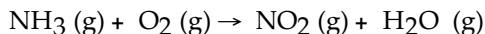


Name \_\_\_\_\_

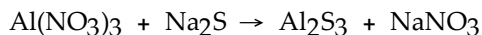
**MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.**

- 1) When the following equation is balanced, the coefficients are \_\_\_\_\_. 1) \_\_\_\_\_



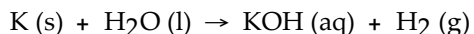
- A) 1, 3, 1, 2      B) 4, 3, 4, 3      C) 1, 1, 1, 1      D) 2, 3, 2, 3      E) 4, 7, 4, 6

- 2) When the following equation is balanced, the coefficients are \_\_\_\_\_. 2) \_\_\_\_\_



- A) 1, 1, 1, 1      B) 2, 3, 1, 6      C) 2, 3, 2, 3      D) 2, 1, 3, 2      E) 4, 6, 3, 2

- 3) When the following equation is balanced, the coefficient of
- $\text{H}_2$
- is \_\_\_\_\_. 3) \_\_\_\_\_



- A) 4      B) 1      C) 5      D) 2      E) 3

- 4) When the following equation is balanced, the coefficient of Al is \_\_\_\_\_. 4) \_\_\_\_\_



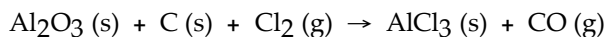
- A) 5      B) 2      C) 4      D) 1      E) 3

- 5) When the following equation is balanced, the coefficient of
- $\text{H}_2\text{O}$
- is \_\_\_\_\_. 5) \_\_\_\_\_



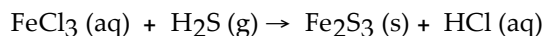
- A) 3      B) 4      C) 2      D) 1      E) 5

- 6) When the following equation is balanced, the coefficient of
- $\text{Al}_2\text{O}_3$
- is \_\_\_\_\_. 6) \_\_\_\_\_



- A) 2      B) 4      C) 5      D) 1      E) 3

- 7) When the following equation is balanced, the coefficient of
- $\text{H}_2\text{S}$
- is \_\_\_\_\_. 7) \_\_\_\_\_



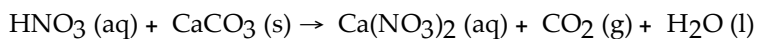
- A) 1      B) 2      C) 5      D) 4      E) 3

8) When the following equation is balanced, the coefficient of HCl is \_\_\_\_\_. 8) \_\_\_\_\_



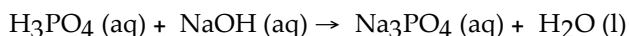
- A) 3                      B) 0                      C) 2                      D) 4                      E) 1

9) When the following equation is balanced, the coefficient of HNO<sub>3</sub> is \_\_\_\_\_. 9) \_\_\_\_\_



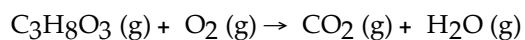
- A) 2                      B) 1                      C) 3                      D) 5                      E) 4

10) When the following equation is balanced, the coefficient of H<sub>3</sub>PO<sub>4</sub> is \_\_\_\_\_. 10) \_\_\_\_\_



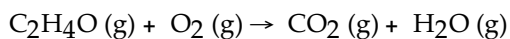
- A) 2                      B) 1                      C) 0                      D) 4                      E) 3

11) When the following equation is balanced, the coefficient of C<sub>3</sub>H<sub>8</sub>O<sub>3</sub> is \_\_\_\_\_. 11) \_\_\_\_\_



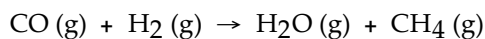
- A) 1                      B) 3                      C) 2                      D) 5                      E) 7

12) When the following equation is balanced, the coefficient of O<sub>2</sub> is \_\_\_\_\_. 12) \_\_\_\_\_



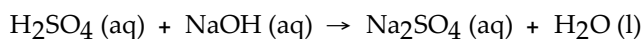
- A) 2                      B) 5                      C) 3                      D) 1                      E) 4

13) When the following equation is balanced, the coefficient of H<sub>2</sub> is \_\_\_\_\_. 13) \_\_\_\_\_



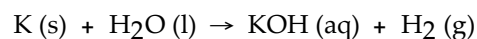
- A) 3                      B) 4                      C) 0                      D) 1                      E) 2

14) When the following equation is balanced, the coefficient of H<sub>2</sub>SO<sub>4</sub> is \_\_\_\_\_. 14) \_\_\_\_\_



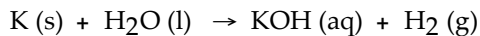
- A) 0.5                      B) 1                      C) 3                      D) 4                      E) 2

15) When the following equation is balanced, the coefficient of water is \_\_\_\_\_. 15) \_\_\_\_\_



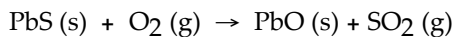
- A) 2                      B) 1                      C) 3                      D) 4                      E) 5

16) When the following equation is balanced, the coefficient of hydrogen is \_\_\_\_\_. 16) \_\_\_\_\_



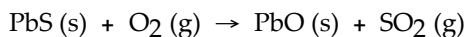
- A) 5                      B) 2                      C) 3                      D) 4                      E) 1

17) When the following equation is balanced, the coefficient of oxygen is \_\_\_\_\_. 17) \_\_\_\_\_



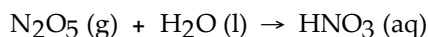
- A) 5                      B) 1                      C) 4                      D) 2                      E) 3

18) When the following equation is balanced, the coefficient of sulfur dioxide is \_\_\_\_\_. 18) \_\_\_\_\_



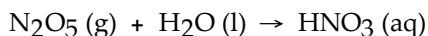
- A) 3                      B) 1                      C) 5                      D) 4                      E) 2

19) When the following equation is balanced, the coefficient of dinitrogen pentoxide is \_\_\_\_\_. 19) \_\_\_\_\_



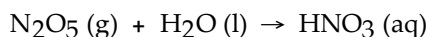
- A) 4                      B) 1                      C) 2                      D) 3                      E) 5

