Sample Text Passage Derived From Henderson-Hasselbalch Concept Map

The Henderson-Hasselbalch equation shows the relationship between pH and the concentrations of HA and A^-. The equation as represented below has three main components: 1) pH which is variable, 2) pK which is a constant, and 3) the log of the ratio of the concentrations of the conjugate pair, $[A^-]$ and [HA], which are variable.

$$pH = pK + \log [A^-]/[HA]$$

The pH and the ratio of the conjugate pair are variable because the conjugate pair represents and equilibrium: $HA \leftrightarrow H^+ + A^-$. The law of mass action dictates that if protons are added to the system, the equilibrium shifts to the left, increasing HA, and if protons are neutralized (removed) the equilibrium shifts to the right, increasing A^-. If an increased proton concentration (acidity) causes an excess of HA over A^-, then the value of the ratio of the conjugate pair becomes less than 1.0 and the log will have a negative value (you may need to review the basics of logarithms as exponents of 10). This reduces the pH to a value less than the pK. Likewise, if the proton concentration is neutralized and A^- is in excess over HA, then the value of the ratio is greater than 1.0 and the log is positive. Solving the Henderson-Hasselbalch equation would produce a value for the pH that would be greater than the pK (i.e. pK plus some positive number). When the amount of HA is exactly equal to A^-, then the ratio is exactly 1.0 and the log of 1.0 is zero. Thus, the pH would equal the pK under these conditions.

Acid base problems are solved by plugging values into the Henderson-Hasselbalch equation and solving algebraically. These problems always give