(26) $100\,mL \left| \frac{L}{1000\,mL} \right| \frac{0.200\,mol}{L} \left| \frac{60.05\,g}{1\,mol} \right| \frac{mL}{1.049\,g} \Big| = 1.14\,mL$ acetic acid

$5.00 = 4.756 + \log \frac{[base]}{[acid]}$; $[acid] + [base] = 0.200\,M$

$\frac{[base]}{[acid]} = 1.754$

$[acid] = \frac{[base]}{1.754}$

$\frac{[base]}{1.754} + [base] = 0.200$

$\frac{1}{1.754} + 1 = \frac{0.200}{[base]}$

$[base] = 0.127\,M$

$[acid] = 0.0726\,M$

$0.100\,L \left| \frac{0.127\,mol\ base}{1\,L} \right| \frac{1\,mol\ NaOH}{1\,mol} \left| \frac{1000\,mL}{3\,mol} \right| = 4.2\,mL$ of NaOH

- Add 1.14 mL of liquid acetic acid to ~90 mL H_2O
- Add 3M. NaOH until pH reaches 5.00 as measured by a pH meter (should use ~ 4 mL of NaOH)
- Transfer solution to a 100 mL volumetric flask
- Dilute to the mark

(27) The pH of a buffer depends on the ratio of weak base to weak acid. If a buffer solution is diluted, the ratio remains the same.

(28) Buffer capacity is a measure of how much acid or base can be added to a buffer solution without having a large effect on the solution's pH. As the concentration of weak acid and cojugate base in a buffer increase, it takes a larger amount of added acid or base to change the ratio $\frac{[base]}{[acid]}$

(29) Very acidic and very basic solutions contain a ~~large~~ high concentration of protons or hydroxide already. Additional protons or hydroxide will not make much of a contribution to the solution's pH.

(31) When using the Henderson-Hasselbalch equation, we assume that the weak acid does not dissociate, and that the weak base does not hydrolyze. This is usually a good assumption until the ratio $\frac{[base]}{[acid]}$ either becomes very large or small.

(32) 4-aminobenzenesulfonic acid is the most suitable because its pka is closest to the desired pH.

(34)

$$pH = 3.744 + \log \frac{[HCO_2^-]}{[H_2CO_2]}$$

a. $3.000 = 3.744 + \log \frac{[A^-]}{[HA]} \Rightarrow \frac{[A^-]}{[HA]} = \boxed{0.180}$

b. $3.744 = 3.744 + \log \frac{[A^-]}{[HA]} \Rightarrow \frac{[A^-]}{[HA]} = \boxed{1.00}$

c. $4.000 = 3.744 + \log \frac{[A^-]}{[HA]} \Rightarrow \frac{[A^-]}{[HA]} = \boxed{1.80}$

36 a. $2.00 = 3.15$ ~~10.85~~ $+ \log \frac{[NO_2^-]}{[HNO_2]} = \frac{[HNO_2]}{[NO_2^-]} = \boxed{14.1}$

b. $10.00 = 3.15 + \log \frac{[NO_2^-]}{[HNO_2]} = \boxed{1.41 \times 10^{-7}}$

$4.19 = 4.34 + \log \frac{[A^-]}{[HA]} \therefore \frac{[A^-]}{[HA]} = 0.708$ and $[A^-] + [HA] = 0.00666M$

38 $A^- + H^+ \rightarrow HA$

$$\frac{0.00666 - [HA]}{[HA]} = 0.708$$

$$[HA] = 3.90 \times 10^{-3} M$$

$$\frac{3.90 \times 10^{-3}\ mol\ HA}{L} \Big| \frac{0.213\ L}{} \Big| \frac{1\ mol\ HNO_3}{1\ mol\ HA} \Big| \frac{1000\ mL\ HNO_3}{0.246\ mol\ HNO_3} = \boxed{3.38\ mL}$$

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$$HA + OH^- \rightarrow A^- + H_2O$$

$$7.40 = 7.48 + \log \frac{[A^-]}{[HA]}$$

$$5.00\,g \left| \frac{mol}{223.29\,g} \right| = 0.0224\,mol$$

$$\frac{[A^-]}{[HA]} = 0.832 = \frac{mol\ A^-}{mol\ HA}$$

$$mol\ A^- + mol\ HA = 0.0224\,mol$$

$$mol\ HA = 0.0224\,mol - mol\ A^-$$

$$0.832 = \frac{mol\ A^-}{0.0224\,mol - mol\ A^-}$$

$$mol\ A^- = 0.0102\,mol\ A^- \left| \frac{1\,mol\ KOH}{1\,mol\ A^-} \right| \frac{1000\,mL}{0.626\,mol\ KOH} \right| = \boxed{16.3\,mL}$$