20) When the following equation is balanced, the coefficient of water is \_\_\_\_\_. 20) \_\_\_\_\_



- A) 4                      B) 2                      C) 5                      D) 3                      E) 1

21) When the following equation is balanced, the coefficient of nitric acid is \_\_\_\_\_. 21) \_\_\_\_\_



- A) 1                      B) 5                      C) 4                      D) 2                      E) 3

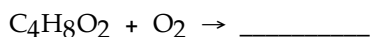
22) Write the balanced equation for the reaction that occurs when methanol,  $\text{CH}_3\text{OH (l)}$ , is burned in air. What is the coefficient of methanol in the balanced equation? 22) \_\_\_\_\_

- A) 1                      B) 2                      C) 3                      D) 4                      E) 3/2

23) Write the balanced equation for the reaction that occurs when methanol,  $\text{CH}_3\text{OH (l)}$ , is burned in air. What is the coefficient of oxygen in the balanced equation? 23) \_\_\_\_\_

- A) 1                      B) 2                      C) 3                      D) 4                      E) 3/2

24) What is the coefficient of  $\text{O}_2$  when the following equation is completed and balanced? 24) \_\_\_\_\_



- A) 1                      B) 2                      C) 5                      D) 3                      E) 6

- 25) What are the spectator ions in the reaction between KOH (aq) and HNO<sub>3</sub> (aq)? 25) \_\_\_\_\_
- A) K<sup>+</sup> and NO<sub>3</sub><sup>-</sup>  
 B) K<sup>+</sup> and H<sup>+</sup>  
 C) H<sup>+</sup> and NO<sub>3</sub><sup>-</sup>  
 D) OH<sup>-</sup> only  
 E) H<sup>+</sup> and OH<sup>-</sup>
- 26) The net ionic equation for the reaction between aqueous solutions of HF and KOH is \_\_\_\_\_. 26) \_\_\_\_\_
- A) H<sup>+</sup> + F<sup>-</sup> + K<sup>+</sup> + OH<sup>-</sup> → H<sub>2</sub>O + K<sup>+</sup> + F<sup>-</sup>  
 B) H<sup>+</sup> + OH<sup>-</sup> → H<sub>2</sub>O  
 C) HF + OH<sup>-</sup> → H<sub>2</sub>O + F<sup>-</sup>  
 D) HF + K<sup>+</sup> + OH<sup>-</sup> → H<sub>2</sub>O + KF  
 E) HF + KOH → H<sub>2</sub>O + K<sup>+</sup> + F<sup>-</sup>
- 27) Combining aqueous solutions of BaI<sub>2</sub> and Na<sub>2</sub>SO<sub>4</sub> affords a precipitate of BaSO<sub>4</sub>. Which ion(s) 27) \_\_\_\_\_  
 is/are spectator ions in the reaction?
- A) Na<sup>+</sup> and I<sup>-</sup>  
 B) Ba<sup>2+</sup> only  
 C) Na<sup>+</sup> only  
 D) Ba<sup>2+</sup> and SO<sub>4</sub><sup>2-</sup>  
 E) SO<sub>4</sub><sup>2-</sup> and I<sup>-</sup>
- 28) Which ion(s) is/are spectator ions in the formation of a precipitate of AgCl via combining aqueous 28) \_\_\_\_\_  
 solutions of CoCl<sub>2</sub> and AgNO<sub>3</sub>?
- A) NO<sub>3</sub><sup>-</sup>  
 B) NO<sub>3</sub><sup>-</sup> and Cl<sup>-</sup>  
 C) Co<sup>2+</sup> and NO<sub>3</sub><sup>-</sup>  
 D) Cl<sup>-</sup>  
 E) Co<sup>2+</sup> and Ag<sup>+</sup>
- 29) The balanced net ionic equation for precipitation of CaCO<sub>3</sub> when aqueous solutions of Na<sub>2</sub>CO<sub>3</sub> 29) \_\_\_\_\_  
 and CaCl<sub>2</sub> are mixed is \_\_\_\_\_.
- A) 2Na<sup>+</sup> (aq) + 2Cl<sup>-</sup> (aq) → 2NaCl (aq)  
 B) Na<sub>2</sub>CO<sub>3</sub> (aq) + CaCl<sub>2</sub> (aq) → 2NaCl (aq) + CaCO<sub>3</sub> (s)  
 C) Na<sup>+</sup> (aq) + Cl<sup>-</sup> (aq) → NaCl (aq)  
 D) Ca<sup>2+</sup> (aq) + CO<sub>3</sub><sup>2-</sup> (aq) → CaCO<sub>3</sub> (s)  
 E) 2Na<sup>+</sup> (aq) + CO<sub>3</sub><sup>2-</sup> (aq) → Na<sub>2</sub>CO<sub>3</sub> (aq)

