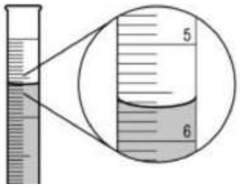
AP Test Tips from AP Chem Teachers…

General Test Tips:

- Spend more time on the problems you know rather than the problems you don't know
- Do the MC in three passes - ones you know that are quick, then ones you know that take time, then try the ones you didn't know (on first pass through, answer quick MC, circle MC you know that take time, circle MC you don't know)
- Pay attention to you MC pacing → answer 10 MCQs in the first 15 min., 20 MCQs in 30 min., etc. (90 sec/question) …If you start to spend too long on an MC question, remember that 10 of the 60 MC questions don't even contribute to your score. Efficiency is key
- In multiple choice math questions round, approximate. You NEVER need long division et al.
- Do the easy FR question first. Only the suckers/losers go in order.
- If part (a) looks too confusing to you, then skip it and come back to it later. You can answer part (b) before part (a). Label your answers clearly.
- "RTQ - ATQ" (read the question – answer the question) …After you have finished your FRQ answer, read it back to yourself. Did you actually answer the question that was being asked?
- Don't write too much, just answer the question! Be brief… be brilliant
- If they ask you to make a choice (higher, lower, increase, decrease, etc.) make the choice and write this part down FIRST...BEFORE you start justifying your answer.
- If the question asks you to compare 2 substances make sure you refer to TWO substances
- When in doubt, find moles.
- MV =moles, but millimoles works just fine a lot of the time.
- Get a good night's sleep
- Lab error normally looks for an increase or decrease in experimental values.
- Burets measure liquids more precisely than beakers or graduated cylinders. STOP TRYING TO USE A BEAKER TO MEASURE TENTHS OF A MILLILITER!!!!!!!
- You would read the volume on this buret as 5.65 mL...NOT 6.35 mL



- If you are clueless about rounding off your answer, 3 sig figs is plenty most of the time.

- % error does not mean the same thing as % yield

- How about this..."The AP test writers are lazy and boring. I highly doubt that they will come up with anything original. You have seen these questions before!!"

- Avoid the use of the word "it" ...refer to substances by name, so we know exactly what you meant to say.

- "Just remember this, if I get your exam back next fall and I see that you answered, YES/NO when asked if something will increase, decrease, or stay the same, I will hunt you down like a bloodhound and taser you in your face! Now, good luck on your test!" ;)

- Don't forget units! (and pay attention to the units you're given!)

Big Idea 1 – Atoms & Elements

- **Horizontal trends**: they both have the same energy level (subshell), but one of them has more protons (greater nuclear charge).

- **Vertical trends**: one of them has valence electrons in an orbital with a higher value of n; this orbital is higher in energy (and farther away from the nucleus).

- Atoms/elements/ions/molecules/compounds don't "like" or "want" anything (ex. Justification for a trend cannot it "it wants to have a full shell) …also, stating a trend is NOT a justification. Give the scientific reason why things happen. Trends are usually about nuclear charge & distance (coulomb's law!)

- When explaining trends, don't talk about placement on the table or the atom having a full shell. Period... Talk about things in the atoms like Z_{eff} (nuclear charge), nuclear pull, distance between nucleus and valence electrons, etc.

- Mass Spectroscopy is all about isotopes! Proton Electron Spectroscopy (PES) is all about coulomb's law & electron configurations!

- Ions have a charge… Na and Na^+ are not the same!

Big Idea 2 – Structure & Properties of Matter

- If the question says, "Draw ALL resonance structures," chances are there's more than one Lewis Structure.

- Never trust printed structures for bond angles! Count the electron domains.

- For heaven's sake, carbon will make 4 bonds total and hydrogen will only have one bond in a Lewis structure!!!!!!!!!!!!!

- Use electron domains to help with determining shapes (and double bonds represent a single domain)
- "Tetrahedral" is not a bond angle.
- Non-polar molecules can contain polar bonds.
- The greater the difference in electronegativity between two atoms, the more polar the bond is.
- Breaking attractions (bonds, IMFs, nucleus-valence e-) REQUIRES energy (endothermic).
- Lattice energy and Coulomb's law:
  - MgO beats NaF (similar ionic radii, greater charge magnitude wins)
  - NaF beats KCl (same charge magnitude, smaller ionic radii wins)
- If the question says to justify your answer in terms of IMFs, mention ALL of the IMFs that each substance experiences. Do NOT say "like dissolves like" when justifying why two substances dissolve or mix together.
- Larger e-cloud = more London dispersion forces = more polarizable …this is dependent on SIZE, not MASS
- Stronger IMFs = higher boiling point = lower vapor pressure = greater viscosity
- Hydrogen bonds only occur between an H already bonded to F, N, or O and another F, N, or O …(H–H is NOT a hydrogen bond)
- Chromatography → distance traveled is based on affinity for the mobile phase and affinity for the stationary phase.
- Sometimes the data tells you something that is different than what you would have predicted (i.e. CCl_4 has stronger IMFs than HCl.) GO WITH THE DATA!!!
- Water is wet. ;)
- Do NOT use 1 mole = 22.4 L unless you are actually at STP (0°C & 298 K) …*STP is NOT "standard state" (which is 25°C & 298 K)
- Any two gases at the same temp. Have the same KE but NOT the same velocities
- Ideal gas conditions = high temperature & low pressure
  - Deviations from ideal gas law occur at low T & high P
  - Deviations also occur when gases are too sticky (polar) or too large (LD).
- MM =dRT/P (meow, meow)
- Larger = size. Heavier = mass. More = amount (like moles). Don't mix them up!

