

Useful tips for the examination

General tips

- Leave no multiple choice blank.
- Avoid the use of the word "it" Refer to substances by name, so they know exactly what you meant to say.
- Atoms/elements/ions/molecules/compounds don't "like" or "want" anything. Give the scientific reason why things happen.
- Redefining the meaning of a term is NOT a justification.
- Lab error normally looks for an increase or decrease in experimental values.
- Sometimes the data tells you something that is different than what you predicted (i.e. CCl_4 has stronger IMFs than HCl .) GO WITH THE DATA!
- Burettes measure liquids more accurately than graduated cylinders or beakers . DON'T USE A BEAKER TO MEASURE ACCURATELY!
- Burettes are read from the top down, not the bottom up like a graduated cylinder.
- The proper way to use a burette or pipette is to rinse it first with your solution. Any water could dilute the solution.
- Spend more time on the problems you know rather than the problems you don't know.
- On the structured questions...Read. every. single. word. of each part of the question very carefully before you start to write down your answer.
- After you have finished answering, read the answer back to yourself. Did you actually answer the question that was being asked?
- If the question asks you to compare 2 substances make sure you refer to TWO substances.
- If they ask you to make a choice (higher, lower, increase, decrease, etc.) make the choice and write this part down FIRST, justify your answer.
- Don't write too much! Just answer the question!
- Put your answers in the box, or use continuation papers. The areas outside the box are not scanned.
- Use the formula sheet! There is a lot of useful information in there.
- Larger = size, volume. Heavier = mass. More = amount (like moles). Don't mix them up!
- When explaining trends, don't talk about placement on the table. Talk about things in the atoms like nuclear pull and distance.
- Do the exam in three passes - ones you know that are quick, then ones you know that take time, then try the ones you didn't know.
- 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.
- Thermodynamics tells you IF it will happen. Kinetics tells you how FAST.
- Rate k has units, equilibrium K does not.
- When explaining a lab based error, explain that a certain mistake would increase or decrease your calculated value and why.

Chapter 1

- Percent error, $(\text{observed} - \text{actual}) / \text{actual} \times 100$, does not mean the same thing as percent yield, $\text{actual} / \text{theoretical} \times 100$
- Any two gases at the same temperature have the same KE but NOT the same velocities
- Ideal gas conditions = high Temperature low Pressure; Deviations also occur when gases are too sticky (polar) or too large (LD).
- At low temperature or high pressure the gas is closer to not being a gas anymore, condensing. That is why it isn't ideal
- Do NOT use 22.7 L unless you are actually at STP. STP is NOT standard state ° Standard state is 25° C, 298 K
- Adding water to the analyte (what you are testing) won't change the number of moles of substance present.
- All equations must be balanced for atoms AND charge!

Chapter 2

Chapter 3

- Horizontal trends: they both have the same energy level (subshell), but one of them has more protons (greater nuclear charge).
- Vertical trends: if valence electrons are in an orbital with a higher n ; this orbital is higher in energy and farther away from the nucleus

Chapter 4

- LDF, London Dispersion Forces, depend on size and polarizable electron clouds, not mass!
- Bigger size = more polarizable = larger LDF
- (HL) Lone pairs on the central atom doesn't mean that the molecule is polar (think XeF₄ and KrF₂ - symmetry)
- Use electron domains to help with determining shapes AND double bonds represent a single domain.
- (HL) Always consider the octet rule and formal charge when drawing molecules
- The size of the electron cloud matters for LDF (larger = more easily polarized = stronger IMF), not for dipole-dipole.
- Polarity is determined by the difference in electronegativity of the atoms in the bond (greater difference in EN = more polar = stronger IMF).
- Non polar molecules can contain polar bonds.
- The greater the difference in electronegativity between two atoms, the more polar the bond is.
- Lattice energy MgO has a greater attraction than NaF, similar ionic radii, greater charge. NaF > KCl same charge, smaller ionic radii
- Larger and more e-cloud = more London Dispersion = More polarizable
- Stronger IMFs higher Boiling Point, lower vapor pressure

