Chemistry 202: Quiz #5

1. Consider 1.00 mole of an ideal monatomic gas in a 25.0-L container at a pressure of 4.50 atm. The gas expands isothermally to a volume of 100.0 L at constant pressure. Determine the ratio of [maximum work performed:minimum work performed] for this expansion.

   a) 1.85 b) 2.43 c) 4.00 d) 5.63 e) 7.32

2. In how many of the following cases is the sign of q negative?

   I. An isothermal expansion of an ideal gas against a constant external pressure.
   II. An isothermal reversible expansion of an ideal gas against a constant external pressure.
   III. An isothermal free expansion of an ideal gas.
   IV. An isothermal phase change from a liquid to its vapor at its boiling point.
   V. An isothermal spontaneous chemical reaction for which $\Delta S < 0$.

   a) 0 b) 1 c) 2 d) 4 e) 5

3. Chloroform ($CHCl_3$) is a liquid at room temperature and has a boiling point of 61.7°C. The value of $\Delta H_{vaporization}$ for chloroform at its boiling point is 31.4 kJ/mol. Determine the value of $\Delta S_{univ} + \Delta S_{surr} + \Delta S$ for the vaporization of 1.00 mol of chloroform at 61.7°C.

   a) 0 J/K b) 93.8 J/K c) –93.8 J/K d) 188 J/K e) –188 J/K

4. A quantity of 11.50 kJ of heat is transferred to 1.000 mole of an ideal, monatomic gas in a rigid steel container at 25.0°C. Determine ΔS in J/K.

   a) 8.728 b) 11.72 c) 17.58 d) 21.82 e) 29.30

5. A 500.0 g sample of water at 27.0°C is mixed with a 500.0 g sample of water at 73.0°C in an insulated container and allowed to come to thermal equilibrium. Assume the specific heat capacity of water is constant at 4.18 J/g°C and that there is no heat transfer to or out of the container. Determine ΔS_{univ} in J/K.

   a) 0 b) 10.62 c) 21.25 d) 30.14 e) 39.17

6-7. Consider a sample of 1.000 mol of an ideal monatomic gas taken from a condition of 3.000 atm and 20.00 L to 5.000 atm and 15.00 L in one step.

6. Determine the value of ΔH (in kJ/mol) for this process.

   a) 0 b) 2.280 c) −2.280 d) 3.799 e) −3.799

7. Determine the value of ΔE (in kJ/mol) for this process.

   a) 0 b) 2.280 c) −2.280 d) 3.799 e) −3.799

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KEY: 1a, 2b, 3a, 4c, 5b, 6d, 7b