

# T18Q1: Level 2 (L.G. 9)

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Give the **complete ionic equation** for the reaction that occurs when aqueous solutions of lithium sulfide and copper (II) nitrate are mixed:

- A.  $\text{Li}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + \text{Li}^+(\text{aq}) + \text{NO}_3(\text{aq})$
- B.  $\text{Li}^+(\text{aq}) + \text{S}^-(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + \text{LiNO}_3(\text{aq})$
- C.  $2\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq})$   
→  $\text{Cu}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) + 2\text{LiNO}_3(\text{s})$
- D.  $2\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + 2\text{Li}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq})$

# T18Q1: Solution

Give the **complete ionic equation** for the reaction that occurs when aqueous solutions of lithium sulfide and copper (II) nitrate are mixed:

- A.  $\text{Li}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + \text{Li}^+(\text{aq}) + \text{NO}_3(\text{aq})$
- B.  $\text{Li}^+(\text{aq}) + \text{S}^-(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + \text{LiNO}_3(\text{aq})$
- C.  $2\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq})$   
→  $\text{Cu}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) + 2\text{LiNO}_3(\text{s})$
- D.  $2\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + 2\text{Li}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq})$

**Complete Ionic Equation:**  
**contains the solids and ALL the ionic species**

# T18Q2: Level 2 (L.G. 9)

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Give the net ionic equation for the reaction that occurs when aqueous solutions of barium nitrate and ammonium phosphate are mixed:

- A.  $3\text{Ba}(\text{NO}_3)_2(\text{aq}) + 2(\text{NH}_4)_3\text{PO}_4(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{NH}_4\text{NO}_3(\text{aq})$
- B.  $3\text{Ba}(\text{NO}_3)_2(\text{aq}) + 2(\text{NH}_4)_3\text{PO}_4(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{aq}) + 6\text{NH}_4\text{NO}_3(\text{s})$
- C.  $2\text{NO}_3^-(\text{aq}) + 6\text{NH}_4^+(\text{aq}) \rightarrow 6\text{NH}_4\text{NO}_3(\text{s})$
- D.  $3\text{Ba}^{2+}(\text{aq}) + 2\text{PO}_4^-(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s})$
- E.  $2\text{NO}_3^-(\text{aq}) + 6\text{NH}_4^+(\text{aq}) + 2\text{PO}_4^-(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq})$

# T18Q2: Solution

Give the net ionic equation for the reaction that occurs when aqueous solutions of barium nitrate and ammonium phosphate are mixed:

- A.  $3\text{Ba}(\text{NO}_3)_2(\text{aq}) + 2(\text{NH}_4)_3\text{PO}_4(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{NH}_4\text{NO}_3(\text{aq})$
- B.  $3\text{Ba}(\text{NO}_3)_2(\text{aq}) + 2(\text{NH}_4)_3\text{PO}_4(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{aq}) + 6\text{NH}_4\text{NO}_3(\text{s})$
- C.  $2\text{NO}_3^-(\text{aq}) + 6\text{NH}_4^+(\text{aq}) \rightarrow 6\text{NH}_4\text{NO}_3(\text{s})$
- D.  $3\text{Ba}^{2+}(\text{aq}) + 2\text{PO}_4^{2-}(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s})$
- E.  $2\text{NO}_3^-(\text{aq}) + 6\text{NH}_4^+(\text{aq}) + 2\text{PO}_4^{2-}(\text{aq}) \rightarrow \text{Ba}_3(\text{PO}_4)_2(\text{s}) + 6\text{NH}_4^+(\text{aq}) + \text{NO}_3^-(\text{aq})$

**Net Ionic Equation:**

**Only the species that ACTUALLY react to form a solid!**

**All  $\text{NH}_4^+$  and  $\text{NO}_3^-$  ion salts are soluble so any species with those ions will cancel out**

# T18Q3: Level 3 (L.G. 10)

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Consider the decomposition of calcium carbonate to form calcium oxide and carbon dioxide. If the reaction produced 732 mL of  $\text{CO}_2$  at 21°C and 77.1 cm Hg, how many grams of CaO are produced?

- A. 0.21 g
- B. 1.73 g
- C. 1.86 g
- D. 3.10 g
- E. 17.2 g

# T18Q3: Solution

Consider the decomposition of calcium carbonate to form calcium oxide and carbon dioxide. If the reaction produced 732 mL of CO<sub>2</sub> at 21°C and 77.1 cm Hg, how many grams of CaO are produced?

