Answer on Question #54992 – Chemistry – General Chemistry

Question:
Assuming the volume of the stomach to be 1.0L, what will be the pH change of the stomach acid resulting from the ingestion of one Tums ultra 1000 tablet that contains 1000mg of calcium carbonate.

Solution:
It is known that the main acidic component of gastric acid is hydrochloric acid and pH of the solution is about 1.5.
pH = -lg[H^+]
[H^+] = 10-pH = 10-1.5 = 0.032 M
If we add some calcium carbonate the following reaction will take place:
$CaCO_3$ + 2HCl = $CaCl_2$ + H_2O + CO_2
As we can see one mole of carbonate can neutralize two moles of acid.
n($CaCO_3$) = m($CaCO_3$)/MW($CaCO_3$) = 1.000 g/100.0869 g/mole = 0.009991 moles
One liter of solution with pH = 1.5 contains about 0.032 moles of hydrochloric acid, so after the addition of carbonate its quantity will decrease to 0.032 – 2 × 0.009991 = 0.012 moles that corresponds to following pH
pH = -lg0.012 = 1.92
Answer:
If starting pH was 1.5 it will decrease to 1.92