

Writing Excellence answers to Ions and Conductivity questions

Ions and Conductivity QUESTION

Question: Some properties of three aqueous solutions A, B and C, of equal concentration are shown in the table below. It is known that the solutions are $\text{NH}_3(\text{aq})$, $\text{HCl}(\text{aq})$ and $\text{NH}_4\text{Cl}(\text{aq})$

Justify the identification of all three solutions.

- refer to both pH and electrical conductivity of the solutions
- link your answers to appropriate chemical equations.

Solution	A	B	C
pH	5.15	11.6	1.05
Electrical conductivity	good	poor	good

ANSWER

1. Identify each solution as either A, B or C by linking to being a **weak or strong acid or base** and also to the **pH**

Solution A with a pH of 5.15 is a weak acid (salt) and is $\text{NH}_4\text{Cl}(\text{aq})$
 Solution B with a pH of 11.6 is a weak base and is $\text{NH}_3(\text{aq})$
 Solution C with a pH of 1.05 is a strong acid and is $\text{HCl}(\text{aq})$

2. State requirements for conductivity

In order to conduct electricity there needs to be the presence of **free moving charged particles**. The more charged particles there are available the better conductivity there will be. Ions in solution provide the charged particle.

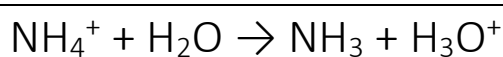
3. **Solution A** (pH 5.15) weak acid salt. Equation 1. [A salt will first dissociate fully into ions]



Write equation **AND** link ions formed to conductivity and level of dissociation

$\text{NH}_4\text{Cl}(\text{aq})$ is solution **A**: good conductor of electricity – it fully dissociates in solution into ammonium and chloride ions, which conduct electricity.

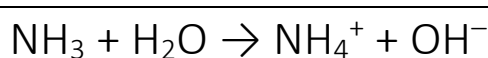
4. **Solution A** (pH 5.15) weak acid salt. Equation 2. [One of the products of dissociation will further react as an acid]



Write equation **AND** link ions formed to conductivity and level of dissociation (must form H_3O^+ ions)

Its pH (5.15) is that of a weak acid, as the ammonium ion is a weak acid and partially dissociates in water, producing hydronium ions.

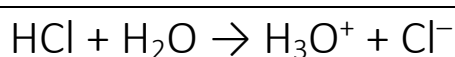
5. **Solution B** (pH 11.6) weak base.



Write equation **AND** link ions formed to conductivity and level of dissociation (must form OH^- ions)

$\text{NH}_3(\text{aq})$ is solution **B**: its pH (11.6) is that of a weak base as NH_3 so it **partially dissociates** in water, producing hydroxide ions.
 It is a poor conductor of electricity as it is only partially dissociated into ions in water. The remaining NH_3 molecules are neutral and do not conduct electricity.

6. **Solution C** (pH 1.05) strong acid.



Write equation **AND** link ions formed to conductivity and level of dissociation (must form H_3O^+ ions)

$\text{HCl}(\text{aq})$ is solution **C**: low pH (1.05) is that of a strong acid, HCl fully dissociates in water, producing hydronium ions.
 It is a good conductor of electricity as it fully dissociates into ions in solution which conduct electricity.

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.