- A. 0.21 g
- B. 1.73 g
- C. 1.86 g
- D. 3.10 g
- E. 17.2 g



2

$$PV = nRT$$

$$n = PV/RT$$

$$\begin{aligned} &= (1.01 \text{ atm})(0.732\text{L})/(0.082 \text{ L-atm/mol-K})(294 \text{ K}) \\ &= 0.031 \text{ moles} \end{aligned}$$

3

1:1 mole ratio  
0.031 moles CaO

4

$$\begin{aligned} &0.031 \text{ moles CaO} \times 56.08 \text{ g/mol} \\ &= 1.73 \text{ grams} \end{aligned}$$

$$77.1 \text{ cm Hg} = 1.01 \text{ atm}$$

$$21^\circ\text{C} = 294 \text{ K}$$

# T18Q4: Level 3 (L.G. 10)

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Consider the reaction between 100 mL of 0.41 M iron(II) nitrate with 63 mL of 0.35M potassium phosphate. How many moles of precipitate are formed from this reaction?

- A. 0.011
- B. 0.014
- C. 0.022
- D. 0.041

# T18Q4: Solution

Consider the reaction between 100 mL of 0.41 M iron(II) nitrate with 63 mL of 0.35M potassium phosphate. How many moles of precipitate are formed from this reaction?



- A. 0.011
- B. 0.014
- C. 0.022
- D. 0.041

2

$$\text{M} = \frac{\text{moles of Solute}}{\text{volume of Solution (L)}}$$

$$\text{moles} = \text{M} \times \text{vol (L)}$$

$3\text{Fe}(\text{NO}_3)_2$	$2\text{K}_3\text{PO}_4$
$0.41 \text{ M} \times 0.100 \text{ L} = 0.041 \text{ mol}$	$0.35 \text{ M} \times 0.063 \text{ L} = 0.0221 \text{ mol}$
$0.041 \times (1/3)$ $= 0.014 \text{ mol } \text{Fe}_3(\text{PO}_4)_2$	$0.0221 \times (1/2)$ $= 0.011 \text{ mol } \text{Fe}_3(\text{PO}_4)_2$

3 LR  
calcs

# T18Q5: Level 3 (L.G. 10)

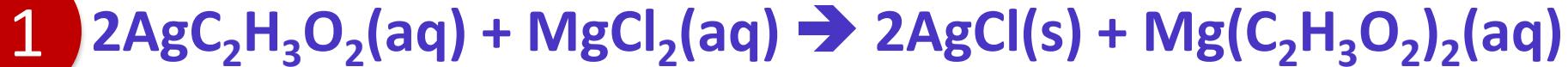
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What mass, in g, of AgCl is formed from the reaction of 75.0 mL of a 0.078 M  $\text{AgC}_2\text{H}_3\text{O}_2$  solution with 55.0 mL of 0.109 M  $\text{MgCl}_2$  solution?

- A. 0.860 g
- B. 1.72 g
- C. 2.56 g
- D. 3.20 g

# T18Q5: Solution

What mass, in g, of AgCl is formed from the reaction of 75.0 mL of a 0.078 M  $\text{AgC}_2\text{H}_3\text{O}_2$  solution with 55.0 mL of 0.109 M  $\text{MgCl}_2$  solution?



A. 0.860 g

B. 1.72 g

C. 2.56 g

D. 3.20 g

2

$$M \equiv \frac{\text{moles of solute}}{\text{volume of solution (L)}}$$

$$\text{moles} = M \times \text{vol (L)}$$



3

$$0.006 \times (2/2) = 0.006 \text{ mol AgCl}$$

$$0.006 \times (2/1) = 0.012 \text{ mol AgCl}$$

LR  
calcs

4

$$0.006 \text{ mol} \times (143.35 \text{ g / 1 mol}) = 0.86 \text{ g}$$

# T18Q6: Level 2 (L.G. 8)

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What precipitate is most likely formed from a solution containing  $\text{Ba}^{+2}$ ,  $\text{Na}^{+1}$ ,  $\text{OH}^{-1}$ , and  $\text{CO}_3^{-2}$ ?

- A.  $\text{NaOH}$
- B.  $\text{BaCO}_3$
- C.  $\text{Na}_2\text{CO}_3$
- D.  $\text{Ba(OH)}_2$

# T18Q6: Solution

What precipitate is most likely formed from a solution containing  $\text{Ba}^{+2}$ ,  $\text{Na}^{+1}$ ,  $\text{OH}^{-1}$ , and  $\text{CO}_3^{-2}$ ?

