## Entropy/ Electrochemistry Mini Quiz

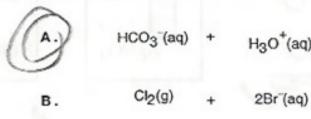


Which of the laws of thermodynamics concern(s) entropy?

- 1-
- A. only the first
- B. only the second
- C. only the third

- D. both the first and second
- E. both the second and third

In which of the following processes does the entropy of the system increase?



CO<sub>2</sub>(g)

2H<sub>2</sub>O(liq)

- C. 4NO(g) + 2O<sub>3</sub>(g) → 2N<sub>2</sub>O<sub>5</sub>(g)
- D. all of them
- E. none of them

3.\_\_\_\_

Which one of the following statements is false?

the entropy of the universe increases in a spontaneous process
 S° for the stable form of an element is zero at 25 °C
 ΔG =0 for a system at equilibrium

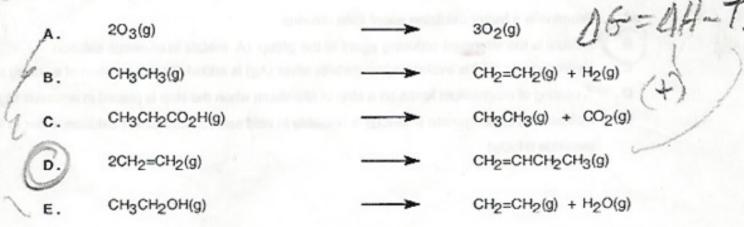
- D. the Gibbs free energy is a minimum for a system at equilibrium
- E. the Gibbs free energy of the system decreases in a spontaneous process

4.

Given the thermodynamic values shown, calculate  $\Delta G^{\circ}$  for the reaction shown at 100 °C:

100 °C					
Al <sub>2</sub> O <sub>3</sub> (s)	+ 3H <sub>2</sub> (g)		2AI(s)	+	3H <sub>2</sub> O(g)
-1666 kJ/mol	0	24 . 83	0		-242 kJ/mol
51 J mol 1.K 1	131 J mol 1.K	C <sup>-1</sup>	28 mol 1.K 1		189 J mol 1.K 1
00 kJ B38	kJ C	. 246 kJ	D.) 873 kJ		E. 1068 kJ
	-1666 kJ/mol 51 J mol <sup>-1</sup> .K <sup>-1</sup>	-1666 kJ/mol 0 51 J mol <sup>-1</sup> .K <sup>-1</sup> 131 J mol <sup>-1</sup> .k	Al <sub>2</sub> O <sub>3</sub> (s) + 3H <sub>2</sub> (g) -1666 kJ/mol 0 51 J mol <sup>-1</sup> .K <sup>-1</sup> 131 J mol <sup>-1</sup> .K <sup>-1</sup>	Al <sub>2</sub> O <sub>3</sub> (s) + 3H <sub>2</sub> (g)  2Al(s)  -1666 kJ/mol 0  51 J mol <sup>-1</sup> .K <sup>-1</sup> 131 J mol <sup>-1</sup> .K <sup>-1</sup> 28 J mol <sup>-1</sup> .K <sup>-1</sup>	Al <sub>2</sub> O <sub>3</sub> (s) + 3H <sub>2</sub> (g)  -1666 kJ/mol 0 51 J mol <sup>-1</sup> .K <sup>-1</sup> 131 J mol <sup>-1</sup> .K <sup>-1</sup> 28 J mol <sup>-1</sup> .K <sup>-1</sup>

None of the following processes are spontaneous at 25 °C. All but one are spontaneous at very high temperatures (500-1000 °C). Which one is not spontaneous under any of the conditions just described?



