

Solubility Multiple Choice

August 1998

13) In 0.20M Na_2CrO_4 , the ion concentrations are

	$[\text{Na}^+]$	$[\text{CrO}_4^{2-}]$
A	0.40M	0.20M
B	0.20M	0.20M
C	0.20M	0.40M
D	0.40M	0.80M

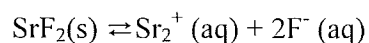
14) Which of the following compounds is the least soluble in water?

- A. H_2S
- B. KNO_3
- C. ZnSO_4
- D. $\text{Ca}(\text{OH})_2$

15) Which of the following 0.20M solutions will **not** form a precipitate when mixed with an equal volume of 0.20M $\text{Sr}(\text{OH})_2$?

- A. CaS
- B. NH_4Cl
- C. Na_2SO_4
- D. $\text{Ba}(\text{NO}_3)_2$

16) Consider the following equilibrium:



The equilibrium will shift left upon the addition of

- A. $\text{H}_2\text{O}(\text{l})$
- B. $\text{SrF}_2(\text{s})$
- C. $\text{SrCl}_2(\text{s})$
- D. $\text{NaNO}_3(\text{s})$

17) Two ions found in hard water are Ca^{2+} and Mg^{2+} . Which of the following will precipitate only one of these ions?

- A. I^{-}
- B. S^{2-}
- C. SO_4^{2-}
- D. CO_3^{2-}

18) At 25°C, the solubility of AgBr is

- A. $2.9 \times 10^{-25} \text{ M}$
- B. $5.4 \times 10^{-13} \text{ M}$
- C. $2.7 \times 10^{-13} \text{ M}$
- D. $7.3 \times 10^{-7} \text{ M}$

19) Which of the following saturated solutions has the greatest $[\text{CO}_3^{2-}]$?

- A. SrCO_3
- B. CaCO_3
- C. BaCO_3
- D. MgCO_3

January 1999

14. Which of the following units could be used to describe solubility?

- A. g/s
- B. g/L
- C. M/L
- D. mol/s

15. Consider the following anions:

	ANION
I.	10.0 mL of 0.20 M Cl^-
II.	10.0 mL of 0.20 M OH^-
III.	10.0 mL of 0.20 M SO_3^{2-}

When 10.0mL of 0.20M $\text{Pb}(\text{NO}_3)_2$ are added to each of the above, precipitates form in:

- A. I and II only.
- B. I and III only.
- C. II and III only.
- D. I, II and III.

16. When equal volumes of 0.20M CuSO_4 and 0.20M Li_2S are combined, the complete ionic equation is:

- A. $\text{Cu}^{2+}_{(aq)} + \text{S}^{2-}_{(aq)} \rightarrow \text{CuS}(s)$
- B. $\text{CuSO}_4(aq) + \text{Li}_2\text{S}(aq) \rightarrow \text{CuS}(s) + \text{Li}_2\text{SO}_4(aq)$
- C. $\text{Cu}^{2+}_{(aq)} + \text{SO}_4^{2-}_{(aq)} + 2\text{Li}^{+}_{(aq)} + \text{S}^{2-}_{(aq)} \rightarrow \text{Li}_2\text{SO}_4(aq) + \text{CuS}(s)$
- D. $\text{Cu}^{2+}_{(aq)} + \text{SO}_4^{2-}_{(aq)} + 2\text{Li}^{+}_{(aq)} + \text{S}^{2-}_{(aq)} \rightarrow \text{CuS}(s) + 2\text{Li}^{+}_{(aq)} + \text{SO}_4^{2-}_{(aq)}$

17. The K_{sp} expression for a saturated solution of Ag_2CO_3 is

- A. $K_{sp} = [\text{Ag}_2^+][\text{CO}_3^{2-}]$
- B. $K_{sp} = [\text{Ag}^+]^2[\text{CO}_3^{2-}]$
- C. $K_{sp} = [2\text{Ag}^+][\text{CO}_3^{2-}]$
- D. $K_{sp} = [2\text{Ag}^+]^2[\text{CO}_3^{2-}]$

