Exercise 9.6
Calculations for Ideal Gases

1. A balloon is filled with 1.000 L of an unknown gas at 101.3 kPa and 25 °C.

(a) How many moles of gas are in the balloon?

(b) What other piece of information would you need to calculate the molar mass of the gas (and, depending on the molar mass, possibly identify it)? Show how you would do this calculation.

You may wish to invent a number for the required property; if you report that property using units with no SI prefix, any number between 1 and 10 should give a reasonable answer. Alternatively, you can leave the property as a variable and just show the process.

(c) If the balloon is heated to 65 °C, does the volume increase or decrease? Assume no change to pressure. After you have predicted the direction of change, calculate the new volume of the gas.

2. Two identical 250 mL flasks are filled with gas. Flask A is filled with 2.5 g of neon (Ne). Flask B is filled with 2.5 g of xenon (Xe).

(a) If both flasks are at the same temperature, in which flask is the pressure higher? Why?

(b) Confirm your prediction by calculating the pressure in each flask at 25 °C.

3. A tire will burst if the air inside it reaches a pressure greater than 1.4×10^3 kPa. At what temperature will the tire burst if it has a volume of 30. L and contains 2.5 mol of air? Assume that the air behaves as an ideal gas.

Assuming that these values are representative, do you need to worry about your car tires bursting from overheating if they are in good condition?