- 30) When aqueous solutions of  $\text{AgNO}_3$  and  $\text{KI}$  are mixed,  $\text{AgI}$  precipitates. The balanced net ionic equation is \_\_\_\_\_.
- A)  $\text{Ag}^+(\text{aq}) + \text{I}^-(\text{aq}) \rightarrow \text{AgI}(\text{s})$   
B)  $\text{Ag}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{AgNO}_3(\text{s})$   
C)  $\text{AgNO}_3(\text{aq}) + \text{KI}(\text{aq}) \rightarrow \text{AgI}(\text{aq}) + \text{KNO}_3(\text{s})$   
D)  $\text{Ag}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{AgNO}_3(\text{aq})$   
E)  $\text{AgNO}_3(\text{aq}) + \text{KI}(\text{aq}) \rightarrow \text{AgI}(\text{s}) + \text{KNO}_3(\text{aq})$
- 31) When  $\text{H}_2\text{SO}_4$  is neutralized by  $\text{NaOH}$  in aqueous solution, the net ionic equation is \_\_\_\_\_.
- A)  $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$   
B)  $\text{SO}_4^{2-}(\text{aq}) + 2\text{Na}^+(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq})$   
C)  $2\text{H}^+(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + 2\text{Na}^+(\text{aq})$   
D)  $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{OH}^-(\text{aq}) \rightarrow 2\text{H}_2\text{O}(\text{l}) + \text{SO}_4^{2-}(\text{aq})$   
E)  $\text{SO}_4^{2-}(\text{aq}) + 2\text{Na}^+(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{s})$
- 32) The spectator ions in the reaction between aqueous perchloric acid and aqueous barium hydroxide are \_\_\_\_\_.
- A)  $\text{OH}^-$  and  $\text{ClO}_4^-$   
B)  $\text{ClO}_4^-$  and  $\text{Ba}^{2+}$   
C)  $\text{H}^+$  and  $\text{OH}^-$   
D)  $\text{H}^+$  and  $\text{Ba}^{2+}$   
E)  $\text{H}^+$ ,  $\text{OH}^-$ ,  $\text{ClO}_4^-$ , and  $\text{Ba}^{2+}$
- 33) The spectator ions in the reaction between aqueous hydrofluoric acid and aqueous barium hydroxide are \_\_\_\_\_.
- A)  $\text{OH}^-$ ,  $\text{F}^-$ , and  $\text{Ba}^{2+}$   
B)  $\text{H}^+$ ,  $\text{OH}^-$ ,  $\text{F}^-$ , and  $\text{Ba}^{2+}$   
C)  $\text{F}^-$  and  $\text{Ba}^{2+}$   
D)  $\text{OH}^-$  and  $\text{F}^-$   
E)  $\text{Ba}^{2+}$  only
- 34) The spectator ions in the reaction between aqueous hydrochloric acid and aqueous ammonia are \_\_\_\_\_.
- A)  $\text{Cl}^-$  and  $\text{NH}_4^+$   
B)  $\text{Cl}^-$  only  
C)  $\text{H}^+$ ,  $\text{Cl}^-$ , and  $\text{NH}_4^+$   
D)  $\text{H}^+$ ,  $\text{Cl}^-$ ,  $\text{NH}_3$ , and  $\text{NH}_4^+$   
E)  $\text{H}^+$  and  $\text{NH}_3$
- 35) When the equation  $\text{K}_2\text{S}_2\text{O}_3 + \text{I}_2 \rightarrow \text{K}_2\text{S}_4\text{O}_6 + \text{KI}$  is balanced with the smallest integer coefficients, the coefficient of  $\text{KI}$  is:
- A) 4                      B) 1                      C) 2                      D) 5                      E) 3

- 36) When the equation  $\text{Fe}_2(\text{C}_2\text{O}_4)_3 \rightarrow \text{FeC}_2\text{O}_4 + \text{CO}_2$  is balanced with the smallest integer coefficients, the coefficient of  $\text{CO}_2$  is: 36) \_\_\_\_\_  
 A) 2                      B) 3                      C) 4                      D) 1                      E) 5
- 37) When the equation  $\text{CS}_2 + \text{Cl}_2 \rightarrow \text{CCl}_4 + \text{S}_2\text{Cl}_2$  is balanced with the smallest integer coefficients, the sum of the coefficients is: 37) \_\_\_\_\_  
 A) 4                      B) 3                      C) 6                      D) 7                      E) 5
- 38) What is the sum of the coefficients when the following is balanced? 38) \_\_\_\_\_  
 $\text{K}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{KOH}$   
 A) 8                      B) 2                      C) 3                      D) 4                      E) 6
- 39) What is the sum of the coefficients when the following is balanced? 39) \_\_\_\_\_  
 $\text{Na} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2$   
 A) 10                      B) 2                      C) 4                      D) 7                      E) 9
- 40) What is the sum of the coefficients when the following is balanced? 40) \_\_\_\_\_  
 $\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + \text{Fe}$   
 A) 6                      B) 8                      C) 9                      D) 4                      E) 12
- 41) What is the sum of the coefficients when the following is balanced? 41) \_\_\_\_\_  
 $\text{CaC}_2(\text{s}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{Ca}(\text{OH})_2(\text{s}) + \text{C}_2\text{H}_2(\text{g})$   
 A) 9                      B) 8                      C) 4                      D) 10                      E) 5
- 42) What is the sum of the coefficients when the following is balanced? 42) \_\_\_\_\_  
 $\text{KClO}_3(\text{s}) \rightarrow \text{KCl}(\text{s}) + \text{O}_2(\text{g})$   
 A) 7                      B) 10                      C) 6                      D) 11                      E) 5
- 43) What is the sum of the coefficients when the following is balanced? 43) \_\_\_\_\_  
 $\text{PCl}_3(\text{l}) + \text{Cl}_2(\text{g}) + \text{P}_4\text{O}_{10}(\text{s}) \rightarrow \text{POCl}_3(\text{l})$   
 A) 18                      B) 23                      C) 45                      D) 10                      E) 3
- 44) What is the sum of the coefficients when the following is balanced? 44) \_\_\_\_\_  
 $\text{Al}(\text{s}) + \text{HCl}(\text{aq}) \rightarrow \text{AlCl}_3(\text{aq}) + \text{H}_2(\text{g})$   
 A) 11                      B) 18                      C) 13                      D) 21                      E) 19
- 45) What is the sum of the coefficients when the following is balanced? 45) \_\_\_\_\_  
 $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$   
 A) 5                      B) 7                      C) 8                      D) 4                      E) 9
- 46) What is the sum of the coefficients when the following is balanced? 46) \_\_\_\_\_  
 $\text{C}_2\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$   
 A) 5                      B) 10                      C) 25                      D) 21                      E) 19
- 47) What is the sum of the coefficients when the following is balanced? 47) \_\_\_\_\_  
 $\text{CH}_3\text{OH} \rightarrow \text{CO} + \text{H}_2$   
 A) 5                      B) 4                      C) 8                      D) 7                      E) 3

