AP Chemistry

Formula Sheet · 公式表

AP Chemistry supplies a full equations-and-constants sheet plus the periodic table, so recall is not what is tested. What the sheet cannot tell you is which relationship the situation calls for, what has to be true before you may use it, and how to justify the choice in a sentence – which is precisely how the free-response is scored. 公式表已给出，考的是选择与论证。

Given on the AP sheet

Gas laws including $PV = nRT$, partial pressures, and the kinetic-molecular relationships; the constants R in three unit systems.

Thermodynamics: $q = mc\Delta T$, ΔH and ΔS from formation values, $\Delta G = \Delta H - T\Delta S$, and $\Delta G = -RT \ln K$.

Equilibrium and acid-base: the K expressions, K_w, pH and pOH definitions, the Henderson-Hasselbalch relationship.

Kinetics: the integrated rate laws for zero, first and second order, and the Arrhenius relationship. Electrochemistry: E°_{cell}, $\Delta G = -nFE$, and $Q = It$.

Choosing the right rate law

Order comes from data, never from the equation — Compare experiments where one concentration changes and the others do not. Doubling a concentration that doubles the rate is first order; quadrupling it is second; no change is zero.

Which integrated form — A straight line of [A] against t means zero order; ln[A] against t means first; 1/[A] against t means second. The exam gives you the three plots and asks which is linear – that question IS the order determination.

Mechanisms — The rate law must match the slow step, counting only species that appear up to and including it. A proposed mechanism is rejected when its rate-determining step disagrees with the experimental rate law – say that explicitly.

Equilibrium and acid-base decisions

Q against K — Compute the reaction quotient with the same expression as K. If $Q < K$ the reaction proceeds forwards. This comparison is the standard justification and is worth stating in words.

Which acid-base tool — Strong acid: pH straight from the concentration. Weak acid: an ICE table with K_a. Buffer: Henderson-Hasselbalch. After the equivalence point of a titration: it is now excess strong reagent, so go back to the first tool.

At the half-equivalence point — pH = pK_a exactly, because the acid and its conjugate base are equal. That single fact answers a large share of titration-curve questions with no calculation at all.

Le Chatelier with a reason — Never answer "the equilibrium shifts right". Say which stress was applied, which side it increased, and therefore which way the system responds to reduce that change – the reasoning is the point, not the direction.

Thermodynamics and electrochemistry

Sign conventions — Exothermic means negative ΔH. A negative ΔG means thermodynamically favourable, which is not the same as fast – this distinction is examined nearly every year.

Entropy predictions — Entropy rises when moles of gas increase, when a solid dissolves, and with temperature. Predict the sign from the equation before computing anything, then check the number agrees.

Temperature dependence — From $\Delta G = \Delta H - T\Delta S$: if both are positive the reaction becomes favourable at high temperature; if both are negative, at low. The crossover temperature is $T = \Delta H/\Delta S$.

Cells — A positive E°_{cell} means a galvanic cell and a negative ΔG. Oxidation is always at the anode; electrons flow from anode to cathode through the wire.

What the graders are looking for

Every "justify" and "explain" part is scored on a claim plus evidence plus reasoning. Name the principle, cite the number from the data given, then draw the conclusion. A correct conclusion with no cited evidence typically earns nothing.

Particle-level explanations must talk about particles: intermolecular forces, collision frequency, effective collisions, energy distributions. Macroscopic restatements of the observation earn no credit.

Show the setup for every calculation, including the units, and carry them through. Partial credit follows a visible method; a lone number cannot receive it.