



INTRODUCTION TO K_p

The concept of dynamic equilibrium	<p>In a closed system (where nothing can get in or out), reversible reactions can reach a state of dynamic equilibrium, meaning that:</p> <ul style="list-style-type: none">• both reactions are taking place simultaneously and at the same rate, and• the concentration of all reactants and products remains constant
K_c	<p>K_c is the equilibrium constant for a system at equilibrium which uses the concentrations (in mol dm^{-3}) of the reactants and products.</p> <p>K_c is a constant for an equilibrium. The only factor that changes K_c is temperature.</p> <p>For example, for this equilibrium: $3A + B \rightleftharpoons 2C$</p> $K_c = \frac{[C]^2}{[A]^3[B]} \quad \text{the units are} \quad \frac{(\text{mol dm}^{-3})^2}{(\text{mol dm}^{-3})^4} = (\text{mol dm}^{-3})^{-2} = \text{mol}^{-2} \text{ dm}^6$ <p>Calculate K_c at temperature T for an equilibrium mixture containing 1.2 mol of A, 3.0 mol of B and 1.8 mol of C in a container with volume 2.0 dm^3.</p> $K_c = \frac{[C]^2}{[A]^3[B]} = \frac{\left(\frac{1.8}{2.0}\right)^2}{\left(\frac{1.2}{2.0}\right)^3 \left(\frac{3.0}{2.0}\right)} = 2.5 \text{ mol}^{-2} \text{ dm}^6$
Le Chatelier's principle	<p>In simple terms – if the conditions of a system in equilibrium are changed, then the position of the equilibrium moves to oppose that change.</p> <p><i>Gas pressure (if a reaction involves one or more gases)</i></p> <p>If the overall pressure on the system is increased, the equilibrium moves in the direction of the side with fewer gas molecules to lower the pressure.</p> <p>The equilibrium moves, but K_c/K_p remains constant.</p> <p><i>Temperature</i></p> <p>If the temperature is increased, the equilibrium moves in the direction of the endothermic reaction to lower the temperature.</p> <p>K_c does change with temperature: if it moves right then K_c/K_p increases, but if it moves left then K_c decreases</p> <p><i>Concentration</i></p> <p>If the concentration of a chemical is increased, the equilibrium moves in the direction that removes that chemical.</p> <p>The equilibrium moves, but K_c/K_p remains constant.</p>
Mole fraction	<p>If you have 10 moles of a mixture of gases, of which 3 moles is O_2, then the mole fraction of O_2 in the mixture is $\frac{3}{10}$ or 0.3 (or even 30%, but it is not usually expressed as a %)</p> $\text{mole fraction of gas A in a mixture of gases} = \frac{\text{moles of gas A}}{\text{total moles of gas in the mixture}}$
Partial pressure	<p>Imagine a mixture of gases with a total pressure of 100 kPa.</p> <p>If the mole fraction of gas A in that mixture is $\frac{3}{10}$, then that gas makes up 30 kPa (i.e. $\frac{3}{10}$) of the total pressure. The contribution that each gas makes to the total pressure is called the partial pressure of that gas; therefore the partial pressure of gas A is 30 kPa.</p> <p>partial pressure of gas A in a mixture of gases = mole fraction of gas A x total pressure</p>