

## Introduction To Green Chemistry



The primary focus of green chemistry is to reduce the amount of pollution produced in chemical reactions.

Twelve principals have been identified to assist in determining how “green” a reaction is. Green reactions are those that prevent the production of waste and reduce energy requirements.

In many reactions, the desired product does not incorporate all of the reactants. The lost atoms form large amounts of waste products.

By incorporating the principles of green chemistry, desired products can be obtained more economically while generating less pollution.

## What Is Atom Economy?

Barry Trost, from Stanford University, published the concept of Atom Economy in 1991. In 1998 he received the Presidential Green Chemistry Award for developing the concept of Atom Economy.

Atom Economy is a way of showing how efficiently a reaction uses the atoms involved. Ideally, the amount of reactant atoms equals the amount of product atoms. This results in no wasted atoms.

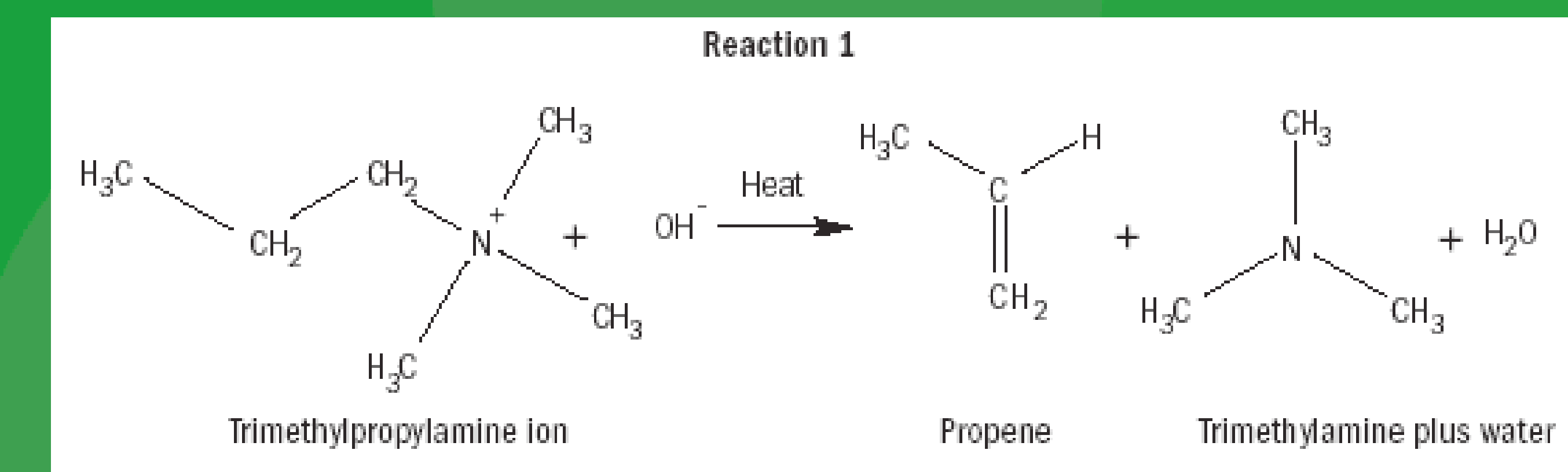
To determine the atom economy for a product, calculate the molecular weight of the desired product using the periodic table.

Divide this value by the sum of the molecular weight of all the reactants

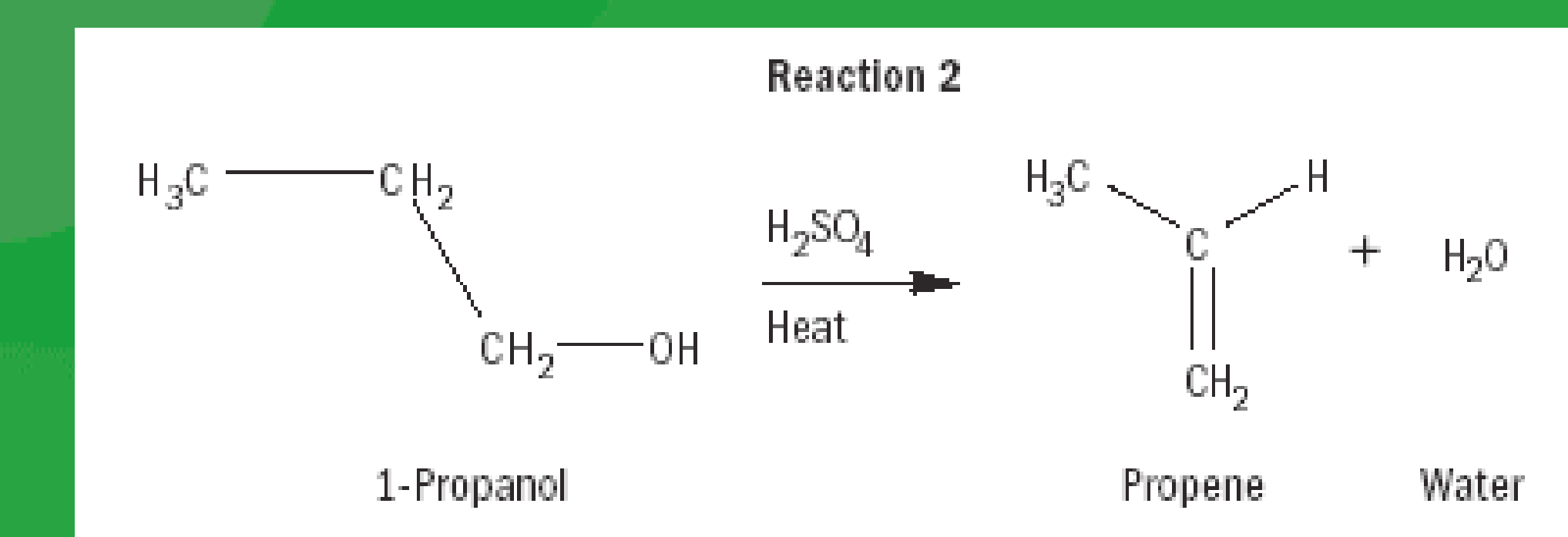
Multiply this value by 100.

## Calculating and Comparing Atom Economy

Compare these two methods for preparing propene:



$$\% \text{ Atom Economy} = \frac{42\text{g}}{119\text{g}} \times 100 = 35\% \text{ (Poor)}$$



$$\% \text{ Atom Economy} = \frac{42\text{g}}{60\text{g}} \times 100 = 70\% \text{ (Good)}$$

# ATOM ECONOMY

$$\% \text{ Atom Economy} = \frac{\text{Molecular Weight of Desired Product}}{\text{Molecular Weight of All Reactants}} \times 100$$

References: [www.greeningschools.org](http://www.greeningschools.org) [www.epa.gov/greenchemistry](http://www.epa.gov/greenchemistry) [www.greener-industry.org](http://www.greener-industry.org)

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