18. The solubility of FeF_2 is $8.4 \times 10^{-3} \text{ M}$. The K_{sp} value is

- A. 5.9×10^{-7}
- B. 2.4×10^{-6}
- C. 7.1×10^{-5}
- D. 8.4×10^{-3}

19. If the Trial Ion Product for AgBrO_3 is calculated to be 1.0×10^{-7} , then

- A. a precipitate forms because the Trial Ion Product $> K_{sp}$
- B. a precipitate forms because the Trial Ion Product $< K_{sp}$
- C. no precipitate forms because the Trial Ion Product $> K_{sp}$
- D. no precipitate forms because the Trial Ion Product $< K_{sp}$

20. The least soluble salt in water is

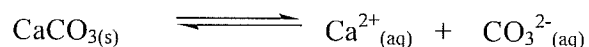
- A. CaS
- B. CaSO_4
- C. CaC_2O_4
- D. $\text{Ca}(\text{NO}_3)_2$

April 1999

14. Which of the following produces a molecular solution when dissolved in water?

- A. RbClO
- B. CH_3OH
- C. NH_4SCN
- D. NaCH_3COO

15. Consider the solubility equilibrium:



An additional piece of solid CaCO_3 is added to the equilibrium above. The rate of dissolving and rate of crystallization have

	RATE OF DISSOLVING	RATE OF CRYSTALLIZATION
A.	increased	increased
B.	increased	not changed
C.	not changed	increased
D.	not changed	not changed

16. At 25°C , which of the following compounds would dissolve to form a saturated solution with the greatest $[\text{Pb}^{2+}]$?

- A. PbI_2
- B. PbCl_2
- C. PbBr_2
- D. $\text{Pb}(\text{IO}_3)_2$

17. When equal volumes of 0.20M ZnSO_4 and 0.20M $\text{Sr}(\text{OH})_2$ are combined,

- A. no precipitate forms.
- B. a precipitate of only SrSO_4 forms.
- C. a precipitate of only $\text{Zn}(\text{OH})_2$ forms.
- D. precipitates of both SrSO_4 and $\text{Zn}(\text{OH})_2$ form.

18. The solubility of SnS is $3.2 \times 10^{-3}\text{M}$. The value of K_{sp} is

- A. 1.0×10^{-5}
- B. 3.2×10^{-3}
- C. 6.4×10^{-3}
- D. 5.7×10^{-2}

19. Silver chloride, AgCl , would be least soluble in

- A. 1.0M HCl
- B. 1.0M NaNO_3
- C. 1.0M ZnCl_2
- D. 1.0M AgNO_3

20. The solubility of SrF_2 is

- A. $4.3 \times 10^{-9} \text{ M}$
- B. $6.6 \times 10^{-5} \text{ M}$
- C. $1.0 \times 10^{-3} \text{ M}$
- D. $1.6 \times 10^{-3} \text{ M}$

June 1999

14. The ion concentrations in 2.00L of 0.32M K_3PO_4 are

	$[\text{K}^+]$	$[\text{PO}_4^{3-}]$
A.	0.16M	0.16M
B.	0.32M	0.32M
C.	0.48M	0.16M
D.	0.96M	0.32M

15. Which of the following compounds is the least soluble in water?

- A. CaS
- B. $\text{Fe}(\text{OH})_3$
- C. KMnO_4
- D. $\text{NH}_4\text{HC}_2\text{O}_4$

16. A solution contains two cations, each having a concentration of 0.20M. When an equal volume of 0.20M OH^- is added, these cations are removed from the solution by precipitation. These ions are:

- A. Ba^{2+} and K^+
- B. Sr^{2+} and Na^+
- C. Mg^{2+} and Sr^{2+}
- D. Mg^{2+} and Ca^{2+}

