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### Introduction to the 12 Principles of Green Chemistry

Background: The Twelve Principles of Green Chemistry are guidelines that chemists are increasingly using to be more environmentally friendly. As student chemists, you too will abide by the Twelve Principles. However, professional scientists often use overly-complicated language that can be difficult to interpret, and the Twelve Principles are no exception. In this activity, you will become familiar with the Twelve Principles by writing them in simpler language.

Part 1: The Untranslated Principles – Read the descriptions of the principles below.

1. **Prevention**: It is better to prevent waste than to treat or clean up waste after it is formed.
2. **Atom Economy**: Synthetic methods should be designed to maximize the incorporation of all material used in the process into the final product.
3. **Less Hazardous Chemical Syntheses**: Wherever practicable, synthetic methodologies should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. **Designing Safer Chemicals**: Chemical products should be designed to preserve efficacy of function while reducing toxicity.
5. **Safer Solvents and Auxiliaries**: The use of auxiliary substances (e.g. solvents, separation agents, etc.) should be made unnecessary whenever possible and innocuous when used.
6. **Design for Energy Efficiency**: Energy requirements should be recognized for their environmental and economic impacts and should be minimized. Synthetic methods should be conducted at ambient temperature and pressure.
7. **Use of renewable feedstocks**: A raw material feedstock should be renewable rather than depleting whenever technically and economically practical.

8. **Reduce Derivatives:** Unnecessary derivatization (blocking group protection/deprotection, temporary modification of physical/chemical processes) should be avoided whenever possible.
9. **Catalysis:** Catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. **Design for Degradation:** Chemical products should be designed so that at the end of their function they do not persist in the environment and break down into innocuous degradation products.
11. **Real-time analysis for Pollution Prevention:** Analytical methodologies need to be further developed to allow for real-time in-process monitoring and control prior to the formation of hazardous substances.
12. **Inherently Safer Chemistry for Accident Prevention:** Substances and the form of a substance used in a chemical process should be chosen so as to minimize the potential for chemical accidents, including releases, explosions, and fires.

Part 2: Principle Match-up – Use the untranslated principles above to help you match each pink card to a yellow card. Write the resulting complete sentences in the table below, along with a real-life example to help you remember each principle.

Principle	Simple Version	Example
1. <b>Prevention.</b>		
2. <b>Atom Economy.</b>		

<b>3. Less Hazardous Chemical Synthesis.</b>		
<b>4. Designing Safer Chemicals.</b>		
<b>5. Safer Solvents &amp; Auxiliaries.</b>		
<b>6. Design for Energy Efficiency.</b>		
<b>7. Use of Renewable Feedstocks.</b>		

<b>8. Reduce Derivatives.</b>		
<b>9. Catalysis.</b>		
<b>10. Design for Degradation.</b>		
<b>11. Real-time Analysis for Pollution Prevention.</b>		
<b>12. Inherently Safer Chemistry for Accident Prevention.</b>		