

- Rank the following ions from *most* basic to *least* basic: P^{3-} , Br^- , Ge^{4-} , Sb^{3-} , S^{2-} . Explain your ranking.
- An electron has the following set of quantum numbers: $n=4$, $l=2$, $m_l=-1$, $m_s=-1/2$. What is the effective nuclear charge felt by this electron in a palladium atom? Give the complete electron configuration for the most likely oxidation state of palladium.
- Based on the rules we discussed in class, we would expect the highest oxide of arsenic (As) to have 5 oxo groups, but arsenate has only 4 oxos. Explain this apparent contradiction. Calculate the pK_b of the arsenic oxo anions with 5 oxos and with 4 oxos.
- Name the fully protonated acid of arsenate and calculate its pK_a .
- Using s-, p-, and d-orbitals (as necessary), draw at least one example of each type of bonding interactions (σ , π , δ bonds). (Briefly explain what is shown in your drawings in case I have trouble interpreting your artwork.)
- Draw Lewis structures and VSEPR shapes for the following. Name the electronic geometry around the central atom, calculate formal charges, and estimate the bond angles.
 SCN^- , BrF_4^- , XeOF_4
- Aluminum phosphate is a very insoluble salt ($K_{sp} = 1.3 \times 10^{-20}$), but will dissolve in fairly strong acid or base solutions. What ions are present in a solution of “Aluminum phosphate” at slightly below $\text{pH}=2$? Describe what will happen in this solution as the pH is increased to 15.

$\text{Al}^{3+}(\text{aq})$	$\text{Al}_2\text{O}_3(\text{s})$			$[\text{Al}(\text{OH})_4]^{-}(\text{aq})$
	↑	↑	↑	↑
pH	2	7	12	15
	↓	↓	↓	↓
$\text{H}_3\text{PO}_4(\text{aq})$	$[\text{H}_2\text{PO}_4]^{-}(\text{aq})$	$[\text{HPO}_4]^{2-}(\text{aq})$	$[\text{PO}_4]^{3-}(\text{aq})$	