A.  $\text{NaOH}$  → Soluble, bc Na is a group 1 metal

B.  $\text{BaCO}_3$

C.  $\text{Na}_2\text{CO}_3$  → Soluble, bc Na is a group 1 metal

D.  $\text{Ba(OH)}_2$  → Slightly soluble, bc OH &  $\text{Ba}^{2+}$

2. Alkali metal (Group 1A) salts and  $\text{NH}_4^+$  are soluble.

3.  $\text{F}^-$ ,  $\text{S}^{2-}$ ,  $\text{CO}_3^{2-}$ ,  $\text{CrO}_4^{2-}$ ,  $\text{PO}_4^{3-}$  salts are insoluble, except for those containing Group 1A cations.

6. OH salts are insoluble (except for those containing Group 1A cations and  $\text{NH}_4^+$  which are soluble and those containing  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$  and  $\text{Ba}^{2+}$  which are slightly soluble).

# T18Q7: Level 3 (L.G. 8)

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How many of the following compounds are soluble in water?



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

# T18Q7: Solution

How many of the following compounds are soluble in water?



A. 0

**Soluble Soluble Soluble**

B. 1

1. Nitrate ( $\text{NO}_3^{-1}$ ) and acetate ( $\text{C}_2\text{H}_3\text{O}_2^{-1}$ ) salts are soluble.

C. 2

2. Alkali metal (Group 1A) salts and  $\text{NH}_4^+$  are soluble.

D. 3

4.  $\text{Cl}^{-1}$ ,  $\text{Br}^{-1}$ , and  $\text{I}^{-1}$  salts are soluble (except when combined with  $\text{Ag}^+$ ,  $\text{Hg}_2^{2+}$ ,  $\text{Pb}^{2+}$ ).

E. 4

5. Sulfate salts are soluble (except when combined with  $\text{Ag}^+$ ,  $\text{Hg}_2^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$  and  $\text{Ba}^{2+}$ ).

6.  $\text{OH}^{-1}$  salts are insoluble (except for those containing Group 1A cations and  $\text{NH}_4^+$  which are soluble and those containing  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$  and  $\text{Ba}^{2+}$  which are slightly soluble).

# T18Q8: Level 1 (L.G. 6)

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Choose the reaction that represents a combustion reaction:

- A.  $\text{C}_6\text{H}_{12}\text{O}_2(\text{l}) + 8\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- B.  $\text{Mg}(\text{s}) + \text{Cl}_2(\text{l}) \rightarrow \text{MgCl}_2(\text{aq})$
- C.  $\text{C}_6\text{H}_{12}\text{O}_2(\text{l}) \rightarrow 6\text{C}(\text{s}) + 6\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
- D.  $\text{NaOH}(\text{aq}) + \text{CuCl}_2(\text{aq}) \rightarrow \text{NaCl}_2(\text{aq}) + \text{Cu}(\text{OH})_2(\text{s})$
- E. None of the above are combustion

# T18Q8: Solution

Choose the reaction that represents a combustion reaction:

- A.  $\text{C}_6\text{H}_{12}\text{O}_2(\text{l}) + 8\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- B.  $\text{Mg}(\text{s}) + \text{Cl}_2(\text{l}) \rightarrow \text{MgCl}_2(\text{aq})$
- C.  $\text{C}_6\text{H}_{12}\text{O}_2(\text{l}) \rightarrow 6\text{C}(\text{s}) + 6\text{H}_2(\text{g}) + \text{O}_2(\text{g})$
- D.  $\text{NaOH}(\text{aq}) + \text{CuCl}_2(\text{aq}) \rightarrow \text{NaCl}_2(\text{aq}) + \text{Cu}(\text{OH})_2(\text{s})$
- E. None of the above are combustion

A = Combustion (reaction with oxygen)

B = Synthesis (combining things)

C = Decomposition (breaking down)

D = Double displacement (swapping ions)

# T18Q9: Level 2 (L.G. 9)

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Give the **complete ionic equation** for the reaction that occurs when aqueous solutions of lithium sulfide and copper (II) nitrate are mixed:

- A.  $\text{Li}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + \text{Li}^+(\text{aq}) + \text{NO}_3(\text{aq})$
- B.  $\text{Li}^+(\text{aq}) + \text{S}^-(\text{aq}) + \text{Cu}^+(\text{aq}) + \text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + \text{LiNO}_3(\text{aq})$
- C.  $2\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq})$   
→  $\text{Cu}^{2+}(\text{aq}) + \text{S}^{2-}(\text{aq}) + 2\text{LiNO}_3(\text{s})$
- D.  $2\text{Li}^+(\text{aq}) + \text{S}^{2-}(\text{aq}) + \text{Cu}^{2+}(\text{aq}) + 2\text{NO}_3^-(\text{aq})$   
→  $\text{CuS}(\text{s}) + 2\text{Li}^+(\text{aq}) + 2\text{NO}_3^-(\text{aq})$