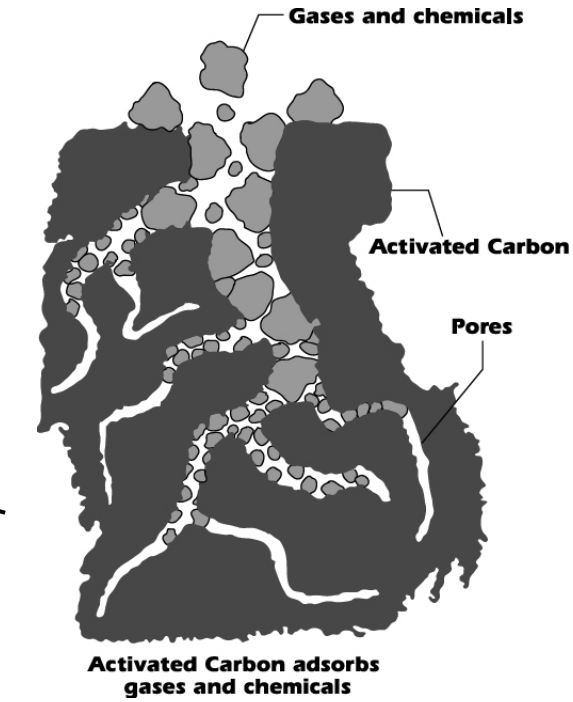
Name: _____ Date: _____ Class: _____

Water Remediation Lab Worksheet

Earlier we talked about how contaminants and pollutants enter groundwater. We also talked about how engineers design ways to clean groundwater and make it safe to drink. Running water through activated carbon, like in the picture below, adsorbs contaminants and allows clean water to pass through.



Activated carbon block and powder photo source: 2006 Ravedave, Wikimedia Commons, http://commons.wikimedia.org/wiki/File:Activated_Carbon.jpg

Activated carbon pores drawing source: Innofresh Products, Inc., http://www.capitalcarbon.in/process.html

In this lab, we are going to test to see how well Brita® household water filters which use activated carbon, remove chlorine from bleach water. Chlorine is used as a disinfectant in treating drinking water, but too much chlorine in drinking water is dangerous—it damages your nervous system and may cause cancer.

Procedure

1. Prepare the chlorine-contaminated water by adding a certain volume (refer to the table, below) of bleach to the beaker containing 1 L of tap water. Record the chlorine concentration tested at your lab station: _____

Initial Cl Concentration (ppm)	Volume of water (mL)	Volume of 1 M HCl solution (mL)
50	14.10	985.90
60	16.92	983.08
70	19.74	980.26
80	22.56	977.44
90	25.38	974.62
100	28.20	971.80
110	31.02	968.98
120	33.86	966.14
130	36.68	963.32
140	39.50	960.50
150	42.32	957.68
160	45.14	954.86
170	47.96	952.04
180	50.78	949.22
190	53.60	946.40
200	56.42	943.58

Useful information: $HCl = H^+ + Cl^-$, Cl = 35.345 g/mol , 0.1 M = 0.1 mol/L, 1 mg/L = 1 ppm

2. Once the sample chlorine-water is made, use a chlorine strip to test the starting concentration of the contaminated water. Do this by pouring a small sample of the beaker water into a paper cup. Dip the test strip in the water sample and then compare the test strip to the scale provided in the test strip vial to determine the chlorine concentration. Record the chlorine concentration in the worksheet table—this is the measurement corresponding to time 0.

   IMPORTANT: Never reuse a paper cup or test strip; always use a new paper cup and test strip for each sample.

3. Pour the chlorinated water into the opening at the top of the Brita filter lid to begin collecting it in the pitcher base. If the full liter of chlorine solution does not fit, then just add enough of the solution so that the top reservoir of the water pitcher (containing the solution to be filtered) is full. Add the rest of the solution when enough room frees up.

4. Two minutes after the chlorine-contaminated water has started passing through the filter to be collected in the pitcher base, use another chlorine strip to test the concentration of the water. Do this by pouring a small sample of the filtered solution in the base of the Brita pitcher into a paper cup and taking a chlorine measurement, just as in step 4. Record the results in the worksheet table.

5. Every two minutes, pour another small sample of filtered water into a new paper cup and use a new chlorine strip to test the concentration. Record the concentrations in the table after each sample. Take measurements for 30 minutes.
6. After data collection is complete, graph the chlorine concentration vs. time to see the adsorption pattern.
7. Once the graph is complete, pour water straight from a tap into a paper cup. Use a chlorine strip to measure the concentration of the chlorine.
   Record this measurement: _____
8. Leave the chlorinated solutions at your station for your instructor to dispose of.

