Launch Lab: The Model Airbag Answer Key

Answers to Procedure Questions

1. Successful groups will have used gas, solution, and stoichiometry calculations to figure out
   (a) how many moles of carbon dioxide correspond to a large enough volume to fill the bag (using $n = \dfrac{PV}{RT}$);

   (b) how many moles of baking soda and ethanoic acid are needed to react (using mole ratios); and

   (c) what mass of baking soda and what volume of acetic acid correspond to those calculated amounts (using $m = nM$ and $V = \dfrac{n}{c}$).

Answers to Analysis Questions

Successful groups will probably have used an excess of vinegar to ensure a complete reaction. Possible sources of error include errors in measurement (temperature, mass, pressure), in calculations, or in not adding excess vinegar to ensure complete reaction of the baking soda.

2. The reaction between vinegar and baking soda is not used to fill air bags because it is too slow. Air bags need to fill immediately on impact to be effective. Also, a trigger mechanism that would instantly mix the solid and liquid reactants on impact would be difficult to design. Finally, the mass of the gas produced by the reaction is small compared to the mass of the reactants (31%). By contrast, the mass of the product gas compared to the reactant for the decomposition of sodium azide (see the Chapter 8 Opener in the student textbook) is large (65%). Especially in space travel, it is important to minimize mass and waste.