

Self-Assessment Exam

Bonding and Molecules

Write your answers on these pages.

State your assumptions and show calculations that support your conclusions.

RESOURCES PERMITTED: PERIODIC TABLE OF THE ELEMENTS, TABLE OF CONSTANTS,
AN AID SHEET (ONE PAGE $8\frac{1}{2}'' \times 11''$), AND A CALCULATOR.

NO BOOKS OR OTHER NOTES ALLOWED.

2009 Test #1, Problem #3

Answer the following questions about the difluoroiodate ion (IF_2^+).

(a) Draw a 3-dimensional representation of the molecular geometry around the central atom (not simply the Lewis structure). Show all atoms and bonds between them.

(b) Name the type of hybrid orbitals that the central atom forms.

(c) Name the molecular geometry of the compound.

(d) Is IF_2^+ polar or nonpolar? Explain.

(e) Determine the maximum wavelength of electromagnetic radiation capable of breaking the I-F bond.

Bond energies(kJ/mol): F-F = 160 I-I = 150

2009 Test #1, Problem #5

On the same graph below, for (1) BeF_2 ; and (2) BeO , sketch the variation in potential energy, $E_{\text{potential}}$ with internuclear separation, r , between a cation and anion pair in each compound. The diagram need not be drawn to scale; however, you must convey the relative magnitudes of key features.



2009 Test #2, Problem #4

- (a) Boron exists in the gas state as the dimer, B_2 . Explain how the fact that B_2 is paramagnetic (two unpaired electrons) implies that in this molecule the π_{2p} orbitals must lie at a lower energy than do the σ_{2p} .
- (b) Is the gas molecule, B_2^{2-} , more or less stable than the gas molecule, B_2 ? Explain.
- (c) Aluminum arsenide (AlAs) is a compound semiconductor with a band gap energy, E_g , of 2.3 eV. The value of E_g can be decreased by mixing AlAs with a compound semiconductor that has a smaller band gap energy. Name one such compound semiconductor and justify your choice by making reference to the operative chemical bonding.

2009 Test #2, Problem #5

- (a) Which compound do you expect to have the *higher* boiling point: HF or NH₃? Justify your choice with an explanation, using narrative or cartoons or both, that makes reference to the operative chemical bonding.
- (b) To which does an atom of Ar form a stronger bond: another Ar atom or an atom of Kr? Justify your choice with an explanation, using narrative or cartoons or both, that makes reference to the operative chemical bonding.

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3.091SC Introduction to Solid State Chemistry
Fall 2009

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