Question#6042

How would you make a 50.0 mM MOPS buffer (pKa=7.15) at pH=7.00 using MOPS acid (324.4 g/mol) and MOPS base (346.3 g/mol)? Provide a recipe, indicating the following:
Grams of MOPS base:
Grams of MOPS acid:
Total volume:

Solution:

$$\mathrm{ph} = \mathrm{pK_A} - \lg\frac{[\mathrm{acid}]}{[\mathrm{salt}]}$$

$$7 = 7{,}15 - \lg\frac{[\mathrm{MOPS_A}]}{[\mathrm{MOPS_B}]}$$

$$\lg\frac{[\mathrm{MOPS_A}]}{[\mathrm{MOPS_B}]} = 0{,}15$$

$$\frac{[\mathrm{MOPS_A}]}{[\mathrm{MOPS_B}]} = 1{,}413$$

$$[\mathrm{MOPS_A}] = 1{,}413 \times [\mathrm{MOPS_B}]$$

$$\vartheta = [\mathrm{MOPS}] \times \mathrm{V}$$

For 1L of 50.0 mM solution: $\vartheta(\mathrm{MOPS}) = [\mathrm{MOPS}], \text{because } (\mathrm{V} = 1)$

$$\vartheta = \frac{\mathrm{m}}{\mathrm{M_r}}$$

$$\vartheta(\mathrm{MOPS_A}) + \vartheta(\mathrm{MOPS_B}) = 0{,}05$$

$$\vartheta(\mathrm{MOPS_A}) = 1{,}413 \times \vartheta(\mathrm{MOPS_B})$$

$$1{,}413 \times \vartheta(\mathrm{MOPS_B}) + \vartheta(\mathrm{MOPS_B}) = 0{,}05$$

$$\vartheta(\mathrm{MOPS_B}) = \frac{0{,}05}{2{,}413} \approx 0{,}021 \text{ mol}$$

$$\mathrm{m}(\mathrm{MOPS_B}) = \vartheta \times \mathrm{M_r} = 0{,}021 \times 346{,}3 = 7{,}27 \text{ g}$$

$$\vartheta(\mathrm{MOPS_A}) = 1{,}413 \times \vartheta(\mathrm{MOPS_B}) = 1{,}413 \times 0{,}021 \approx 0{,}030 \text{ mol}$$

$$\mathrm{m}(\mathrm{MOPS_A}) = \vartheta \times \mathrm{M_r} = 0{,}030 \times 324{,}4 = 9{,}73 \text{ g}$$

Answer:

Grams of MOPS base: 7.27
Grams of MOPS acid: 9.73
Total volume: 1L