

Writing Excellence answers to **Reaction Rates of Acids** questions**Reaction Rates of Acids QUESTION**

Question: The pH values of 0.100 mol L^{-1} solutions of two acids, HA and HB, are given in the table below.

(i) Compare the relative strengths of the two acids, $\text{HA}_{(aq)}$ and $\text{HB}_{(aq)}$, using the information given above.

Your answer should include equations and calculations.

(ii) Predict and compare, with reasons, what would be observed when two 5 g samples of calcium carbonate chips, $\text{CaCO}_{3(s)}$, are reacted, separately, with excess HA and HB.

Solution	pH
$0.100 \text{ mol L}^{-1} \text{ HA}_{(aq)}$	1.0
$0.100 \text{ mol L}^{-1} \text{ HB}_{(aq)}$	2.2

ANSWER

1. Write an equation for <u>HA</u> [Remembering H_3O^+ must be produced]	$\text{HA} + \text{H}_2\text{O} \rightarrow \text{A}^- + \text{H}_3\text{O}^+$
2. Calculate H_3O^+ for <u>HA</u> [$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$]	$\text{pH} = 1.0$ $[\text{H}_3\text{O}^+] = 0.100 \text{ mol L}^{-1}$
3. For HA link concentration of ions formed to level of dissociation AND compare to concentration of acid (are they the same?)	HA is a strong acid since it fully dissociates, as shown by concentration of hydronium ions in HA solution – same as original concentration of HA (both 0.100 mol L^{-1}).
4. Write an equation for <u>HB</u> [Remembering H_3O^+ must be produced]	$\text{HB} + \text{H}_2\text{O} \rightleftharpoons \text{B}^- + \text{H}_3\text{O}^+$
5. Calculate H_3O^+ for <u>HB</u> [$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$]	$\text{pH} = 2.2$ $[\text{H}_3\text{O}^+] = 0.00631 \text{ mol L}^{-1}$
6. For HB link concentration of ions formed to level of dissociation AND compare to concentration of acid (are they the same?)	HB is a weak acid since it only partially dissociates; as shown by the concentration of hydronium ions in HB solution – concentration is only $0.00631 \text{ mol L}^{-1}$.
7. For HA link observation of reaction to concentration of ions	Expect reaction to be more vigorous; rapidly produces gas / bubbles (CO_2) – since the concentration of hydrogen ions is high,
8. then For HA link collision frequency to rate of reaction	there will be more frequent collisions resulting in a faster rate of reaction.
9. For HB link observation of reaction to concentration of ions	Expect a slower reaction, taking longer to produce the same volume of gas – since the concentration of hydrogen ions is low,
10. then For HB link collision frequency to rate of reaction	there will be less frequent collisions resulting in a slower rate of reaction.

NOTE: The white column is how your answer would appear on your test paper so make sure you **write out complete sentences**. The grey area is just to help you structure your answer and would not appear in the question.