	estions	The state of the s	Parameter		
	the same of the sa	ern the galvanic	\		
	cell shown at the righ		eo		OX
	What is the standard cell p	potential E° for this			<
	galvanic cell?	A	g		Ni
	A0.57 V	001.			
	0.57 V	.000			
	C 1.03 V D. 1.26 V	.230	AgNO <sub>3</sub>	NiSO <sub>4</sub>	
	E. 1.74 V	10.20)			J
		1.0 0		M L	- 1
	What is the cell potential E for	or this cell when [Ni2+] = 2.0	M and [Ag*] = 0.1M?	Agt te	-20
	A0.73 V	D. 0.99 V		1	1124
	B. 0.16	E. 1.11 V		Ni	· Wit
	(C) 0.95 V	E = E = .	0592 16	9	
	Which one of the following	statements concerning the	galvanic cell shown is	true?	
	A. Silver (Ag) is the ano	ode.		ms 1 407	
	<ul> <li>B. Ni<sup>2+</sup> is reduced.</li> </ul>				
	<ul> <li>Ni is reduced.</li> </ul>				
		n the left compartment			
	[AgNO <sub>3</sub> ] increases in				
		he Ni electrode to the Ag ele	ectrode (i.e., from right	to left).	
			ectrode (i.e., from right	to left).	
	E. Electrons flow from the	he Ni electrode to the Ag ele			
	E. Electrons flow from the			hydrogen electrode is:	
	E. Electrons flow from the	he Ni electrode to the Ag ele	ructed in the standard		
	E. Electrons flow from the material from which the A. platinum B. c	he Ni electrode to the Ag electrode is normally const	ructed in the standard D. lead	hydrogen electrode is:	
	E. Electrons flow from the material from which the A. platinum B. c	the Ni electrode to the Ag electrode is normally constant copper C. zinc	D. lead	hydrogen electrode is: E. graphite	
	E. Electrons flow from the material from which the A. platinum B. c	the Ni electrode to the Ag electrode is normally constant copper C. zinc	ructed in the standard D. lead	hydrogen electrode is:	
DAGE OF THE PARTY	E. Electrons flow from the material from which the A. platinum B. c	the Ni electrode to the Ag electrode is normally constant copper C. zinc	D. lead	hydrogen electrode is: E. graphite	
200	E. Electrons flow from the material from which the A. platinum B. c	the Ni electrode to the Ag electrode is normally constant copper C. zinc	D. lead	hydrogen electrode is: E. graphite	
	E. Electrons flow from the material from which the A. platinum B. c  Which one of the following A. Cl <sub>2</sub> B. K	the Ni electrode to the Ag electrode is normally constant copper C. zinc	b. lead  b. lead  hydrochloric acid?  c. PbO <sub>2</sub>	hydrogen electrode is: E. graphite E. Pt	
	E. Electrons flow from the material from which the A. platinum B. c  Which one of the following A. Cl <sub>2</sub> B. K	e electrode is normally constant copper C. zinc  will liberate H <sub>2</sub> (g) from 1 M	b. lead  D. lead  hydrochloric acid?  D. PbO <sub>2</sub> tandard reduction pote	hydrogen electrode is: E. graphite E. Pt	
	E. Electrons flow from the material from which the A. platinum B. c  Which one of the following A. Cl <sub>2</sub> B. K.  Based on the information statements is true? (All	e electrode is normally constant copper C. zinc  will liberate H <sub>2</sub> (g) from 1 M  C. Mn	b. lead  D. lead  hydrochloric acid?  D. PbO <sub>2</sub> tandard reduction pote	hydrogen electrode is: E. graphite E. Pt	
	E. Electrons flow from the material from which the A. platinum B. c  Which one of the following A. Cl <sub>2</sub> B. K.  Based on the information statements is true? (All	e electrode is normally constant copper C. zinc  will liberate H <sub>2</sub> (g) from 1 M  C. Mn  contained in the table of standard substances are in their standard grant	b. lead  b. lead  hydrochloric acid?  D. PbO <sub>2</sub> tandard reduction pote dard state.)	hydrogen electrode is:  E. graphite  E. Pt  ntials which one of the	
	E. Electrons flow from the material from which the A. platinum B. c  Which one of the following A. Cl <sub>2</sub> B. K'  Based on the information statements is true? (All Bromine is a better oxidia B. Lithium is the strongest results and the strongest results are strongest results and the strongest results are strongest results and the strongest results are s	he Ni electrode to the Ag electrode is normally constance copper C. zinc  will liberate H <sub>2</sub> (g) from 1 M  C. Mn  contained in the table of standard contained in the table of standard contained in the standard contained in the group reducing agent of the group	tructed in the standard D. lead hydrochloric acid? D. PbO2 tandard reduction pote dard state.)	hydrogen electrode is:  E. graphite  E. Pt  ntials which one of the solution.	
	E. Electrons flow from the material from which the A. platinum B. co  Which one of the following A. Cl <sub>2</sub> B. K.  Based on the information statements is true? (All Bromine is a better oxidial Lithium is the strongest reference to the hydrogen gas (H <sub>2</sub> ) is evolution.	he Ni electrode to the Ag electrode is normally constance copper C. zinc  will liberate H <sub>2</sub> (g) from 1 M  C. Mn  contained in the table of standard contained in the table of standard contained in the group of the group of the group of the group of the decing agent of the group of the decing agent of the group of the	b. lead  hydrochloric acid?  D. PbO2  candard reduction pote dard state.)  1A metals in aqueous g) is added to a 1M soli	E. Pt  E. Pt  ntials which one of the solution.	
	E. Electrons flow from the A. platinum B. co  Which one of the following A. Cl <sub>2</sub> B. K.  Based on the information statements is true? (All B. Lithium is the strongest r. Hydrogen gas (H <sub>2</sub> ) is evo D. A coating of magnesium is	he Ni electrode to the Ag electrode is normally constance copper C. zinc  will liberate H <sub>2</sub> (g) from 1 M  C. Mn  contained in the table of standard contained in the table of standard contained in the standard contained in the group reducing agent of the group	b. lead  hydrochloric acid?  D. PbO2  candard reduction poted dard state.)  1A metals in aqueous g) is added to a 1M solution when the strip is place.	E. Pt  E. Pt  ntials which one of the solution.  ation of a strong acid.  at in aqueous MgCl2.	following

4) 
$$Al_2O_3 + 3l_2 \rightarrow 2Al + 3l_2O$$
 $AH = 3(-242) - (-1666) = 940 ET$ 
 $AS = \left\{2(28) + 3(189)\right\} - \left\{51 + 3(131)\right\}$ 
 $= 179 \frac{5}{k}$ 
 $= 0.179 \frac{k5}{k}$ 
 $AG = AH - TAS$ 
 $= 940 \frac{kT}{k} - (373\frac{k}{k})(6.179 \frac{kT}{k})$ 
 $AG = 873 \frac{kT}{k}$ 

7)  $2A_5^4 + 2C \rightarrow 2A_5$ 
 $0.30 \quad 2A_5^4 + 2C \rightarrow 2A_5$ 
 $0.23 \quad Ni \rightarrow Ni^{24} + 2C \rightarrow 2A_5$ 
 $E = E^c - \frac{.0591}{2} \log Q$ 
 $= 1.03 - \frac{.0591}{2} \log Q$ 

10) 2H+ 2e- -> H2 0 Mn -> 2c-+ Mn2+ 1.18 U 2H+ +Mn -> Mn2+ + H2 E= 1.18 U

3