KINGSBOROUGH COMMUNITY COLLEGE

The Science of Nutrition Laboratory
Science 70

Detection of Alcohol

I Had Only one Drink, Occifer.

Ethyl alcohol is the drug that is the most misused or "abused." There are millions of people who feel that they must have something to drink. There are others who drink to relax or to forget or to have fun. Unfortunately, many of these people do not realize how much alcohol slow their reflexes, distorts their view, and clouds their reasoning.

One especially tragic outcome of alcohol use is Fetal Alcohol Syndrome. A baby born to a mother who drinks while she is pregnant are often small, deformed, or is mentally retarded.

It is especially dangerous when drinkers attempt to drive an automobile. Alcohol is involved in about half of the fatal automotive accidents.

Today instrumentation provides the means for police to test drivers for alcohol consumptions. Before modern instrumentation, chemical reactions were used to prove intoxication. One reaction that indicates an alcohol uses the dichromate ion.

Purpose: In this experiment, we're going to fake alcohol breath and use a dichromate solution to detect the alcohol. This setup is not intended to be like a police alcohol detection system.

The reaction is:

$$3CH_3CH_2OH\,(g) + 2Cr_2O_7^{2-} + 16\,H^+ \rightarrow 3CH_3CO_2H + 4Cr^{3+} + 11H_2O$$

Yellow Orange — Green

Safety!

$K_2Cr_2O_7$ is a hazardous chemical. Sulfuric acid is caustic. Use caution when handle those chemicals. You MUST wear goggles all the time.

Procedure:

1. Place 300 mL of water in a large beaker. Add 30g of potassium dichromate ($K_2Cr_2O_7$) and 30 mL of concentrated (18M) sulfuric acid. Swirl until dissolved. Label "dichromate solution" and set aside.

2. Arrange a 500 mL Erlenmeyer flask with stopper and hose as shown in the drawing. Be sure to wash the mouthpiece well.

3. Prepare a control sample by adding 0.1 mL of ethanol to 50 mL of dichromate solution. Set the control sample aside.

4. Place 50 mL of the dichromate solution in a 150 mL Erlenmeyer flask. Place the glass end of the test hose in the dichromate solution.

5. Place 100 mL of test solution in the 500 mL flask. The glass tube from the below hose should be down in the solution. The first test solution should be 50 mL of ethyl alcohol and 50 mL of water.

6. One lab partner measures 60 seconds on a watch as the other partner blows through the mouthpiece with long, even breaths.

7. As soon as the student stops blowing begin timing. Set the flask beside the control sample. Stop timing when the test sample is the same color as the control sample.

8. Repeat steps 4 – 7 for a 40 mL alcohol, 60 mL water solution.

9. Repeat steps 4 -7 for a 30 mL alcohol 70 mL water solution.

10. Repeat steps 4 -7 for a 20 mL alcohol 80 mL water solution.

11. Repeat steps 4 -7 for a 10 mL alcohol 90 mL water solution.

12. Clean up. Pour the chromium solution in waste jar marked chromium.

Table 9.1

Blood Alcohol Concentration Tables

For Women

Body Weight in Pounds

Drinks per hour	100	120	140	160	180	200
1	0.05	0.04	0.03	0.03	0.03	0.02
2	0.09	0.08	0.07	0.06	0.05	0.05
3	0.14	0.11	0.10	0.09	0.08	0.07
4	0.18	0.15	0.13	0.11	0.10	0.09
5	0.23	0.19	0.16	0.14	0.13	0.11
6	0.27	0.23	0.19	0.17	0.15	0.14
7	0.32	0.27	0.23	0.20	0.18	0.16
8	0.36	0.30	0.26	0.23	0.20	0.18
9	0.41	0.34	0.29	0.26	0.30	0.20
10	0.45	0.38	0.32	0.28	0.25	0.23

For Men

Body Weight in Pounds

Drinks per hour	100	120	140	160	180	200
1	0.04	0.03	0.03	0.02	0.02	0.02
2	0.08	0.06	0.05	0.05	0.04	0.04
3	0.11	0.09	0.08	0.07	0.06	0.06
4	0.15	0.12	0.11	0.09	0.08	0.08
5	0.19	0.16	0.13	0.12	0.11	0.09
6	0.23	0.19	0.16	0.14	0.13	0.11
7	0.26	0.22	0.19	0.16	0.15	0.13
8	0.30	0.25	0.21	0.19	0.17	0.15
9	0.34	0.28	0.24	0.21	0.19	0.17
10	0.38	0.31	0.27	0.23	0.21	0.19

Notes: Shaded area indicates legal intoxication.
Blood alcohol concentrations are expressed as percent, meaning grams of alcohol per 10 milliliters (per deciliter) of blood. Tables are adapted from those of the Pennsylvania Liquor Control Board, Harrisburg.

DETECTION OF ALCOHOL

REPORT SHEET

I. Test Solution Time to color of control

50 alcohol 50 water	_____ seconds
40 alcohol 60 water	_____ seconds
30 alcohol 70 water	_____ seconds
20 alcohol 80 water	_____ seconds
10 alcohol 90 water	_____ seconds

II. Questions

1. What is the color of the control sample?

2. What happens to the temperature of the dichromate solution? Why?

3. Would this test be convenient for a police officer to carry with him if it were calibrated to determine percent alcohol?

4. Why was proper disposal of the dichromate and chromium solution important?

Graph the class average for a given experiment (use linear fit).