

Quiz: Ch 19 & 20
Thermodynamics & Electrochemistry
Version A

Name:
Date: Pd: 6 7

Show your work for all questions; answer all parts of all questions. No work = no credit.

1. State the 2nd Law of Thermodynamics.
2. Are all exothermic reactions spontaneous? Why, or why not?
3. Given the following data for graphite and diamond at 298K.
 S° (diamond) = 2.43 J/(mol K)
 S° (graphite) = 5.73 J/(mol K)
 ΔH_f° CO₂ (from graphite) = - 395.3 kJ/mol
 ΔH_f° CO₂ (from diamond) = -393.4 kJ/mol

Consider the change: C (graphite) → C (diamond) at 298K and 1 atm.

- a. What are the values of ΔS° and ΔH° for the conversion of graphite to diamond?
- b. Perform a calculation to show whether it is thermodynamically feasible (practical) to produce diamond from graphite at 298K and 1 atm. Then explain how you know if it is feasible or not.
- c. For the reaction, calculate the equilibrium constant K_{eq} at 298K.

4. A voltaic cell is constructed that consists of a 10.0 g gold metal electrode in a solution of 1.0 M $\text{Au}(\text{NO}_3)_3$, connected by a wire and a salt bridge to a 10.0 g thallium (Tl) metal electrode in a 1.0 M solution of TlNO_3 .

Write the balanced half reaction that would occur at the:

a. Cathode

b. Anode

c. Write the overall, balanced cell reaction and calculate E°_{cell} .

d. Calculate E_{cell} at 25°C when $[\text{Au}^{3+}] = 1.0 \times 10^{-2} \text{ M}$ and $[\text{Tl}^{1+}] = 1.0 \times 10^{-4} \text{ M}$.

e. Calculate the mass of the gold electrode if this cell produces a 2.50 Amp current for 1.00 hour.