- Calculate the pH of a 0.020 M solution of lactic acid, $HC_3H_5O_3$, at 25 °C. The pK_a of lactic acid is 3.86. **5**

As lactic acid is a weak acid, $[H_3O^+]$ must be calculated using a reaction table:

	$HC_3H_5O_3$	H_2O	⇌	H_3O^+	$C_3H_5O_3^-$
initial	**0.020**	**large**		**0**	**0**
change	**$-x$**	**negligible**		**$+x$**	**$+x$**
final	**$0.020 - x$**	**large**		**x**	**x**

The equilibrium constant K_a is given by:

$$K_a = \frac{[H_3O^+][C_3H_5O_3^-]}{[HC_3H_5O_3]} = \frac{x^2}{0.020 - x}$$

As $pK_a = -\log_{10}K_a$, $K_a = 10^{-3.86}$ and is very small, $0.010 - x \sim 0.010$ and hence:

$x^2 = 0.020 \times 10^{-3.86}$ or $x = 1.7 \times 10^{-3}$ M $= [H_3O^+]$

Hence, the pH is given by:

$pH = -\log_{10}[H_3O^+] = -\log_{10}(1.7 \times 10^{-3}) = 2.78$

pH = **2.78**

A 1.0 L solution of 0.020 M lactic acid is added to 1.0 L of 0.020 M sodium hydroxide solution. Write the ionic equation for the reaction that occurs.

$HC_3H_5O_3(aq) + OH^-(aq) \rightarrow C_3H_5O_3^-(aq) + H_2O(l)$

Is the resulting solution acidic, basic or neutral? Give a reason for your answer.

All of the lactic acid will have reacted as the number of moles of sodium hydroxide added equals the number of moles of lactic acid originally present.

The solution contains lactate ions, $C_3H_5O_3^-(aq)$, which is the conjugate base. The solution contains a weak base so is basic.