

Name _____

Breaking the Bond: Understanding Chemical Bond Breakage

Open-Ended Response Answer Key

1. When heating a solid block of ice, the covalent bonds between water molecules are broken. As heat energy is added, the kinetic energy of water molecules increases, causing them to vibrate and move more freely. Eventually, the covalent bonds are entirely broken, and the ice transitions from a solid to a liquid phase (melting). During this phase change, no new substances are formed, but the ice becomes liquid water.
2. Understanding bond breakage is crucial in chemistry as it allows scientists to design and synthesize new materials with specific properties. By manipulating the breaking and formation of chemical bonds, researchers can create innovative materials for various applications, such as polymers, pharmaceuticals, and nanomaterials. This knowledge also contributes to advancements in technologies like catalysts for chemical reactions and energy storage systems.
3. An example is the combustion of gasoline in car engines. Gasoline contains covalent bonds between carbon and hydrogen atoms. During combustion, these bonds are broken as gasoline reacts with oxygen from the air. The release of energy in the form of heat is harnessed to power the engine, which propels the vehicle forward. This energy is utilized for practical purposes, enabling transportation.
4. Bond breakage is essential in environmental processes like the water cycle. When water evaporates from the Earth's surface, covalent bonds between water molecules are broken as liquid water transitions into water vapor (gas). This phase change allows water to rise into the atmosphere. When the water vapor condenses back into liquid form (precipitation), new covalent bonds are formed. This cycle ensures the continuous availability of water on Earth, supporting ecosystems and sustaining life.

