

CHM2131: Thermodynamics of Gases and Solutions  
Assignment 3 2016  
Internal Energy and Enthalpy  
Due: Friday Sept. 30

1. Comment, briefly, on the following (some may be true, some may be false and some may be partially true....)

a) U and H depend only on T

b)  $C_p$  is constant

c)  $p dV = nR dT$  for an ideal gas

d)  $dU = C_v dT$

e) It is incorrect to speak of heat or work associated with a system.

2. A 2.85 mole sample of an ideal gas ( $C_{vm} = 3/2 R$ ) undergoes the following two step process:

i) From an initial state described by  $T = 14.5 \text{ C}$  and  $P = 10^4 \text{ Pa}$ , the gas is cooled at constant volume. The temperature falls to  $-35.6 \text{ }^\circ\text{C}$ ; ii) Subsequently, the gas undergoes an isothermal expansion against a constant external pressure of  $5.0 \times 10^3 \text{ Pa}$  until the volume has doubled.

Calculate  $q$ ,  $w$ ,  $\Delta U$  and  $\Delta H$  for each step and for the overall process.

3. Consider the adiabatic expansion of 0.5 moles of monoatomic ideal gas. The initial state is described by  $P = 5.5 \text{ bar}$  and  $T = 285 \text{ K}$ .

a) Calculate the final temperature if this gas undergoes an adiabatic expansion against an external pressure of  $P = 1.00 \text{ bar}$  to a final pressure of  $P = 1.0 \text{ bar}$ .

b) Calculate the final temperature if the gas were to undergoes a reversible adiabatic expansion to a final pressure of  $1.0 \text{ bar}$ .

c) Explain the difference.

d) Would the final temperature be higher for an adiabatic reversible compression or for an adiabatic irreversible compression?