Writing good answers to AP bonding questions

Again, here I am not really trying to address the chemistry per se, rather I’m trying to address the *way* kids write their answers. The language, phraseology, the common misconceptions & pitfalls, and how they generally screw-up when trying to transfer what is in their head on to the paper in front of them.

1. The word *molecule* should never be used when discussing ionic compounds. Molecules are small groups of covalently boned atoms, and do not exist in ionic substances.

2. Ionic compounds don’t contain atoms, and covalent molecules don’t contain ions. While we’re at it, there no such thing as a ‘water atom’, either!

3. A hydrogen bond is an intermolecular force (IMF), NOT an intra, covalent bond between a hydrogen atom and another atom. A particular pet peeve of mine is the use (by students) of the phrase, ‘Water is a hydrogen bond’. PLEASE get into the habit of re-phrasing to say, ‘The IMF’s between water molecules are hydrogen bonds’.

4. London Dispersion Forces exist as IMF’s between ALL molecules, but they may not be the correct answer when considering what I call, ‘the spirit of the question’. For example, it would be an extremely unusual question, that when asking about the IMF’s between molecules of say, HCl, expected an answer that talked *exclusively* about LDF’s and not dipole-dipole attractions.

5. London dispersion forces DO increase with size, but you had better be REALLY careful saying such. In recent years, the AP readers have been very keen to make sure that YOU know that ‘size’ does not mean ‘mass’.

LDF’s are not gravitational forces between two very large masses like planets, rather they are electrostatic forces that depend on the number of electrons present and the surface area of the atoms/molecules. Of course, it is true that with more electrons and larger atoms that mass does increase as well, but make it clear that you know that the LDF is not dependent upon mass per se.

6. In relation to #5, AP readers have recently been very keen for you to use the words, ‘*increased polarizability*‘ to help make the distinction when explaining the increases in intermolecular attractions that come with larger molecules and atoms.

7. Don’t apply the concept of IMF’s (of any kind) to ionic compounds. Ionic compounds are held together with ionic bonds and contain no molecules so also contain no inter-molecular forces.

8. When comparing the boiling points of a couple of substances where the IMF’s are different, do two things. Firstly talk about **both** substances in terms of identifying the IMF’s present (a common complaint from readers is the students only talk about one of the substances), and secondly, state clearly which force is the stronger of the two.

Declaring for example, that ‘hydrogen bonding is present between molecules of X’, without mentioning the other substance, OR that hydrogen bonding is a relatively strong IMF, is unlikely to cut it.

9. Avoid the phrase, *‘sodium chloride is polar’* (insert any ionic compound you choose). Although it could be argued that ionic compounds are the *ultimate* in polarity (completely separated charges with a MEGA-dipoles), don’t! The word ‘polar’ is much better off being exclusively used in relation to covalently bonded molecules.

10. Most AP questions that ask about shape are likely to be asking about the geometry of the *atoms*, not the geometry of the electron domains (that include lone pairs), but either way, be sure to state what you are referring to, clearly.

11. There’s little or no point in ever attempting to compare the strength of an ionic and covalent bond. You will never be comparing like-with-like, so I don’t think comparisons are really all that helpful. For example, you can never compare the ionic and covalent bond strengths between Na and Cl, since no covalent bond exists between the two. Likewise, it is not ever going to be possible to compare the ‘ionic bond’ between two chlorine atoms to the covalent bond that *does* exist between them.

12. You certainly *can* draw Lewis diagrams for individual, simple, monatomic ions, since in their purest form we are only talking about representing outer shell electrons, but to be honest, in virtually all cases, Lewis diagrams are better used only for covalent compounds and for showing the covalent bonds *within*, polyatomic ions.

13. Atoms, not molecules, have differences in electronegativity.

14. Take great care to distinguish between the polarity of a bond, and the polarity of the overall molecule – they are different things.