Answer on the Question #63813, Chemistry / General chemistry

Use the Acid-Base Table to determine the pKa of the weak acid H2O. Express your answer to two decimal places.

pKa=_____

Solution:

Dissociation of the weak acid like water occurs by the following reaction:

$$H_2O_{(aq)} = OH^-_{(aq)} + H^+_{(aq)}$$

The law of mass action for this equation would be expressed as:

$$K_a = \frac{a_{OH^-} \cdot a_{H^+}}{a_{H_2O}} = \frac{[OH^-] \cdot [H^+]}{[H_2O]}$$

The product of $[OH^-] \cdot [H^+] = 1 \cdot 10^{-14}$ and concentration of water $[H_2O] = 55.33\ M$, thus

$$K_a = \frac{1 \cdot 10^{-14}}{55.33} = 2 \cdot 10^{-16}$$

Therefore:

$$pK_a = -\log(K_a) = -\log(2 \cdot 10^{-16}) = 15.69$$

Answer: pKa=15.69