

WORKSHEETS ARE DUE AT THE BEGINNING OF CLASS ON THE DATE GIVEN ON THE WORKSHEET. LATE WORKSHEETS WILL NOT BE ACCEPTED.

NAME _____ Panther ID _____

For problems involving calculations you must show your work for credit.

1) CFC-113a is a chlorofluorocarbon whose use is now tightly regulated by international treaty. The formula for CFC-113a is $\text{CCl}_3\text{CF}_3(\ell)$. Give the correctly balanced formation reaction for $\text{CCl}_3\text{CF}_3(\ell)$. Be sure to indicate the correct phase (s, ℓ , g) for all reactants and products.

2) For a chemical reaction to be spontaneous for standard conditions, which of the following must be true?

- a) $\Delta S^\circ_{\text{univ}} > 0$
- b) $\Delta S^\circ_{\text{syst}} > 0$
- c) $\Delta S^\circ_{\text{surr}} > 0$
- d) Both b and c
- e) Both a and b and c

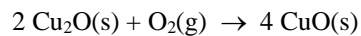
3) Complete the table below. You may assume that both $\Delta H^\circ_{\text{rxn}}$ and $\Delta S^\circ_{\text{rxn}}$ have values that are independent of temperature.

$\Delta H^\circ_{\text{rxn}}$	$\Delta S^\circ_{\text{rxn}}$	When is the reaction spontaneous?
positive	_____	Reaction is spontaneous at high temperatures
negative	negative	_____
_____	_____	Reaction is always spontaneous

4) Thermodynamic data for several pure chemical substances are given below (at T = 298.0 K).

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol·K)
CuO(s)	- 157.3	- 129.7	42.63
Cu ₂ O(s)	- 168.6	- 146.0	93.14
O ₂ (g)	0.0	0.0	205.14

a) Using the above information, find the values for $\Delta H^\circ_{\text{rxn}}$, $\Delta G^\circ_{\text{rxn}}$, and $\Delta S^\circ_{\text{rxn}}$ for the following reaction, at T = 298. K.



b) Find $\Delta S^\circ_{\text{sys}}$, $\Delta S^\circ_{\text{surr}}$, and $\Delta S^\circ_{\text{univ}}$ for the above reaction at T = 298.0 K.

c) Will the above reaction be spontaneous for standard conditions at T = 298.0 K? Justify your answer?