Table B1: Examples of Idea Units

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| Classification | Prototypical response | Correct Student Example | Incorrect Student Example |
| Relating energy to the stability of the system at distances other than the equilibrium distance | At inter-nuclear distances shorter or greater than the equilibrium distance, potential energy increases, which corresponds to a decrease in the system’s stability | “If atoms are too far or too close then the system is disturbed and the molecule is less stable thus energy is higher.” | “Otherwise, energy will increase as they are not stable at other distances” |
| Explaining the energy minimum | There exists an inter-nuclear distance where repulsive forces and attractive forces are equivalent, and the potential energy is at its lowest | The lowest energy point of the well is the point where there is equal repulsion and attraction | The lowest energy occurs when two atoms are attracted together at the optimal r |
| Explaining the Vertical Asymptote | The vertical asymptote arises from nuclear repulsion, where at smaller internuclear distances, the force and resulting energy rise exponentially | The left part of the well rises exponentially because when the nuclei are too close there is significant electronic repulsion from the inner molecular orbitals of both atom constituting the bond | It starts with a high energy when atoms are close together. |
| Explanation of horizontal asymptote /bond breaking | As the internuclear distance increases, the attractive force diminishes the energy supplied to the bond exceeds the bond dissociation energy, resulting in the bond breaking | The flattening occurs when the distance is large since little interaction is possible between atoms, so the energy doesn’t change | If it stretches too far away from the nucleus, it flies off (like a spring breaking) |
| Statements on overall well shape | Major contributions to the well shape are the attractive and repulsive forces acting upon the two atoms. | The shape of the energy well results from the attractive and repulsive forces | the shape of each molecular orbital correlates to the distance from the nucleus => the resonance of each bond |
| Relating the energy of a system to the vibration of the bond and the amplitude of the oscillation | The greater the overall potential energy of the system, the higher the vibrational frequency of the bond. Additionally, the amplitude of bond stretching increases. | As you move up the well of any state, the energy of the vibration is greater and corresponds to a greater stretching of the bonds. | At ground state (bottom of the well), it does not have energy to stretch the bond (spring at rest). |