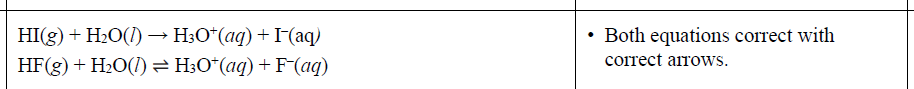
ANSWERS: **Conjugate acid/base pairs**

**2022**



**2021**



**2020**

A white background with black lines

Description automatically generated

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2019** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (i)  (ii) | HNO3(*aq*) + H2O(l) 🡪 H3O+(*aq*) + NO3–(*aq*)  CH3COOH(*aq*) + H2O(l) " H3O+(*aq*) + CH3COO–(*aq*)  When these substances dissociate / ionise in water, they produce  hydronium ions / donate protons.  OR  When hydronium ions are in greater concentration than hydroxide  ions (OH–), the pH will be below 7 and therefore acidic. | Writes equation for ONE substance in water (arrows must be correct). | Links ONE equation to  explanation of substance being acidic. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2018** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
|  |  | Products in one reaction correct. |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2017** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (a) (i)  (ii) | C2H5COO–(*aq*), H3O+(*aq*)  Propanoic acid transfers a proton / H+ to the water so it is the acid and it forms a conjugate base, C2H5COO–. The water, H2O, accepts the proton and therefore acts as a base, forming H3O+, hydronium ion, which is the conjugate acid. | • Products correct with charges.  • Identifies TWO of acid, base, conjugate acid, conjugate base. | Explains proton transfer and gives  BOTH correct conjugate acid-base  pairs. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| (b) | EQUATION ONE: CH3COONa(*s*) → Na+(*aq*) + CH3COO–(*aq*)  The salt dissociates / dissolves into ions in water.  The ethanoate ions then react with water to form CH3COOH(*aq*) and OH–(*aq*).  EQUATION TWO: CH3COO–(*aq*) + H2O(ℓ) ⇌ CH3COOH(*aq*) + OH–(*aq*)  The OH– ions produced make this a basic solution. | Identifies CH3COONa as basic with a correct dissociation equation (ONE or TWO)  OR  Identifies CH3COONa as a basic solution since OH– produced /accepts a proton / cannot donate a proton. | CH3COONa / CH3COO– to its ability to produce  OH– ions in solution  / accept a proton,  including equation TWO. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2016** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (a)  (b)  (c) | H2O(l) + NH3(*aq*)⇌ OH–(*aq*) + NH4+(*aq*)  H2O(l) + NH4+(*aq*)⇌ H3O+(*aq*) + NH3 (*aq*)  When sodium carbonate dissolves in water, it dissociates into ions.  EQUATION ONE: Na2CO3(*s*) → 2Na+(*aq*) + CO32–(*aq*)  The carbonate ions then react in water.  EQUATION TWO: CO32–(*aq*) + H2O(l) ⇌ HCO3–(*aq*) + OH–(*aq*)  The OH– ions produced make this a basic (alkaline) solution.  The value of *K*w at 1 × 10–14 is very small, which means that very little water has ionised / dissociated because there is very little product (i.e. very few ions). | • Products in one reaction correct.   * Writes a correct dissociation equation (ONE or TWO).   OR  Identifies Na2CO3 as a basic solution since OH- produced / accepts a proton / cannot donate a proton.  • Identifies there is little dissociation in water. | Links basic nature of CO32– to its ability to produce OH– ions in solution, with equation TWO correct.  (*States not required.*)  Links magnitude of *K*w value to the degree of ionisation / dissociation and amount of product / reactant. |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2015** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (a) (i)  (ii)  (b) | Ammonia is basic, NH3 + H2O ⇌ NH4+ + OH–.  When ammonia (partially) ionises in water, it produces hydroxide ions. (When hydroxide ions are in greater concentration than H3O+, the pH will be above 7 and therefore basic.)  Ammonia is a weak base, and so doesn’t ionise fully. This means that there are still many ammonia molecules in the reaction mixture with just some ammonium and hydroxide ions. Because all 3 species are present, the labels of ammonia or ammonium hydroxide are equally valid.  HCO3– + H2O ⇌ CO32– + H3O+  HCO3– + H2O ⇌ H2CO3 + OH– | Writes equation for ammonia in  water  Identifies NH3 as a base  Completes one equation. | Links equation to explanation of ammonia being alkaline*.*  Explains that all species are present in the equilibrium mixture. | Links ammonia as a **weak base** to ionisation(or dissociation / reaction**)**  AND  the presence of each reactant and product species in the equilibrium mixture. |

© <https://www.chemical-minds.com>

NCEA questions and answers reproduced with permission from NZQA