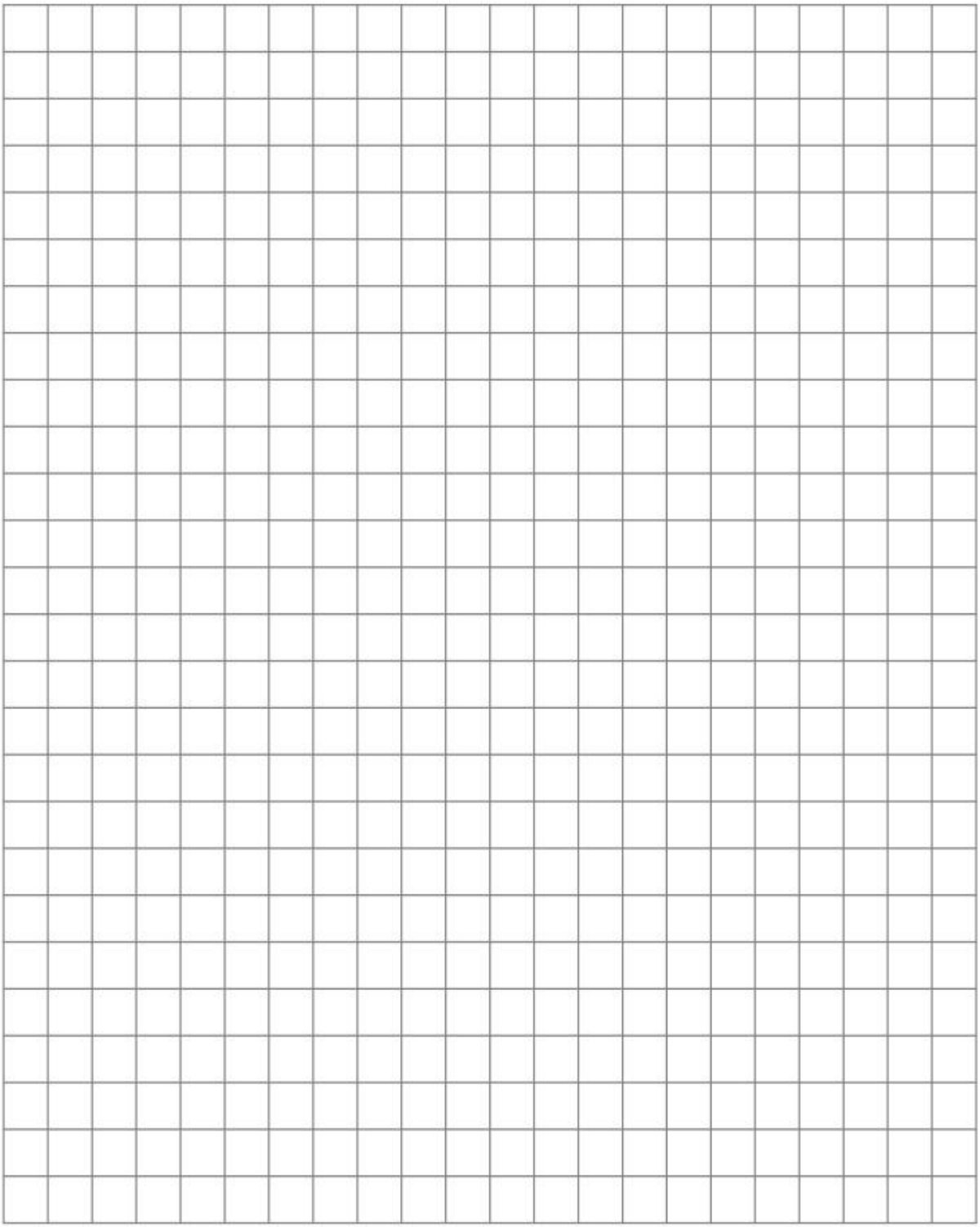
Data Collection

Time (minutes)	Chlorine Concentration (ppm)
0	
2	
4	
6	
8	
10	
12	
14	
16	
18	
20	
22	
24	
26	
28	
30	

Data Analysis

Graph your data (from the table, above) on the graph, below.

Make sure to correctly label the x- and y-axes.



Questions

1. How well did the activated carbon water filter remove the chlorine? Look at your graph for help and include data values in your answer.

2. The amount of chlorine in drinking water set forth by the Environmental Protection Agency is 4 parts per million. Was the “contaminated water” you tested safe to drink before filtration? After filtration? Is our tap water safe to drink? Explain your answers.