10^{-3})^2$$

$$1.17\times10^{-5} = (x-9.4\times10^{-3})^2$$

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 $x-9.4\times10^{-3}$; you do not actually have to calculate for x itself, which is the initial conc of NOCl.

so $\sqrt{1.17\times10^{-5}} = x-9.4\times10^{-3}$

3.42×10^{-3} M = [NOCl] at equil.

from earlier 4.7×10^{-3} M = $[Cl_2]$ at equil