

Water pollutants**Introduction:**

As the community of Riverside Brookfield continues to expand, the water demands of this community grow exponentially. With Lake Michigan nearly dry, community leaders have been forced to look for water elsewhere. A newly discovered river promises to deliver a continuous source of water. This new river has been named the mighty Des Plaines River, after Gas and Go proprietor and outstanding community member Hank Des Plaines.

There does seem to be one problem with these otherwise pristine waters. A recent water sample shows a waxy, white, smelly, organic solid floating on the surface. Once filtered off there does not seem to be any residual flavor, but it raises some possible health concerns. Since not much is known about the chemical nature of this substance, there is no consensus on whether or not the filtered water is safe to drink.

A massive search of possible sources of the pollutant took place last week. It was found that the previously undiscovered natural waters of the mighty Des Plaines had, in fact, been discovered. It would seem that many other communities up and down the Des Plaines have known about this river for quite some time. The unspoiled waters of the Des Plaines, as it turns out, are not as unspoiled as previously thought. Oddly enough other communities also call the river the Des Plaines, obviously also impressed by our outstanding community member Hank Des Plaines.

These pollutants have been traced back to two possible sources. With regular frequency, Bob's Auto Supply and Urinal Cake Emporium dumps large quantities of waste water from their urinal cake manufacturing process. This waste water could contain the compound p-dichlorobenzene, which is a main ingredient in urinal cakes. Another chemical manufacturing plant, Anything Smelly Inc., has been known to release waste into the Des Plaines. Anything Smelly Inc. is a market leader in the production of mothballs. The main ingredient in these mothballs is the compound naphthalene.

Your job is to determine the identity of the pollutant compound in the river. Is it naphthalene, p-dichlorobenzene, or something else? Once the identity is known, you must determine if the chemical poses a threat to our drinking water. The compound does not seem to be very soluble in water, but you must discover if it is significantly soluble to be a risk to human health.

Topics you will need to understand:

Molarity	Colligative properties
Molality	Freezing points and boiling points
Solubility	Polar / nonpolar compounds

Things you need to research:

Freezing point depression Boiling point elevation
Solubility of naphthalene and p-dichlorobenzene
Health concerns with these two compounds

The Task:

Your task is divided into four phases. During Phase One you will be required to have a complete understanding of the topics listed. To demonstrate this understanding you will complete a series of worksheets. The final evidence of this understanding is in the form of a quiz.

Once Phase One is completed, you will begin the Research and Identity Phase. You have very limited resources at your disposal. We do not have modern methods to identify unknowns. Instead we will depend on wet labs. That is to say, labs we can do at the lab bench using chemicals and simple equipment, such as thermometers. The methods you should focus on are freezing point depression and boiling point elevation. Research these, decide one which is best, and then we can decide together on an appropriate solvent. Using a lab procedure you should be able to determine the identity of the unknown pollutant.

Once the compound has been identified, you need to research the risks to human health. Pay very close attention to the compound's solubility in water. How does the solubility affect its danger to us? Can we simply filter the solid out of the water, or might it require more sophisticated methods of separation?

Finally, structure identification can often be accomplished very quickly and accurately with modern technology. In the final phase of this process you should research the following technologies: IR (infrared) spectroscopy, NMR (nuclear magnetic resonance) spectroscopy, and GC/MS (gas chromatogram / mass spectroscopy). You will need to briefly report on the method these machines use to identify compounds.