Lecture Notes R: Acid-Base Chemistry V

Concept
I make a buffer by mixing 10ml of 1M HAc with 10ml of 1M NaAc. About how much acid (1M HCl) would I need to add to break this buffer (with break meaning cause the pH to drop by more than 1 unit).

a) 5ml   b) 6ml   c) 7ml   d) 8ml  
e) 9ml  f) 10ml  g) 11ml  h) 12ml

Which weak acid should I use to make a buffer solution with pH=3.1?

a) A weak acid with pKa = 2  
b) A weak acid with pKa = 3  
c) A weak acid with pKa = 4  
d) A weak acid with pKa = 5

Suppose I want to make a buffer with a pH=3.5, and I would like it to be more resistant to addition of acid than to addition of base, which weak acid should I use?

a) A weak acid with pKa = 2  
b) A weak acid with pKa = 3  
c) A weak acid with pKa = 4  
d) A weak acid with pKa = 5
Which of the following systems is obviously not at equilibrium (for weak acids with pK_a of between 3 and 11):

a) \[
\begin{align*}
[HA] &= 1.2 \\
[A^-] &= 0.3 \\
[H^+] &= 1.2 \times 10^{-4} \\
[OH^-] &= 8.3 \times 10^{-11}
\end{align*}
\]

b) \[
\begin{align*}
[HC] &= 1.2 \\
[C^-] &= 0.0002 \\
[H^+] &= 7.1 \times 10^{-14} \\
[OH^-] &= 0.14
\end{align*}
\]

c) \[
\begin{align*}
[HD] &= 1.2 \\
[D^-] &= 0.0002 \\
[H^+] &= 0.14 \\
[OH^-] &= 7.1 \times 10^{-14}
\end{align*}
\]

d) \[
\begin{align*}
[HE] &= 1.2 \\
[E^-] &= 0.3 \\
[H^+] &= 8.3 \times 10^{-11} \\
[OH^-] &= 1.2 \times 10^{-4}
\end{align*}
\]

Consider two acids HB (pK_a = 4.5) and HC (pK_a = 5.4). I make a solution by mixing together equal amounts of 1M HB and 1M NaB. I then add a drop of HC. The ratio [C^-]/[HC] is closest to:

a) 1/100     b) 1/10     c) 1     d) 10     e) 100

If I want to increase the ratio [C^-]/[HC], which should I add to the above solution:

a) HB     b) NaB