

16.87a) In an oxyacid (Y-OH) the strength of the acid is inversely proportional to the strength of the O-H bond. This, in turn, is a function of the polarity of the bond. Polarity, due to electron drift, increases as the electronegativity of the atom bonded to the oxygen increases. As such, more electronegative central atoms form stronger acids.

b) Similar to the reasoning in part a, the presence of additional oxygen atoms causes increased electron drift, making the O-H bond more polar and the acid stronger.

16.88 a) The strength of a binary acid formed by atoms in the same period depends on the polarity of the H-X bond determined by the electronegativity of the X atom. More electronegative atoms create stronger acid and weaker conjugate bases. As such, less electronegative nitrogen forms a stronger base than more electronegative oxygen. Also, nitrogen, because of its lower electronegativity, will more likely donate electrons to a proton (acting as a base).

b) Because CH_4 does not have unbonded electrons it is not able to function as a base. In contrast, NH_3 has an unbonded electron pair it can donate to H^+ , making it a base.

16.93 a) HNO_3 and HNO_2 are both oxyacids. As such, the strength of the acid is determined by the polarity of the O-H bond. The polarity of this bond increases as more oxygen atoms are bonded to the atom bonded to the O-H. As such, HNO_3 's O-H bond is more polar making it a stronger acid.

b) H_2S and H_2O are both binary acids with central atoms in the same group. As such, the strength of the acid is determined by the relative H-X bond strengths, which is inversely related with the size of atom X. Since S is larger than O it forms the stronger acid.

c) a) H_2SO_4 and H_2SeO_4 are both oxyacids. As such, the strength of the acid is determined by the polarity of the O-H bond. The polarity of this bond increases as the electronegativity of the atom bonded to the O-H increases. As such, H_2SO_4 's O-H bond is more polar making it a stronger acid.

d) CCl_3COOH and CH_3COOH are both oxyacids. As such, the strength of the acid is determined by the polarity of the O-H bond. The polarity of this bond increases as more electronegative atoms are bonded to the atom bonded to the O-H. As such, CCl_3COOH 's O-H bond is more polar making it a stronger acid.

16.95 a) BrO^- and ClO^- are both conjugates of oxyacids. The strength of oxyacids is directly related with the electronegativity of the atom bonded to the O-H. As such, BrO^- is the conjugate of the weaker acid, making it the stronger base.

b) BrO^- and BrO_2^- are both conjugates of oxyacids. The strength of oxyacids is directly related with the number of oxygen atoms bonded to the atom bonded to the O-H. As such, BrO^- is the conjugate of the weaker acid, making it the stronger base.

c) HPO_4^{2-} and H_2PO_4^- are the conjugates of the weak acids H_2PO_4^- and H_3PO_4 , respectively. Because of its negative charge, H_2PO_4^- is a weaker acid than H_3PO_4 , meaning its conjugate acid, HPO_4^{2-} , will be the stronger base. Or, because HPO_4^{2-} has a larger negative charge it is better able to attract H^+ .

16.97

a) True, within a period the strength of a binary acid is directly related with electronegativity, which increases from left to right across a period.

b) False, there is no relationship between the number of hydrogens bonded to a central atom and the strength of the acid.

c) H_2Te is a stronger acid than H_2S not because Te is more electronegative, but because it is bigger, creating a weaker bond with H.

16.98 a) True

b) False, for the oxyacids, the polarity of the O-H bond, and therefore the strength of the acid, increases with increasing electronegativity of the central atom.

c) False, HF is actually a weak acid because fluorine is so small that it creates an extremely strong bond with hydrogen.