- 48) What is the sum of the coefficients when the following equation is balanced? 48) \_\_\_\_\_  

$$\text{H}_2\text{SO}_3 + \text{Al}(\text{OH})_3 \rightarrow \text{Al}_2(\text{SO}_3)_3 + \text{H}_2\text{O}$$
A) 14                      B) 5                      C) 4                      D) 11                      E) 12
- 49) Write the complete balanced equation for the complete combustion reaction expected to occur between  $\text{C}_3\text{H}_7\text{OH}$  and  $\text{O}_2$ . 49) \_\_\_\_\_  
A)  $2 \text{C}_3\text{H}_7\text{OH} + 9 \text{O}_2 \rightarrow 6 \text{CO}_2 + 8 \text{H}_2\text{O} + 9 \text{C}$   
B)  $\text{C}_3\text{H}_7\text{OH} + \text{O}_2 \rightarrow 3 \text{CO}_2 + 4 \text{H}_2\text{O}$   
C)  $2 \text{C}_3\text{H}_7\text{OH} + 6 \text{O}_2 \rightarrow \text{CO} + 8 \text{H}_2\text{O}$   
D)  $2 \text{C}_3\text{H}_7\text{OH} + 9 \text{O}_2 \rightarrow 6 \text{C} + 8 \text{H}_2 + 10 \text{O}_2$   
E)  $2 \text{C}_3\text{H}_7\text{OH} + 9 \text{O}_2 \rightarrow 6 \text{CO}_2 + 8 \text{H}_2\text{O}$
- 50) What is the sum of the coefficients in the balanced equation that represents the complete combustion of the relatively new gasoline additive "MTBE," for which the molecular formula is  $\text{C}_5\text{H}_{12}\text{O}$ ? 50) \_\_\_\_\_  
A) 37                      B) 39                      C) 29                      D) 20                      E) 24
- 51) Which of the following reactions is NOT an oxidation-reduction reaction? 51) \_\_\_\_\_  
A)  $6 \text{HF} + \text{Al}(\text{OH})_3 + 3 \text{NaOH} \rightarrow \text{Na}_3\text{AlF}_6 + 6 \text{H}_2\text{O}$   
B)  $\text{MnO}_4^- (\text{aq}) + 5 \text{Fe}^{2+} (\text{aq}) + 8 \text{H}^+ \rightarrow 5 \text{Fe}^{3+} (\text{aq}) + \text{Mn}^{2+} (\text{aq}) + 4 \text{H}_2\text{O}(\text{l})$   
C)  $2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{H}_2\text{O}(\text{l})$   
D)  $\text{Au}(\text{s}) + 4 \text{H}^+ + \text{NO}_3^- + 4 \text{Cl}^- \rightarrow [\text{AuCl}_4]^- + 2 \text{H}_2\text{O} + \text{NO}(\text{g})$   
E)  $\text{IO}_3^- (\text{aq}) + 3 \text{HSO}_3^- (\text{aq}) \rightarrow \text{I}^- (\text{aq}) + 3 \text{SO}_4^{2-} (\text{aq}) + 3 \text{H}^+ (\text{aq})$
- 52) Which of the following reactions is NOT an oxidation-reduction reaction? 52) \_\_\_\_\_  
A)  $\text{Zn}(\text{s}) + \text{Cr}_2\text{O}_7^{2-} (\text{aq}) \rightarrow \text{Zn}^{2+} (\text{aq}) + \text{Cr}^{2+} (\text{aq})$   
B)  $5 \text{Fe}^{2+} (\text{aq}) + \text{MnO}_4^- (\text{aq}) + 8 \text{H}^+ (\text{aq}) \rightarrow 5 \text{Fe}^{3+} (\text{aq}) + \text{Mn}^{2+} (\text{aq}) + 4 \text{H}_2\text{O}$   
C)  $2 \text{H}_2\text{O}_2(\text{aq}) \rightarrow 2 \text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$   
D)  $5 \text{I}^- (\text{aq}) + \text{IO}_3^- (\text{aq}) + 6 \text{H}^+ (\text{aq}) \rightarrow 3 \text{I}_2(\text{s}) + 3 \text{H}_2\text{O}$   
E)  $\text{BaCl}(\text{aq}) + \text{NaSO}_4(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + \text{NaCl}(\text{aq})$
- 53) Which of the following reactions is an oxidation-reduction reaction? 53) \_\_\_\_\_  
A)  $2 \text{NaHCO}_3(\text{s}) \rightarrow \text{Na}_2\text{CO}_3(\text{s}) + \text{H}_2\text{O}(\text{g}) + \text{CO}_2(\text{g})$   
B)  $\text{N}_2\text{O}_4(\text{g}) \rightarrow 2 \text{NO}_2(\text{g})$   
C)  $2 \text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2 \text{SO}_3(\text{g})$   
D)  $\text{NH}_4\text{HS}(\text{s}) \rightarrow \text{NH}_3(\text{g}) + \text{H}_2\text{S}(\text{g})$   
E)  $2 \text{CH}_3\text{COOH}(\text{aq}) + \text{Ba}(\text{OH})_2(\text{aq}) \rightarrow \text{Ba}(\text{CH}_3\text{COO})_2(\text{aq}) + 2 \text{H}_2\text{O}(\text{l})$
- 54) In which of the following pairs is the oxidation number for the underlined element INCORRECT? 54) \_\_\_\_\_  
A) FeO/2  
B) Mg(OH)<sub>2</sub>/3  
C) IO<sub>3</sub><sup>-</sup>/5  
D) CO<sub>3</sub><sup>2-</sup>/4  
E) BrO<sub>4</sub><sup>-</sup>/7

