Week (1 & 2) Worksheet #1 *Solutions*

1) (Klein 4th Ed. 1.55)

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sp\(^3\), trigonal pyramidal
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2) (Klein 4th Ed. 2.76)
Hydrogen atoms bonded to highly electronegative atoms (O, N) are more acidic due to the electronegativity difference between the H and O/N. We see that molecule B does not contain any hydrogens bonded to highly electronegative atoms, so it is not very acidic. We can determine that C is less acidic than A and D because nitrogen is less electronegative than oxygen. Finally, the only important difference between A and D is the presence of the bromine in A. This bromine,
which is also very electronegative, pulls electron density away from
the O - H bond, making it more acidic due to inductive effects.

Conjugate base strength is based on the weakness of the acid. The
stronger the acid, the weaker the conjugate base and vice versa. So,
because B is the least acidic, it is the strongest conjugate base.

5) The general formula to calculate $K_a$ from $pK_a$ is as follows:

$$K_a = 10^{-pK_a}$$

By plugging in the $pK_a$ values given by the problem, you’ll get the $K_a$

a. $K_a = 10^{-pK_a} = 10^{-7}$
b. $K_a = 10^{-2.8} = 1.6 \cdot 10^{-3}$
c. $K_a = 10^{-9.1} = 7.9 \cdot 10^{-10}$

This formula can also be used to calculate the $pK_a$ when given the $K_a$. By
taking the negative log of both sides to isolate $pK_a$, you get:

$$pK_a = -\log(K_a)$$