Valentine Balloons – Teacher Notes

Most of my students tried to use some sort of displacement for the volume. Beakers of 600-1000 mL size would probably be best. Some students wanted string and rulers to measure, approximating a triangle.

Equation: $NaHCO_{3\,(s)} + H_3C_6H_5O_{7\,(aq)} \rightarrow NaH_2C_6H_5O_{7\,(aq)} + H_20_{\,(l)} + CO_{2\,(g)}$

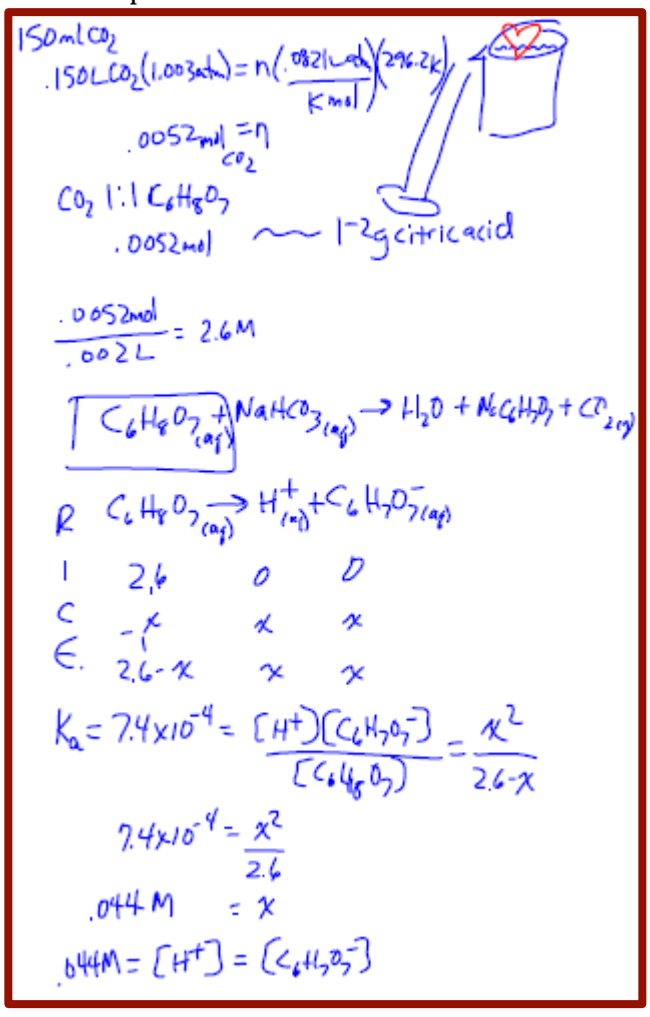
You may choose to ask for a net ionic equation as well, which would have the products $Na^{+}_{\,(aq)} + H_2C_6H_5O_7{}^{-}_{\,(aq)} + H_2O_{\,(l)} + CO_{2\,(g)}$

Moles of citric acid reacted: PV=nRT for the moles of CO_2 then a mole ratio to calculate the citric acid moles.

Concentration = Moles/L – this is where we needed the volume of the solution! After we had molarity, we used a RICE chart to solve for the concentration of the H^{+}.

pH = -log $[H^{+}]$ – we came out with pH of about 1.36 and the measured pH was within 10%.

See example calculations from an actual class below:



ΔG is – as the reaction proceeds on its own, once "whacked." No additional energy is necessary to keep it going.

The entropy is likely the reason that the reaction is spontaneous. Observations show that the temperature of the system decreased, meaning that the reaction is endothermic (i.e. enthalpy is positive) and we are increasing the entropy by quite a bit because of the formation of a gas.