Quiz 1

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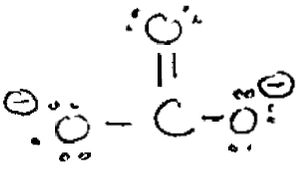
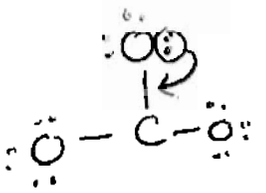
Educational Goal –
Career Goal –

1. Please draw the Lewis structure for the polyatomic ion CO_3^{2-}. Please show all formal charges.





C: 1×4 = 4
O: 3×6 = 18
+2
24e⊖
−6
18e⊖

Formal charge: Group # − # bonds − e⊖ in lone prs

C: 4 − 4 − 0 = 0

O(bp): 6 − 2 − 4 = 0

O(left) = O(right) = 6 − 1 − 6 = (−1)

What is the electron pair geometry about the central C? trigonal planar

What are the bond angles about the central C? 120°

What is the hybridization of the central carbon? sp^2

2. Acetic acid is a weak acid.

a. Complete the following reaction:

$CH_3CO_2H + H_2O \rightarrow$ $H_3O^{\oplus}$ + $CH_3CO_2^{\ominus}$

b. The Ka for acetic acid is 1.8×10^{-5}. What is the concentration of H_3O^+ in 1 M acetic acid?

let $x = [H_3O^{\oplus}] = [CH_3CO_2^{\ominus}]$

$$1.8\times10^{-5} = \frac{[H_3O^{\oplus}]\,[CH_3CO_2^{\ominus}]}{[CH_3CO_2H]} = \frac{x \cdot x}{(1-x)}$$

assume a weak acid: $1 - x \simeq 1$

$$1.8\times10^{-5} = \frac{x^2}{1}$$

$$\sqrt{1.8\times10^{-5}} = x = [H_3O^{\oplus}]$$

$$[H_3O^{\oplus}] = 4.2\times10^{-3}\,M$$

$(pH = -\log [H_3O^{\oplus}] = 2.37)$

3. How many grams of water are produced in the combustion of 1.00 g of glucose and 3.00 g of O_2?

$$C_6H_{12}O_6 + 6\,O_2 \rightarrow 6\,CO_2 + 6\,H_2O$$

$C_6H_{12}O_6 + 6\,O_2 \longrightarrow 6\,CO_2 + 6\,H_2O$

1.00g glucose

3.00g O_2, which is limiting reagent

$$1.00\text{g glucose} \times \frac{\text{mole}}{180.9} \times \frac{6\,H_2O}{\text{glucose}} \times \frac{18.0\text{g}}{\text{mole}} = .600\text{g } H_2O$$

limiting reagent determines amount of product produced.

$$3.00\text{g } O_2 \times \frac{\text{mole}}{32.0\text{g}} \times \frac{6\,H_2O}{6\,O_2} \times \frac{18.0\text{g}}{\text{mole}} = 1.69\text{g } H_2O$$