ANSWERS: **Conjugate acid/base pairs**

**2022**



**2021**



**2020**



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| **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 producehydronium ions / donate protons.ORWhen hydronium ions are in greater concentration than hydroxideions (OH–), the pH will be below 7 and therefore acidic. | Writes equation for ONE substance in water (arrows must be correct). | Links ONE equation toexplanation of substance being acidic. |  |

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

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| **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 givesBOTH correct conjugate acid-basepairs. |  |

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| (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)ORIdentifies CH3COONa as a basic solution since OH– produced /accepts a proton / cannot donate a proton. | CH3COONa / CH3COO– to its ability to produceOH– ions in solution/ accept a proton,including equation TWO. |  |

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| **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) \rightarrow $(*s*) → 2Na+(*aq*)$(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).

ORIdentifies 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. |  |

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| **2015** | **Evidence** | **Achievement** | **Merit** | **Excellence** |
| (a) (i)(ii)(b) | Ammonia is basic, NH3 + H2O ⇌ NH4+$H\_{4}^{+}$ + 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 inwaterIdentifies NH3 as a baseCompletes 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. |

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