

## 12.2 Assignment

### How does Automotive Antifreeze Work?

Automobile engines are designed to convert the potential energy in gasoline to mechanical energy to propel the vehicle. Engines also produce a large amount of heat which must be removed from the engine. Some of this heat is used to warm the inside of the car, but the rest must be dissipated. You may recall that an automobile radiator contains water that circulates to remove excess heat from the engine. Since water freezes in the northern climates in the winter, this creates a problem for a number of reasons. Water expands when it freezes, breaking the container it is in, and ice doesn't flow at all.

Ethylene glycol ( $C_2H_6O_2$ ) is used in automobile radiators to protect against freezing in the winter, since it lowers the freezing temperature of water.

1. If 100.0 grams of ethylene glycol are dissolved in 900.0 grams of water, what is the freezing temperature of the solution formed? Follow these steps: Show all of your calculations.

Calculate the molar mass of ethylene glycol:

Calculate the number of moles of ethylene glycol in the solution:

Calculate the molality of ethylene glycol:

Calculate the freezing point depression using the  $K_f$  from the Chemistry B Information Sheet and the molality that you calculated:

Calculate the freezing point of the solution.

2. Think about the result. Think about the typical mid-winter temperature we experience in Michigan. Is this concentration of ethylene glycol high enough to use in a car radiator in the winter? Why or why not?