- 55) Which of the following reactions is an oxidation–reduction reaction? 55) \_\_\_\_\_
- A)  $\text{HCl(aq)} + \text{NaH}_2\text{PO}_4\text{(aq)} \rightarrow \text{H}_3\text{PO}_4\text{(aq)} + \text{NaCl(aq)}$   
 B)  $2 \text{H}_2\text{O(l)} \rightarrow \text{H}_3\text{O}^+\text{(aq)} + \text{OH}^-\text{(aq)}$   
 C)  $\text{CO(g)} + \text{H}_2\text{O(g)} \rightarrow \text{CO}_2\text{(g)} + \text{H}_2\text{(g)}$   
 D)  $\text{Mg(OH)}_2\text{(s)} \rightarrow \text{Mg}^{2+}\text{(aq)} + 2 \text{OH}^-\text{(aq)}$   
 E)  $\text{NH}_3\text{(g)} + \text{H}_2\text{O(l)} \rightarrow \text{NH}_4\text{OH(aq)}$
- 56) Which of the following statements is FALSE with respect to the oxidation state of the underlined species? 56) \_\_\_\_\_
- A) Mn $\text{O}_4^{2-}/+6$   
 B) S $\text{O}_3^{2-}/+2$   
 C) H $\text{P} $\text{O}_4/+5$   
 D) C $\text{H}_{12}\text{O}_6/0$   
 E) Cr $\text{O}_7^{2-}/+7$$
- 57) Write the net ionic equation for the reaction of barium chloride and sodium sulfate. 57) \_\_\_\_\_
- A)  $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4\text{(aq)}$   
 B)  $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4\text{(s)}$   
 C)  $\text{BaCl(aq)} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4\text{(s)} + \text{Ba}^{2+}$   
 D)  $\text{BaCl(aq)} + \text{NaSO}_4\text{(aq)} \rightarrow \text{BaSO}_4\text{(s)} + \text{NaCl(aq)}$   
 E) no reaction
- 58) Write the net ionic equation for the reaction of lead(II) nitrate and sodium iodide. 58) \_\_\_\_\_
- A)  $\text{Pb(NO}_3)_2\text{(aq)} + 2\text{NaI(aq)} \rightarrow \text{PbI}_2\text{(s)} + 2 \text{NaNO}_3\text{(aq)}$   
 B)  $\text{Pb}^{2+} + 2 \text{I}^- \rightarrow \text{PbI}_2 + 2 \text{I}^-$   
 C)  $\text{Pb}^{2+} + 2 \text{NaI(aq)} \rightarrow \text{PbI}_2\text{(s)} + 2 \text{Na}$   
 D)  $\text{Pb}^{2+} + 2 \text{I}^- \rightarrow \text{PbI}_2\text{(s)}$   
 E) no reaction
- 59) Write the net ionic equation for the reaction of magnesium carbonate and nitric acid. 59) \_\_\_\_\_
- A)  $\text{Mg}^{2+} + \text{CO}_3^{2-} + 2 \text{H}^+ \rightarrow \text{Mg}^{2+} + \text{H}_2\text{O} + \text{CO}_2\text{(g)}$   
 B)  $\text{MgCO}_3\text{(s)} + 2 \text{HNO}_3\text{(aq)} \rightarrow \text{Mg(NO}_3)_2\text{(aq)} + \text{H}_2\text{CO}_3\text{(aq)}$   
 C)  $\text{MgCO}_3\text{(s)} + 2 \text{HNO}_3\text{(aq)} \rightarrow \text{Mg(NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2\text{(g)}$   
 D)  $\text{MgCO}_3\text{(s)} + 2 \text{H}^+ \rightarrow \text{Mg}^{2+} + \text{H}_2\text{O} + \text{CO}_2\text{(g)}$   
 E) no reaction
- 60) Write the net ionic equation for the reaction of ammonium chloride and potassium hydroxide. 60) \_\_\_\_\_
- A)  $\text{NH}_4\text{Cl(aq)} + \text{OH}^- \rightarrow \text{NH}_3\text{(g)} + \text{Cl}^- + \text{H}_2\text{O}$   
 B)  $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3\text{(g)} + \text{H}_2\text{O}$   
 C)  $\text{NH}_4^+ + \text{KOH} \rightarrow \text{NH}_4\text{OH(aq)} + \text{K}^+$   
 D)  $\text{NH}_4\text{Cl(aq)} + \text{KOH(aq)} \rightarrow \text{NH}_3\text{(g)} + \text{KCl(aq)} + \text{H}_2\text{O}$   
 E) no reaction



- 61) Write the net ionic equation for the reaction of ammonium chloride and iron(III) hydroxide. 61) \_\_\_\_\_  
 A)  $3 \text{NH}_4^+ + 3 \text{OH}^- \rightarrow 3 \text{NH}_3(\text{g}) + 3 \text{H}_2\text{O}$   
 B)  $3 \text{NH}_4^+ + \text{Fe}(\text{OH})_3(\text{s}) \rightarrow 3 \text{NH}_3(\text{g}) + 3 \text{H}_2\text{O} + \text{Fe}^{3+}$   
 C)  $3 \text{NH}_4\text{Cl}(\text{aq}) + \text{Fe}(\text{OH})_3(\text{s}) \rightarrow 3 \text{NH}_3(\text{g}) + 3 \text{H}_2\text{O} + \text{FeCl}_3$   
 D)  $3 \text{NH}_4\text{Cl}(\text{aq}) + 3 \text{OH}^- \rightarrow 3 \text{NH}_3(\text{g}) + 3 \text{H}_2\text{O} + 3 \text{Cl}^-$   
 E) no reaction
- 62) For the reaction between aqueous potassium hydroxide and aqueous nitric acid, the so-called "spectator" ions are: 62) \_\_\_\_\_  
 A)  $\text{H}^+$  and  $\text{NO}_3^-$   
 B)  $\text{K}^+$  and  $\text{NO}_3^-$   
 C)  $\text{H}^+$  and  $\text{OH}^-$   
 D)  $\text{K}^+$  and  $\text{OH}^-$   
 E) none of these
- 63) How many electrons are transferred when the perchlorate ion is converted to chloride? 63) \_\_\_\_\_  
 A) 7                                      B) 9                                      C) 8                                      D) 6
- 64) When the following equation is completed and balanced for the reaction in acidic solution, what is the proper coefficient for  $\text{H}^+$ ? 64) \_\_\_\_\_  
 $\text{Zn}(\text{s}) + \text{Cr}_2\text{O}_7^{2-}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cr}^{2+}(\text{aq})$   
 A) 22                                      B) 14                                      C) 18                                      D) 7                                      E) 11
- 65) What is the proper coefficient for water when the following equation is completed and balanced for the reaction in basic solution? 65) \_\_\_\_\_  
 $\text{C}_2\text{O}_4^{2-}(\text{aq}) + \text{MnO}_4^-(\text{aq}) \rightarrow \text{CO}_3^{2-}(\text{aq}) + \text{MnO}_2(\text{s})$   
 A) 0                                      B) 4                                      C) 2                                      D) 1                                      E) 3
- 66) Balance the following equation for an oxidation-reduction reaction occurring in an acidic solution: 66) \_\_\_\_\_  
 $\text{HCl} + \text{H}_2\text{C}_2\text{O}_4 + \text{MnO}_2(\text{s}) \rightarrow \text{MnCl}_2 + \text{CO}_2(\text{g}) + \text{H}_2\text{O}$   
 The sum of the coefficients is:  
 A) 7                                      B) 15                                      C) 45                                      D) 9                                      E) 12
- 67) Balance the following equation for an oxidation-reduction reaction occurring in an acidic solution: 67) \_\_\_\_\_  
 $\text{CuS}(\text{s}) + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{NO}(\text{g}) + \text{S}(\text{s})$   
 The sum of the coefficients is:  
 A) 18                                      B) 35                                      C) 33                                      D) 45                                      E) 23
- 68) Balance the following equation for an oxidation-reduction reaction occurring in an acidic solution: 68) \_\_\_\_\_  
 $\text{HNO}_3 + \text{I}_2 \rightarrow \text{HIO}_3 + \text{NO}_2 + \text{H}_2\text{O}$   
 The sum of the coefficients is:  
 A) 33                                      B) 45                                      C) 27                                      D) 28                                      E) 26
- 69) Balance the following equation for an oxidation-reduction reaction occurring in an acidic solution: 69) \_\_\_\_\_  
 $\text{ClO}_4^- + \text{SO}_3^{2-} \rightarrow \text{SO}_4^{2-} + \text{Cl}^-$   
 The sum of the coefficients is:  
 A) 6                                      B) 12                                      C) 4                                      D) 10                                      E) 8