- H-H is NOT a hydrogen bond. Hydrogen bonds occur when the atoms nitrogen, oxygen or fluorine bond to hydrogen to make a dipole.
- Mention ALL of the IMFs that each substance experiences. Do NOT say "like dissolves like" when justifying substances dissolving
- If the question says, "Draw ALL resonance structures," chances are there's more than one Lewis Structure.
- When drawing the Lewis dot structure don't draw resonance structure

Chapter 5

- High activation energy ---slow reaction rate. Low activation energy ---fast reaction rate
- Bond energy is reactants minus products, everything else is products minus reactants.
- Bonds breaking is Endothermic ΔH is + (reactants). Bonds forming Exothermic ΔH is – (products). Overall ΔH is the net sum of this.
- (HL)If your answer is ΔH , ΔS , ΔG , or E_o , make sure your answer includes the proper SIGN and the proper UNITS. $\Delta = \text{delta}$
- Raising the temperature does NOT affect ΔH or the activation energy. It may help you to achieve it, but doesn't change it
- Breaking attractions (bonds, IMFs, nucleus-valence e-) REQUIRES energy (endothermic) forming bonds releases energy (exothermic)
- (HL)Thermodynamically favorable: $\Delta G < 0$, $E > 0$, $K > 1$
- (HL)Gibbs free energy is used to determine spontaneity, or combining entropy and enthalpy, not just entropy.

Chapter 6

- zero order: $[A]$ vs. t linear first order: $\ln[A]$ vs. t constant half life second order: not linear not constant half life.
- Don't forget your units for the rate law constant, k . Rate is M/time . The constant makes the units match in the equation.
- If the data shows that the half-life is constant over time, it's first-order kinetics for that substance.
- Reactants require effective collisions between molecules of sufficient energy to overcome the activation energy to start the reaction

Chapter 7

- 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.
- A reaction with a large K is said to be product-favored, which is not the same as saying "the reaction shifts toward the right."
- If there's no stress imposed on the system, there's no LeChatelier's involved.
- Finding Q determines which direction a reaction will proceed to re-establish equilibrium. If $K > Q$ to the right, if $K < Q$ to the left.

- If you have a reaction with a HUGE K , assume the reaction goes to completion, treat it like a normal stoich or limiting reactant problem.
- Inert gases and catalysts DO NOT shift an equilibrium
- (HL) Larger K_a = more ionizable or dissociated
- Q uses the same equation as K . Q is where your concentrations are now, K is at equilibrium
- (HL) At equilibrium, $\Delta G=0$, $E=0$. Both essentially indicate how far away from equilibrium the system is.
- The only thing that changes the value of K is changing the temperature.
- Increasing temp increases both the forward and the reverse reaction rates, it just increases the endothermic direction reaction's rate more.

Chapter 8

- (HL) $pH = pK_a$ at half eq point, with a strong acid weak base or weak acid strong base titration. This makes the best buffer because $[HA] = [A^-]$.
- 10 mL of a 1 M weak acid and 10 mL of a 1 M strong acid would require the SAME amount of 1 M NaOH to reach the equivalence point.
- Acid-base reactions proceed from the strong side to the weak side. Use magnitude of K to determine which way the reaction is favored.
- HX versus HY...If HX is a stronger acid than HY, then Y^- is a stronger base than X^- .
- (HL) A buffer is a weak acid + conjugate base or WB/CA. The acidic species in a buffer neutralizes added base, basic species neutralizes an acid.

Chapter 9

- OIL RIG or LEO goes GER for redox reactions
- Oxidation occurs at the anode, reduction at the cathode.
- When adding two half-reactions, the electrons must cancel out. Reversing the rxn, changes the sign. Doubling it does NOT double voltage
- Electrons travel in the wire from anode to cathode. Ions flow through the salt bridge: anions toward the anode, cations toward the cathode.
- All equations must be balanced for atoms AND charge!
- Loss of mass of electrode is due to atoms of electrode going into solution as ions, not the loss of electrons

Chapter 10

Chapter 11