**Quiz 7**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. Copper forms two oxides, Cu2O and CuO (12 points).
	1. Name these oxides. \_\_\_\_copper(II) oxide and copper(I) oxide\_\_\_\_\_\_\_\_
	2. Predict over what temperature range this reaction:

Cu2O (s) → CuO (s) + Cu (s)

 is spontaneous by using the following thermodynamic data and that ∆Gf° Cu (s) is zero:

|  |  |  |
| --- | --- | --- |
|  | ∆Hf° (kJ/mol) | S° (J/mol∙K) |
| Cu2O (s) | -170.7 | 92.4 |
| CuO (s) | -156.1 | 42.6 |

∆G = ∆H - T∆S

$$∆G\_{f}^{°} Cu\_{2}O=-170.7\frac{kJ}{mol}-\left(298 K\right)\left(92.4\frac{J}{mol K}\right)\left(\frac{1 kJ}{1000 J}\right)=-198.2\frac{kJ}{mol}$$

$$∆G\_{f}^{°} CuO=-156.1\frac{kJ}{mol}-\left(298 K\right)\left(42.6\frac{J}{mol K}\right)\left(\frac{1 kJ}{1000 J}\right)=-168.8\frac{kJ}{mol}$$

∆Grxn = ∑np∆Gf°p - ∑nr∆Gf°r = -168.8 kJ/mol – (-198.2 kJ/mol) = 29.4 kJ/mol

Since ∆Grxn is positive, the reaction will never be spontaneous.

* 1. Why is the standard molar entropy of Cu2O (s) larger than that of CuO (s)?

Cu2O is more complex than CuO because it has more bonds.

1. Predict the sign of the entropy change in the system for each of the following processes (4 points):
	1. A solid sublimes \_\_\_\_\_\_\_positive
	2. A liquid freezes \_\_\_\_\_\_\_negative
	3. AgI precipitates from a solution containing Ag+ and I- ions \_\_\_\_\_\_\_negative
	4. Gaseous CO2 bubbles out of a carbonated beverage \_\_\_\_\_\_\_positive
2. If the sign for ∆G is negative, is the process endergonic or exergonic (1 point)?

Exergonic

1. The value of the equilibrium constant of a reaction decreases with increasing temperature. Is the reaction endothermic or exothermic (1 point)?

Exothermic

1. Name two cations that today’s lab is investigating (2 points). \_\_\_

Answers will vary and depend on the qualitative experiment being performed.