- 70) Balance the following equation for an oxidation–reduction reaction occurring in an acidic solution: 70) \_\_\_\_\_  

$$\text{IO}_3^- + \text{N}_2\text{H}_4 \rightarrow \text{I}^- + \text{N}_2 + \text{H}_2\text{O}$$
 The sum of the coefficients is:  
 A) 25                      B) 32                      C) 8                      D) 16                      E) 18
- 71) Balance the following oxidation–reduction reaction in acid solution: 71) \_\_\_\_\_  

$$\text{SO}_3^{2-} + \text{MnO}_4^- \rightarrow \text{SO}_4^{2-} + \text{Mn}^{2+} + \text{H}_2\text{O}$$
 The sum of the coefficients is:  
 A) 28                      B) 23                      C) 30                      D) 13                      E) 45
- 72) Balance the following oxidation–reduction reaction in acid solution: 72) \_\_\_\_\_  

$$\text{Fe(s)} \rightarrow \text{Fe}^{2+} + \text{H}_2\text{(g)}$$
 The sum of the coefficients is:  
 A) 5                      B) 8                      C) 2                      D) 9                      E) 7
- 73) Balance the following oxidation–reduction reaction in acid solution: 73) \_\_\_\_\_  

$$\text{MnO}_4^- + \text{H}_2\text{C}_2\text{O}_4 \rightarrow \text{Mn}^{2+} + \text{CO}_2 + \text{H}_2\text{O}$$
 The sum of the coefficients is:  
 A) 18                      B) 25                      C) 21                      D) 47                      E) 33
- 74) Balance the following equation in basic solution: 74) \_\_\_\_\_  

$$\text{Br}_2 + \text{Mn}^{2+} \rightarrow \text{MnO}_2 + \text{Br}^-$$
 The sum of the coefficients is:  
 A) 15                      B) 12                      C) 8                      D) 17                      E) 11
- 75) Balance the following equation in basic solution: 75) \_\_\_\_\_  

$$\text{Cr}^{3+} + \text{O}_2^{2-} \rightarrow \text{CrO}_4^{2-}$$
 The sum of the coefficients is:  
 A) 38                      B) 53                      C) 49                      D) 18                      E) 27
- 76) What is the sum of all coefficients in the complete and balanced net equation for the reaction occurring when chlorine gas is bubbled through aqueous sodium hydroxide to form aqueous sodium hypochlorite (NaOCl) and sodium chloride? 76) \_\_\_\_\_  
 A) 6                      B) 11                      C) 15                      D) 10                      E) 8
- 77) Balance the following equation in basic solution: 77) \_\_\_\_\_  

$$\text{KMnO}_4\text{(aq)} + \text{H}_2\text{S(g)} \rightarrow \text{MnO}_2\text{(s)} + \text{KOH(aq)} + \text{H}_2\text{O(l)}$$
 The sum of the coefficients is:  
 A) 17                      B) 14                      C) 8                      D) 21                      E) 19
- 78) Balance the following equation in basic solution: 78) \_\_\_\_\_  

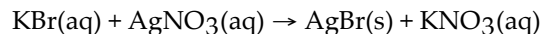
$$\text{Al(s)} + \text{O}_2\text{(g)} \rightarrow [\text{Al(OH)}_4]^-$$
 The sum of the coefficients is:  
 A) 25                      B) 12                      C) 6                      D) 33                      E) 21

