**PHYS 225: Applications of Modern Physics** **Marie Lopez del Puerto**

# HW #7

1. a) The molar specific heat of a diatomic gas is measured at constant volume and found to be 29.1 J/(mol K). What are the types of energy that are contributing to the molar specific heat?
    i. Translation only
    ii. Translation and rotation only
    iii. Translation and vibration only
    iv. Translation, rotation and vibration

    Give a one sentence explanation of your answer.

    b) Why does a diatomic gas have a greater energy content per mole than a monatomic gas at the same temperature?

2. **(Kasap 1.12) Heat Capacity**

a) Calculate the heat capacity per mole and per gram of $N_2$ gas, neglecting the vibrations of the molecule (because they are only relevant at high temperatures). How does this compare with the experimental value of 0.743 J/gK?
b) Calculate the heat capacity per mole and per gram of $CO_2$ gas, neglecting the vibrations of the molecule. How does this compare with the experimental value of 0.648 J/gK? Assume that the $CO_2$ molecule is linear (O-C-O) so that it has two rotational degrees of freedom.
c) Based on the Dulong-Petit rule (for a solid $C_m = 3R$, see Kasap p. 30), calculate the heat capacity per mole and per gram of solid silver. How does this compare with the experimental value of 0.235 J/gK?
d) Based on the Dulong-Petit rule, calculate the heat capacity per mole and per gram of the silicon crystal. How does this compare with the experimental value of 0.71 J/gK?