The Story Behind the Game

It has been common knowledge that our dependence on foreign oil is a long term liability to our economy. Though many have lobbied for investments in alternative fuels, research and development of high-density energy sources has yielded only limited success.

Scientists in the BEST Robotics think tank have recently made breakthroughs leading to a new renewable resource. We have discovered a super-chlorophyll catalyst that, theoretically, will facilitate the production of long hydro-carbon chain molecules from plentiful CO_2 and H_2O. We aim to make combustible fuels from common resources and a catalyst derived from plant tissue.

Prior to going public with this discovery, BEST needs to prove the concept and demonstrate that the reactions can be performed efficiently in an automated environment. Resource quantities, production facilities, and chemical inventories must all be carefully controlled in this exploration phase in order to precisely predict cost and efficacy of production on the national scale.

In an effort to discover the BEST method to maximize production of isooctane, teams of students will compete in an environment with restricted resources to prove that these processes can be conducted safely and efficiently. The strength of each team's design will be measured by the accumulated inventory of reactants, intermediate products, and final product.

Since funding is limited, robots will have to comply with size and weight restrictions as well as only using approved materials to ensure low cost and innovation. The competition event will consist of three stages: the seeding competition, the semi-finals, and the finals. After each stage, the teams with the most valuable inventory will continue to the next stage of testing.

Game Objective

BEST teams have been given the task to collect and employ common molecules (CO_2 and H_2O) and essential resources (energy, catalysts) to complete a series of chemical reactions. The eventual goal is to produce isooctane, or alternatively, the lesser valued naphtha. Intermediate products (ethylene, benzene) that are generated in the process are retained in the team's inventory for later use.

The object of the game is to collect components necessary to satisfy a chemical equation that will generate a desired chemical reaction. Teams accumulate inventory by either:

- Collecting game pieces and placing them in an appropriate scoring receptacle; or
- Accumulating sufficient inventory to complete reactions to produce ethylene, benzene, naphtha, and isooctane.

Game Pieces

H_2O	Water (racquet ball)
Catalyst	Substance that accelerates a chemical reaction (tennis ball)
Energy	Essential resource for chemical reactions (full 6oz can tomato paste)
C_6H_6	Benzene is represented by a Benzene Tanker truck

These pieces are collected and then used in an equation to obtain various ‘virtual game pieces’ (**bold items below**):

[Equation 1] $2\ CO_2 + 2\ H_20 + \text{Energy} + \text{Catalyst} \rightarrow \mathbf{C_2H_4}\ \textbf{(ethylene)} + 3\ O_2$

[Equation 2] $3\ C_2H_4 + \text{Energy} + \text{Catalyst} \rightarrow \mathbf{C_6H_6}\ \textbf{(benzene)} + 3\ H_2$

[Equation 3] $C_6H_6 + 4\ H_2 + \text{Energy} + \text{Catalyst} \rightarrow \mathbf{C_6H_{14}}\ \textbf{(naphtha)}$

[Equation 4] $C_6H_6 + C_2H_4 + 4H_2 + \text{Energy} + \text{Catalyst} \rightarrow \mathbf{C_8H_{18}}\ \textbf{(isooctane)}$

Strategy will play an important part in this game. Teams must compare accumulated inventory with their overall plan. Therefore, inventory tracking becomes a method of scoring.

The field is divided into four quadrants. Robots may move about in each quadrant but have clear advantages in the “home” quadrant where they begin the match. The Processing Plant is located in the corner of the quadrant and houses all the receptacles where game pieces must be placed to be added to the team’s inventory at the end of the match.