- 79) Gold does not react with either nitric acid or hydrochloric acid but with a combination of both called aqua regia. Identify the reducing agent in the following equation: 79) \_\_\_\_\_
- $$\text{Au(s)} + 4 \text{H}^+ + \text{NO}_3^- + 4 \text{Cl}^- \rightarrow [\text{AuCl}_4]^- + 2 \text{H}_2\text{O} + \text{NO(g)}$$
- A) Au  
 B) H<sup>+</sup>  
 C) Cl<sup>-</sup>  
 D) NO<sub>3</sub><sup>-</sup>  
 E) The reaction is not a redox reaction.
- 80) Gold does not react with either nitric acid or hydrochloric acid but with a combination of both called aqua regia. Identify the oxidizing agent in the following equation: 80) \_\_\_\_\_
- $$\text{Au(s)} + 4 \text{H}^+ + \text{NO}_3^- + 4 \text{Cl}^- \rightarrow [\text{AuCl}_4]^- + 2 \text{H}_2\text{O} + \text{NO(g)}$$
- A) NO<sub>3</sub><sup>-</sup>  
 B) Au  
 C) H<sup>+</sup>  
 D) Cl<sup>-</sup>  
 E) The reaction is not a redox reaction.
- 81) The analysis for iron usually is done by titration with permanganate. Identify the oxidizing agent in the following equation: 81) \_\_\_\_\_
- $$\text{MnO}_4^- (\text{aq}) + 5 \text{Fe}^{2+} (\text{aq}) + 8 \text{H}^+ \rightarrow 5 \text{Fe}^{3+} (\text{aq}) + \text{Mn}^{2+} (\text{aq}) + 4 \text{H}_2\text{O}$$
- A) Mn<sup>2+</sup>  
 B) Fe<sup>2+</sup>  
 C) MnO<sub>4</sub><sup>-</sup>  
 D) H<sup>+</sup>  
 E) It is not a redox reaction.
- 82) Identify the reducing agent in the following reaction: 82) \_\_\_\_\_
- $$2 \text{NO}_2(\text{g}) + 7 \text{H}_2(\text{g}) \rightarrow 2 \text{NH}_3(\text{g}) + 4 \text{H}_2\text{O}(\text{g})$$
- A) NH<sub>3</sub>  
 B) H<sub>2</sub>  
 C) H<sub>2</sub>O  
 D) NO<sub>2</sub>  
 E) There is no reducing agent.
- 83) Give the **complete ionic equation** for the reaction (if any) that occurs when aqueous solutions of lithium sulfide and copper (II) nitrate are mixed. (the superscripts below aren't really acceptable on most of the ions, I don't know how to make it any better) 83) \_\_\_\_\_
- A)  $2 \text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2 \text{NO}_3^-(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) + 2 \text{LiNO}_3(\text{s})$   
 B)  $\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{CuS}(\text{s}) + \text{LiNO}_3(\text{aq})$   
 C)  $\text{Li}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq}) \rightarrow \text{CuS}(\text{s}) + \text{Li}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
 D)  $2 \text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2 \text{NO}_3^-(\text{aq}) \rightarrow \text{CuS}(\text{s}) + 2 \text{Li}^+(\text{aq}) + 2 \text{NO}_3^-(\text{aq})$   
 E) No reaction occurs.

- 84) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of  $K_2S$  and  $Fe(NO_3)_2$  are mixed. 84) \_\_\_\_\_
- A)  $Fe^{2+}(aq) + S^{2-}(aq) \rightarrow FeS(s)$   
 B)  $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(s)$   
 C)  $Fe^{2+}(aq) + S^{2-}(aq) + 2 K^+(aq) + 2 NO_3^-(aq) \rightarrow Fe^{2+}(aq) + S^{2-}(aq) + 2 KNO_3(s)$   
 D)  $Fe^{2+}(aq) + S^{2-}(aq) + 2 K^+(aq) + 2 NO_3^-(aq) \rightarrow FeS(s) + 2 K^+(aq) + 2 NO_3^-(aq)$   
 E) No reaction occurs.
- 85) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of  $H_2SO_4$  and  $KOH$  are mixed. 85) \_\_\_\_\_
- A)  $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$   
 B)  $H^+(aq) + OH^-(aq) + 2 K^+(aq) + SO_4^{2-}(aq) \rightarrow H_2O(l) + K_2SO_4(s)$   
 C)  $H_2^{2+}(aq) + OH^-(aq) \rightarrow H_2(OH)_2(l)$   
 D)  $2 K^+(aq) + SO_4^{2-}(aq) \rightarrow K_2SO_4(s)$   
 E) No reaction occurs.
- 86) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of  $Al(C_2H_3O_2)_3$  and  $LiNO_3$  are mixed. 86) \_\_\_\_\_
- A)  $Al^{3+}(aq) + 3 NO_3^-(aq) + Li^+(aq) + C_2H_3O_2^-(aq) \rightarrow Al(NO_3)_3(aq) + LiC_2H_3O_2(s)$   
 B)  $Al^{3+}(aq) + 3 NO_3^-(aq) \rightarrow Al(NO_3)_3(s)$   
 C)  $Li^+(aq) + C_2H_3O_2^-(aq) \rightarrow LiC_2H_3O_2(s)$   
 D)  $3 Li^+(aq) + (C_2H_3O_2)_3^{3-}(aq) \rightarrow Li_3(C_2H_3O_2)_3(s)$   
 E) No reaction occurs.
- 87) Give the **net ionic equation** for the reaction (if any) that occurs when aqueous solutions of  $Na_2CO_3$  and  $HCl$  are mixed. 87) \_\_\_\_\_
- A)  $2 H^+(aq) + CO_3^{2-}(aq) \rightarrow H_2CO_3(s)$   
 B)  $2 Na^+(aq) + CO_3^{2-}(aq) + 2 H^+(aq) + 2 Cl^-(aq) \rightarrow H_2CO_3(s) + 2 Na^+(aq) + 2 Cl^-(aq)$   
 C)  $2 Na^+(aq) + CO_3^{2-}(aq) + 2 H^+(aq) + 2 Cl^-(aq) \rightarrow H_2CO_3(s) + 2 NaCl(aq)$   
 D)  $2 H^+(aq) + CO_3^{2-}(aq) \rightarrow H_2O(l) + CO_2(g)$   
 E) No reaction occurs.
- 88) Give the **complete ionic equation** for the reaction (if any) that occurs when aqueous solutions of  $MgSO_3$  and  $HI$  are mixed. 88) \_\_\_\_\_
- A)  $2 H^+(aq) + SO_3^{2-}(aq) + Mg^{2+}(aq) + 2 I^-(aq) \rightarrow H_2SO_3(s) + MgI_2(aq)$   
 B)  $Mg^{2+}(aq) + 2 I^-(aq) \rightarrow MgI_2(s)$   
 C)  $2 H^+(aq) + SO_3^{2-}(aq) \rightarrow H_2SO_3(s)$   
 D)  $2 H^+(aq) + SO_3^{2-}(aq) \rightarrow H_2O(l) + SO_2(g)$   
 E) No reaction occurs.