Big Idea 3 – Chemical Reactions (including redox)

- Net Ionic Equations (NIE): Dissociate aqueous substances (strong electrolytes) and eliminate spectator ions.

- All equations must be balanced for atoms AND charge!

- Oxidation is loss of electrons/reduction is gaining of electrons
    - LEO goes GER
    - OIL RIG

- The more (+) E_{red} is the reduction and the less (+) is the oxidation reaction.

- When adding two half-reactions together, the electrons must cancel out.
    - If you reverse the rxn, change the sign of E_{red} to serve as E_{ox}.
    - If you double it, do NOT double the voltage.

- Reduction at the cathode, oxidation at the anode. (An Ox/Red Cat)

- Electrons travel in the wire from anode to cathode. Ions flow through the salt bridge: anions toward the anode, cations toward the cathode.

- Electroplating shortcut....grams = MM(I)(t)/nF

Big Idea 4 – Kinetics

- Thermodynamics tells you IF it will happen. Kinetics tells you how FAST.

- Rate Laws can be determined via experimental data OR if you know the reaction mechanism & the rate-determining (slow) step.

- The only thing that changes the value of "k" is changing the temperature (or adding a catalyst.)

- High activation energy --- slow reaction rate
  Low activation energy --- fast reaction rate

- If the data shows that the half-life is constant over time, it's first-order kinetics for that substance.

- Determining order of reaction via graphs… which produces a straight line?
    - [A] vs. t → zero order
    - ln [A] vs. t → first order
    - 1/[A] vs. t → second order
    - **regardless of which order the rxn is, the absolute value of the slope = k

- Don't forget to include the proper UNITS for your k value!)

- Rate "k" HAS units; Equilibrium "K" does NOT have units

Big Idea 5 – Thermodynamics

- Thermodynamics tells you IF it will happen. Kinetics tells you how FAST.

- If your answer is ΔH, ΔS, ΔG, or E°, make sure your answer includes the proper **SIGN** and the proper **UNITS**.

- Thermodynamically favorable reactions → ΔG<0 …E>0 …K>1
    - At equilibrium, ΔG=0, E=0 (both essentially indicate how far away from equilibrium the system is)

- Raising the temperature does NOT affect ΔH or the activation energy.

- Breaking attractions (bonds, IMFs, nucleus–valence e-) REQUIRES energy (endothermic).

- Bonds breaking is endothermic & bonds forming is exothermic (ΔH is the net sum of this)

- Pay attention to units! (specifically, pay attention when you have a mixture of joules & kJ)

Big Idea 6 – Equilibrium

- …At equilibrium, ΔG=0, E=0
  (both essentially indicate how far away from equilibrium the system is)

- Rate "k" HAS units; Equilibrium "K" does NOT have units

- The only thing that changes the value of "K" is changing the temperature.

- Increasing temperature increases both the forward and the reverse rxn rates…it just increases the endothermic direction's rate more.

- Manipulating the equilibrium constant values (K)
    - Reverse the reaction → the new K is the reciprocal of the old K
    - Multiply the reaction by 2 → the new K is the old K squared
    - Add two reactions together → multiply $(K_1)x(K_2)$

- If you have a reaction with a HUGE value of K, assume the reaction essentially goes to completion, and treat it like a normal stoichiometry (or limiting reactant) problem; You don't need to make an ICE table
- Equilibrium *expressions* are determined via a balanced chemical equation

- Beware the pressure equilibrium expression. And if it's K_p, don't use brackets!

- If you complete an equilibrium calculation (ICE table) and find "x", you're not done! x maybe not the answer the question is asking for… answer what the questions is asking

- Discuss reaction quotient (Q) to explain a shift in equilibrium. Saying "LeChatelier's Principle" will get you NOTHING! If Q increases reaction goes towards the reactants. The same goes for a voltaic cell voltage change. If Q increases, the voltage decreases.
    - $Q<K$ …reaction shifts towards the products
    - $Q>K$ …reaction shifts towards the reactants
    - $Q=K$ …reaction is at equilibrium (no need to shift)

- Whenever finding Q can help determine which direction a reaction will proceed to re-establish equilibrium is a good thing.

- Inert gases and catalysts DO NOT shift an equilibrium

- If x = the solubility of an ionic solid (in mol/L)
    - K_{sp} for AgCl $= (x)(x) = x^2$
    - K_{sp} for $PbCl_2 = (x)(2x)^2 = 4x^3$

- "x" = molar solubility

- Larger K_a = more ionizable

- Acid-base reactions proceed from the strong side to the weak side. Look at the magnitude of K to determine which way the reaction is favored.

- HX versus HY…If HX is the stronger acid, then Y- is the stronger base.

- The acidic species in a buffer neutralizes added base.

- weak acid & strong base titration: pH = pKa at the halfway point (also at this point, $[HA]=[A^-]$)

- If you titrate 10 mL of a 1 M weak acid and also titrate 10 mL of a 1 M strong acid, these samples would require the SAME amount of 1 M NaOH to reach the equivalence pt. (i.e. volume of titrant is based on moles, not acid strength) …BUT, the weak acid would have a higher pH at the equivalence point

- $M_1V_1=M_2V_2$ is not on the formula sheet, but extremely useful in dilutions and neutralizations