Kp and the Equilibrium Constant Map

Edexcel International A Level Chemistry · Unit 4 · Topic 13B Kp and the Equilibrium Constant

1 Partial pressures

13.2

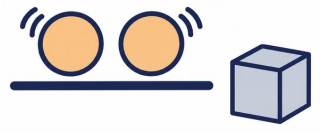
- x = **moles ÷ total moles**
- p = **x × P**
- Mole fractions add to 1
- Partial pressures add to P



2 Writing Kp

13.2

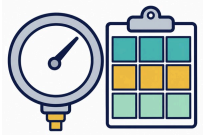
- **Gases only**
- Powers = **balancing numbers**
- Solids left out
- Units from atm: **cancel**

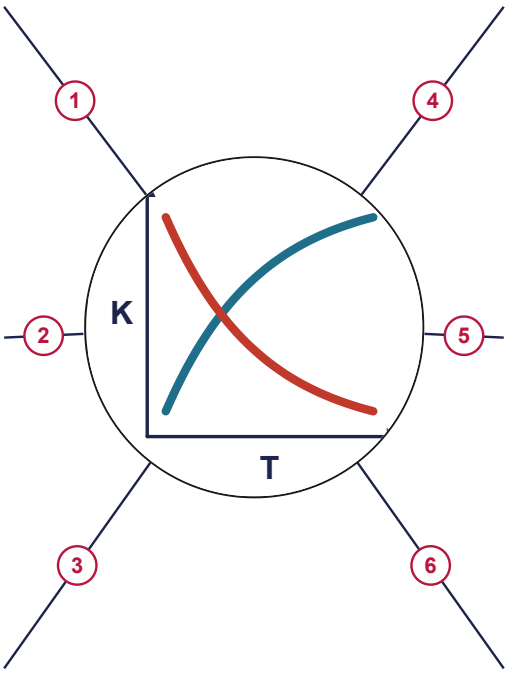


3 Calculating Kp

13.3

- ICE in **moles**
- New **total** amount
- x, then p, then **Kp**
- % dissociated changes the total





4 Only T changes K

13.6, 13.7

- Exothermic: K **falls** as T rises
- Endothermic: K **rises**
- New K: **position moves**
- Same idea for Kc and Kp



5 Ratio against K

13.4, 13.5

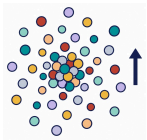
- Concentration, pressure: **K unchanged**
- Ratio ≠ K: system **shifts**
- Catalyst: K the same, **sooner**
- Ratio > K: moves left



6 Entropy and K

13.8, 13.9

- **$\Delta S_{total} = R \ln K$**
- ΔS in **J**; then e^x
- K > 10^{10}: complete
- K is extent, **not rate**



What changes K and the position

for an exothermic forward reaction with fewer gas molecules on the right

Change	Effect on K	Ratio just after	Position
Raise the temperature	falls	larger than K	left
Raise the pressure	none	smaller than K	right
Add a reactant	none	smaller than K	right
Remove a product	none	smaller than K	right
Add a catalyst	none	equal to K	no change

Worked examples

Kp from moles

- 0.80 NO_2, 0.60 N_2O_4 mol
- p = 1.14, 0.857 atm
- **Kp = 0.66 atm^{-1}**

Heating an exothermic

- K falls from 12 to 3.0
- old ratio now too large
- **moves left**

From ΔS to K

- ΔS_{total} = +60.0 J K^{-1} mol^{-1}
- ln K = 7.22
- **K = 1.37 × 10^3**

Kc (Topic 13A) uses concentrations in the same way; Ka and Kw (Topic 14) are the equilibrium constants of acids and water.

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