89) Identify the spectator ions in the following molecular equation.

89) \_\_\_\_\_



- A)  $\text{K}^+$  &  $\text{NO}_3^-$
- B)  $\text{Ag}^+$  &  $\text{NO}_3^-$
- C)  $\text{K}^+$  &  $\text{Br}^-$
- D)  $\text{Ag}^+$  &  $\text{Br}^-$
- E) There are no spectator ions in this reaction.

90) Which of the following is an acid base reaction?

90) \_\_\_\_\_

- A)  $\text{C(s)} + \text{O}_2\text{(g)} \rightarrow \text{CO}_2\text{(g)}$
- B)  $\text{Fe(s)} + 2 \text{AgNO}_3\text{(aq)} \rightarrow 2 \text{Ag(s)} + \text{Fe(NO}_3)_2\text{(aq)}$
- C)  $\text{MgSO}_4\text{(aq)} + \text{Ba(NO}_3)_2\text{(aq)} \rightarrow \text{Mg(NO}_3)_2\text{(aq)} + \text{BaSO}_4\text{(s)}$
- D)  $2 \text{HClO}_4\text{(aq)} + \text{Ca(OH)}_2\text{(aq)} \rightarrow 2 \text{H}_2\text{O(l)} + \text{Ca(ClO}_4)_2\text{(aq)}$
- E) None of the above are acid base reactions.

91) Which of the following is a precipitation reaction?

91) \_\_\_\_\_

- A)  $\text{Zn(s)} + 2 \text{AgNO}_3\text{(aq)} \rightarrow 2 \text{Ag(s)} + \text{Zn(NO}_3)_2\text{(aq)}$
- B)  $2 \text{LiI(aq)} + \text{Hg}_2\text{(NO}_3)_2\text{(aq)} \rightarrow \text{Hg}_2\text{I}_2\text{(s)} + 2 \text{LiNO}_3\text{(aq)}$
- C)  $\text{NaCl(aq)} + \text{LiI(aq)} \rightarrow \text{NaI(aq)} + \text{LiCl(aq)}$
- D)  $\text{HCl(aq)} + \text{KOH(aq)} \rightarrow \text{KCl(aq)} + \text{H}_2\text{O(l)}$
- E) None of the above are precipitation reactions.

92) Which of the following is a gas-evolution reaction?

92) \_\_\_\_\_

- A)  $\text{LiCl(aq)} + \text{NaNO}_3\text{(aq)} \rightarrow \text{LiNO}_3\text{(aq)} + \text{NaCl(g)}$
- B)  $2 \text{C}_2\text{H}_6\text{(l)} + 7 \text{O}_2\text{(g)} \rightarrow 4 \text{CO}_2\text{(g)} + 6 \text{H}_2\text{O(g)}$
- C)  $\text{NH}_4\text{Cl(aq)} + \text{KOH(aq)} \rightarrow \text{KCl(aq)} + \text{NH}_3\text{(g)} + \text{H}_2\text{O(l)}$
- D)  $2 \text{H}_2\text{(g)} + \text{O}_2\text{(g)} \rightarrow 2 \text{H}_2\text{O(g)}$
- E) None of the above are gas-evolution reactions.

93) Which of the following is an oxidation-reduction reaction?

93) \_\_\_\_\_

- A)  $\text{Pb(C}_2\text{H}_3\text{O}_2)_2\text{(aq)} + 2 \text{NaCl(aq)} \rightarrow \text{PbCl}_2\text{(s)} + 2 \text{NaC}_2\text{H}_3\text{O}_2\text{(aq)}$
- B)  $\text{Mg(s)} + 2 \text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$
- C)  $\text{HCl(aq)} + \text{LiOH(aq)} \rightarrow \text{LiCl(aq)} + \text{H}_2\text{O(l)}$
- D)  $\text{NaI(aq)} + \text{AgNO}_3\text{(aq)} \rightarrow \text{AgI(s)} + \text{NaNO}_3\text{(aq)}$
- E) All of the above are oxidation-reduction reactions.

94) Determine the oxidation state of P in  $\text{PO}_3^{3-}$ .

94) \_\_\_\_\_

- A) 0
- B) +6
- C) +3
- D) -3
- E) +2

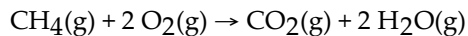
95) Determine the oxidation state of Sn in  $\text{Sn(SO}_4)_2$ .

95) \_\_\_\_\_

- A) +2
- B) 0
- C) +6
- D) +4
- E) -2

96) What element is undergoing oxidation (if any) in the following reaction?

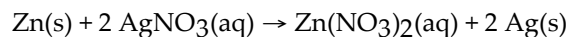
96) \_\_\_\_\_



- A) H
- B) O
- C) C
- D) both C and H
- E) None of the elements is undergoing oxidation.

97) What element is undergoing reduction (if any) in the following reaction?

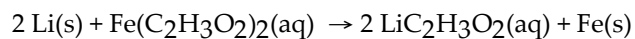
97) \_\_\_\_\_



- A) Zn
- B) Ag
- C) O
- D) N
- E) This is not an oxidation-reduction reaction.

98) Determine the reducing agent in the following reaction.

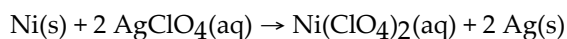
98) \_\_\_\_\_



- A) Fe
- B) Li
- C) H
- D) C
- E) O

99) Determine the oxidizing agent in the following reaction.

99) \_\_\_\_\_



- A) Cl
- B) O
- C) Ag
- D) Ni
- E) This is not an oxidation-reduction reaction.