

## ASSIGNMENT 2

### CHEMISTRY 200

Due: 4:30 pm Wednesday 17 September 2008

1. At 200°C, when the pressure is 41.9 atm, the molar volume of ammonia is observed to be 0.851 L. What pressure would have been calculated on the basis of:
  - (a) ideal gas behaviour
  - (b) the van der Waals equation? [ $a = 4.170 \text{ dm}^6 \text{ atm mol}^{-2}$ ;  $b = 37.07 \text{ cm}^3 \text{ mol}^{-1}$ ]
  - (c) Which equation of state best describes the behaviour of the gas? Why?
2.
  - (a) Surface science experiments are often carried out in ultra-high vacuum apparatus that can attain pressures of  $10^{-14}$  atm. How many gas molecules are there in each cubic centimeter in such an apparatus at room temperature? What is the molar volume?
  - (b) The average density of interstellar space is about 1 H atom per  $\text{cm}^3$  and the temperature is about 10 K. What is the pressure of this interstellar medium? What is the molar volume?
3. It is found that the molar volume of a gaseous saturated hydrocarbon  $C_nH_{2n+2}$  is  $30.61 \text{ L mol}^{-1}$  if 0.432 g of the hydrocarbon fills a 300.0 mL container at constant temperature and pressure.
  - (a) What is the hydrocarbon?
  - (b) What can you say about the temperature and pressure of the experiment?