COMMON ASSUMPTIONS IN NUMERICAL PROBLEMS

Type	Assumption	Why it's made (benefit)	When it can break down
System related assumptions	**Steady state** (accumulation = 0)	Simplifies to Inputs = Outputs, fewer unknowns	Start-up, shutdown, batch processes, or transient operation
	Closed system (no unlisted mass flows)	Reduces number of terms to track	Real systems often have leaks, vents, unmeasured losses
	Perfect mixing	Avoids dealing with gradients in composition	Stratified tanks, plug flow reactors, or incomplete mixing
	Single phase	Simplifies phase equilibrium calculations	Systems with condensation, evaporation, crystallization
	Constant density	Lets you use volume ratios directly as mass ratios	Significant temperature/pressure changes, compressible fluids
Property & measurement assumptions	**Exact measurements**	Avoids error propagation	All real measurements have uncertainty, especially at small scale
	Negligible losses (e.g., no dust, no leaks)	Focuses on main process streams	High-speed operations, pneumatic transport, volatile materials
Composition assumptions	**Pure components**	Simplifies composition balances	Most industrial feeds are mixtures or contain impurities
	No chemical reaction or **complete reaction**	Avoids partial conversion and selectivity calculations	Incomplete reaction, side reactions, or competing pathways
	No side products/byproducts	Keeps mass balance on main product only	Complex chemistry, catalyst degradation, biological processes
Process behavior assumptions	**Linear additivity of mass**	Applies conservation of mass directly	Volume contraction in mixing (e.g., ethanol + water), porous materials
	Instantaneous/continuous operation	Easier math, avoids time-dependence	Batch processes, systems with cycles or surges
Simplifying unit/scale assumption	**Negligible rounding**	Speeds up manual calculation	Small differences can matter in tight tolerance systems
	Discrete count treated as continuous	Allows algebra without integer constraints	Packaging or discrete manufacturing where partial items can't exist