Acid Unit: Reactions

1. The Haber process uses hydrogen and nitrogen to produce ammonia for use as a feedstock for other processes or as a fertilizer. In industry, the goal of manufacturing is to obtain the highest yield of product for the lowest cost.

The equation for the equilibrium reaction is

|  |  |
| --- | --- |
| a | N2(g) + 3H2(g) + 91.8 kJ 🡨 🡪 2NH3(g)  |
| b | 2NH3(g) + 45.9 kJ 🡨 🡪 N2(g) + 3H2(g)  |
| c | N2(g) + 3H2(g) 🡨 🡪 2NH3(g) + 91.8 kJ  |
| d | 2NH3(g) 🡨 🡪 N2(g) + 3H2(g) + 45.9 kJ |

1. Cam and Brent make some observations about equilibrium reactions between acids and bases. Each box indicates if the reaction favours **Products** or favours R**eactants**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | HX(aq) | HY(aq) | HM(aq) | HR(aq) |
| X-(aq) | -------- | **Products** | R**eactants** | **Products** |
| Y-(aq) | R**eactants** | --------- | R**eactants** | **Products** |
| M-(aq) | **Products** | **Products** | -------- | **Products** |
| R-(aq) | R**eactants** | R**eactants** | R**eactants** | -------- |

The boys are asked to rank the acids from the strongest to the weakest acid.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a | HX(aq) | HM(aq) | HR(aq) | HY(aq) |
| b | HM(aq) | HX(aq) | HY(aq) | HR(aq) |
| c | HY(aq) | HR(aq) | HX(aq) | HM(aq) |
| d | HR(aq) | HY(aq) | HX(aq) | HM(aq) |

1. Cam and Brent make some observations about equilibrium reactions between acids and bases. Each box indicates if the reaction favours **Products** or favours R**eactants**.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | HX(aq) | HY(aq) | HM(aq) | HR(aq) |
| X-(aq) | -------- | **Products** | R**eactants** | **Products** |
| Y-(aq) | R**eactants** | --------- | R**eactants** | **Products** |
| M-(aq) | **Products** | **Products** | -------- | **Products** |
| R-(aq) | R**eactants** | R**eactants** | R**eactants** | -------- |

The boys are asked to rank the BASES from the strongest to the weakest base.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a | Y-(aq) | R-(aq) | M-(aq) | X-(aq) |
| b | M-(aq) | X-(aq) | Y-(aq) | R-(aq) |
| c | X-(aq) | M-(aq) | R-(aq) | Y-(aq) |
| d | R-(aq) | Y-(aq) | X-(aq) | M-(aq) |

1. Amy and Carlynn are given four reactions involving acids and bases. A dark arrow facing left (**🡨**  -->) means the reaction favours the reactants. A dark arrow facing right ( <-- **🡪)** means the reaction favours products.

|  |  |  |
| --- | --- | --- |
| Reactants | Arrows | Products |
| HL(aq) + M-(aq) | < -- **🡪** | L-(aq) + HM(aq) |
| HR(aq) + M-(aq) | <-- **🡪** | HM(aq) + R-(aq) |
| HM(aq) + N-(aq) | <-- **🡪** | HN(aq) + M-(aq) |
| HN(aq) + L-(aq) | **🡨**  --> | HL(aq) + N-(aq) |

Based on this information, the girls determine the correct list of acids from strongest to weakest as:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a | HN(aq) | HM(aq) | HR(aq) | HL(aq) |
| b | HL(aq) | HR(aq) | HM(aq) | HN(aq) |
| c | HM(aq) | HN(aq) | HL(aq) | HR(aq) |
| d | HL(aq) | HR(aq) | HN(aq) | HM(aq) |

1. Annette and Marilyn are given four reactions involving acids and bases. A dark arrow facing left (**🡨**  -->) means the reaction favours the reactants. A dark arrow facing right ( <-- **🡪)** means the reaction favours products.

|  |  |  |
| --- | --- | --- |
| Reactants | Arrows | Products |
| HL(aq) + M-(aq) | <-**- 🡪** | L-(aq) + HM(aq) |
| HR(aq) + M-(aq) | <-- **🡪** | HM(aq) + R-(aq) |
| HM(aq) + N-(aq) | <-- **🡪** | HN(aq) + M-(aq) |
| HN(aq) + L-(aq) | **🡨**  --> | HL(aq) + N-(aq) |

Based on this information, the girls determine the correct list of BASES from strongest to weakest as:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| a | M-(aq) | N-(aq) | R-(aq) | L-(aq) |
| b | R-(aq) | L-(aq) | N-(aq) | M-(aq) |
| c | L-(aq) | R-(aq) | M-(aq) | N-(aq) |
| d | N-(aq) | M-(aq) | R-(aq) | L-(aq) |

1. John and Kent are given four reactions involving acids and bases. A dark arrow facing left (**🡨**  -->) means the reaction favours the reactants. A dark arrow facing right ( <-- **🡪)** means the reaction favours products.

|  |  |  |
| --- | --- | --- |
| Reactants | Arrows | Products |
| HL(aq) + M-(aq) | **🡨**  --> | L-(aq) + HM(aq) |
| HR(aq) + M-(aq) | <-- **🡪** | HM(aq) + R-(aq) |
| HM(aq) + N-(aq) | <-- **🡪** | HN(aq) + M-(aq) |
| HN(aq) + L-(aq) | **🡨**  --> | HL(aq) + N-(aq) |

The acid with the largest ka value will be:

|  |  |
| --- | --- |
| a | HL(aq) |
| b | HR(aq) |
| c | HN(aq) |
| d | HM(aq) |

1. Kian and Grant are given four reactions involving acids and bases. A dark arrow facing left (**🡨**  -->) means the reaction favours the reactants. A dark arrow facing right ( <-- **🡪)** means the reaction favours products.

|  |  |  |
| --- | --- | --- |
| Reactants | Arrows | Products |
| HL(aq) + M-(aq) | **🡨**  --> | L-(aq) + HM(aq) |
| HR(aq) + M-(aq) | <-- **🡪** | HM(aq) + R-(aq) |
| HM(aq) + N-(aq) | <-- **🡪** | HN(aq) + M-(aq) |
| HN(aq) + L-(aq) | **🡨**  --> | HL(aq) + N-(aq) |

The BASE with the largest kb value will be:

|  |  |
| --- | --- |
| a | L-(aq) |
| b | M-(aq |
| c | R-(aq) |
| d | N-(aq) |

Solutions:

1. C
2. D
3. B
4. B
5. D
6. B
7. D