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12. Which of the following is the correct relationship between the molar solubility,  $x$ , and the solubility product constant,  $K_{sp}$ , for  $\text{Ag}_2\text{CO}_3(s)$ ?

A.  $K_{sp} = x^2$

C.  $K_{sp} = 4x^3$

B.  $K_{sp} = 27x^4$

D.  $K_{sp} = 9x^2$

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13. Which of the following solutions will see a **decrease** in solubility with an **increase** in pH?



**Questions 14 – 26 cover material after Exam 3**

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14. Two solutions are mixed together such that:

The final concentration of  $\text{Pb}^{2+}$  is  $5.45 \times 10^{-5} M$  and  $\text{CO}_3^{2-}$  is  $2.50 \times 10^{-6} M$ .

The  $K_{sp}$  of  $\text{PbCO}_3$  is  $7.40 \times 10^{-14}$ .

Will a precipitate form?

A. A precipitate will not form because  $Q < K_{sp}$ .

B. A precipitate will not form because  $Q > K_{sp}$ .

C. A precipitate will form because  $Q < K_{sp}$ .

D. A precipitate will form because  $Q > K_{sp}$ .

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15. A solution is prepared that is  $2.00 \times 10^{-4} M \text{Fe}^{3+}$  and  $0.100 M \text{CN}^-$ . What is the final concentration of  $\text{Fe}^{3+}$ ?  $K_f$  of  $\text{Fe}(\text{CN})_6^{3-} = 2.00 \times 10^{43}$ .

A.  $3.62 \times 10^{-33} M \text{Fe}^{3+}$

C.  $5.16 \times 10^{-27} M \text{Fe}^{3+}$

B.  $1.08 \times 10^{-41} M \text{Fe}^{3+}$

D.  $2.27 \times 10^{-54} M \text{Fe}^{3+}$

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16. Which one of the following statements is **true**?

- A. An endothermic reaction always has a positive  $\Delta S_{\text{surr}}$ .
- B. An endothermic reaction always has a positive  $\Delta S_{\text{sys}}$ .
- C. An exothermic reaction always has a positive  $\Delta S_{\text{surr}}$ .
- D. An exothermic reaction always has a positive  $\Delta S_{\text{sys}}$ .

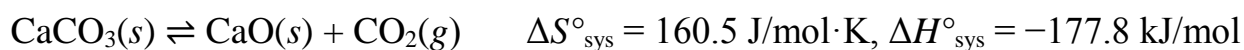
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17. Which of the following systems shows a **decrease** in the entropy of the system?

- A.  $\text{KNO}_3(s) \rightarrow \text{K}^+(aq) + \text{NO}_3^-(aq)$
- B.  $4 \text{PH}_3(g) \rightarrow \text{P}_4(g) + 6 \text{H}_2(g)$
- C.  $\text{NH}_3(l) \rightarrow \text{NH}_3(g)$
- D.  $\text{U}(s) + 3 \text{F}_2(g) \rightarrow \text{UF}_6(s)$

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18. Consider the decomposition of calcium carbonate below:



What is  $\Delta S_{\text{universe}}$  at 300. K for the reaction?

- A. 1,320 J/K
- B. 753 J/K
- C. 378 J/K
- D. 889 J/K

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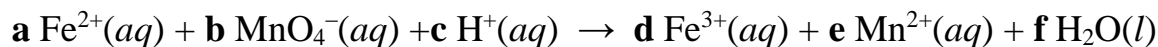
19. Given  $\Delta H = 257 \text{ kJ/mol}$  and  $\Delta S = 470 \text{ J/mol}\cdot\text{K}$ , what is  $\Delta G$  at 273K?

- A. 129 kJ
  - B. 232 kJ
  - C. 72 kJ
  - D. 208 kJ
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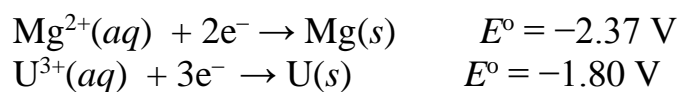
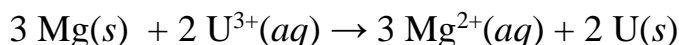
23. What is the coefficient **a** when the reaction below is balanced in acid?



- A. 5  
B. 1  
C. 8  
D. 4

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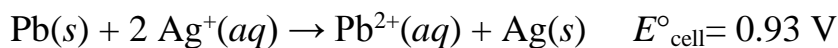
24. Using the standard reduction potentials listed below, calculate the  $E^{\circ}_{\text{cell}}$  at 298 K for



- A. 4.17 V  
B. -0.76 V  
C. -3.51 V  
D. 0.57 V

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25. Calculate the equilibrium constant,  $K$ , at 25°C (298 K) for



- A.  $5.2 \times 10^{45}$   
B.  $3.1 \times 10^{12}$   
C.  $2.6 \times 10^{31}$   
D.  $1.8 \times 10^{-2}$

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26. A voltaic cell is constructed that uses the following reaction:



What is  $E_{\text{cell}}$  when  $[\text{Ni}^{2+}] = 0.200 \text{ M}$  and  $[\text{Zn}^{2+}] = 0.900 \text{ M}$  at 25°C (298 K)?

- A. 0.49 V  
B. 0.51 V  
C. 0.53 V  
D. 0.57 V
-

**Answer Key:**

1. C
2. A
3. C
4. B
5. A
6. D
7. B
8. C
9. A
10. D
11. B
12. C
13. A
14. D
15. B
16. C
17. D
18. B
19. A
20. D
21. C
22. B
23. A
24. D
25. C
26. B