Blood Alcohol Levels[1]

This project explores the affect of alcohol and consumption rates on blood alcohol levels.
Note: Technically this is a continuous model but we will treat it as discrete with a short time step).

The basic assumptions for this project are

- The average human body eliminates 12 grams of alcohol per hour.
- An average college age male in good shape weighing K kilograms has about $0.68K$ liters of fluid in his body. An average college age female in good shape weighing K kilograms has about $0.65K$ liters. People in poor shape have less.
- One kilogram ≈ 2.2046 pounds.
- The threshold for legal driving: If your body fluids contain more than one gram of alcohol per liter of body fluids (0.1 gm/100 ml as it is usually given) then you are too drunk to drive legally in most state.
- A blood alcohol concentration of 4.0 gm/l is likely to result in coma.
- A blood alcohol concentration of 4.5-5.0 gm/l is likely to result in death.
- Alcohol content:

Drink	Alcohol (gm)
12 oz regular beer	13.6
12 oz light beer	11.3
4 oz port wine	16.4
4 oz burgundy wine	10.9
4 oz rose wine	10.0
1.5 oz 100-proof vodka	16.7
1.5 oz 100-proof bourbon	16.7
1.5 oz 80-proof vodka	13.4
1.5 oz 80-proof bourbon	13.4

[1]Project courtesy of *A Course in Mathematical Modeling*, Douglas Mooney and Randall Swift, 1999.

1. Based on the assumptions given plus any additional assumptions you deem necessary, including a hypothetical weight and sex of your hypothetical student, and an appropriate time step, construct a basic mathematical model for the blood alcohol level of your student.

2. Assume your student arrives at a party and immediately finishes a six-pack at a pace of a beer a minute. Assuming the student had no more alcohol that night, discuss alcohol concentration per time. Once you have researched the alcohol legal limit in Colorado, discuss the amount of time necessary before your student can legally drive home.

3. Construct a more realistic manner of consuming six beers. Your approach can include a continuous intake or pauses in intake. Again discuss alcohol concentration per time and the amount of time necessary before your student can legally drive home.

4. Now be creative. Consider other alcohol consumption models. Possible ideas include a piecewise defined model to account for periods of drinking and not drinking as well as faster/slower rates of consumption. You may even expand your model to include functions which relate the rate of consumption to the alcohol concentration or to the number of people at the party.