17. The solubility of $\text{Mn}(\text{IO}_3)_2$ is $4.8 \times 10^{-3} \text{ M}$. What is the value of K_{sp} ?

- A. 1.1×10^{-7}
- B. 4.4×10^{-7}
- C. 7.1×10^{-6}
- D. 1.1×10^{-1}

18. The maximum $[\text{SO}_4^{2-}]$ that can exist in $1.0 \times 10^{-3} \text{ M Ca(NO}_3)_2$ without a precipitate forming is:

- A. $7.1 \times 10^{-5} \text{ M}$
- B. $1.0 \times 10^{-3} \text{ M}$
- C. $8.4 \times 10^{-3} \text{ M}$
- D. $7.1 \times 10^{-2} \text{ M}$

August 1999

14. Consider the following solutes:

I.	K_3PO_4
II.	$\text{C}_2\text{H}_5\text{OH}$
III.	$\text{C}_{12}\text{H}_{22}\text{O}_{11}$
IV.	KCH_3COO

Which of the solutes above form only molecular aqueous solutions?

- A. I and II
- B. II and III
- C. II, III and IV
- D. I, II, III and IV

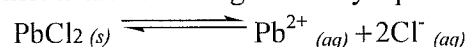
15. At a certain temperature, $7.0 \times 10^{-4} \text{ mol MgSO}_4$ is present in 100.0mL of solution. The concentration of the Mg^{2+} in this solution is

- A. $7.0 \times 10^{-5} \text{ M}$
- B. $7.0 \times 10^{-4} \text{ M}$
- C. $7.0 \times 10^{-3} \text{ M}$
- D. $7.0 \times 10^{-6} \text{ M}$

16. When equal volumes of 0.20M SrBr_2 and 0.20M AgNO_3 are combined,

- A. no precipitate forms.
- B. a precipitate of only AgBr forms.
- C. a precipitate of only $\text{Sr(NO}_3)_2$ forms.
- D. precipitates of both AgBr and $\text{Sr(NO}_3)_2$ form.

17. Consider the following solubility equilibrium:



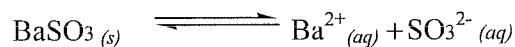
A student adds $\text{NaCl} (s)$ to a saturated solution of PbCl_2 . When equilibrium is reestablished, how have the concentrations changed from the original equilibrium?

- A. $[\text{Pb}^{2+}]$ and $[\text{Cl}^-]$ both increased.
- B. $[\text{Pb}^{2+}]$ and $[\text{Cl}^-]$ both decreased.
- C. $[\text{Pb}^{2+}]$ decreased and $[\text{Cl}^-]$ increased.
- D. $[\text{Pb}^{2+}]$ increased and $[\text{Cl}^-]$ decreased.

18. Solid Ag_2CrO_4 is added to water to form a saturated solution. The K_{sp} value can be calculated by:

- A. $K_{sp} = [\text{CrO}_4^{2-}]^2$
- B. $K_{sp} = [\text{CrO}_4^{2-}]^3$
- C. $K_{sp} = \frac{[\text{CrO}_4^{2-}]^3}{2}$
- D. $K_{sp} = 4 [\text{CrO}_4^{2-}]^3$

19. Consider the following solubility equilibrium:



Which of the following will result in an increase of $[\text{Ba}^{2+}]$?

- A. adding water
- B. adding $\text{BaS} (s)$
- C. adding $\text{BaSO}_3 (s)$
- D. adding $\text{Na}_2\text{SO}_3 (s)$

20. When equal volumes of 0.20M $\text{Ca}(\text{NO}_3)_2$ and 0.20M Na_2SO_4 are combined,

- A. a precipitate forms because Trial Ion Product $> K_{sp}$
- B. a precipitate forms because Trial Ion Product $< K_{sp}$
- C. no precipitate forms because Trial Ion Product $> K_{sp}$
- D. no precipitate forms because Trial Ion Product $< K_{sp}$

21. Solid NaBrO_3 is added to a 0.010M Ag^+ solution. What is the $[\text{BrO}_3^-]$ when a precipitate first forms?

- A. $2.8 \times 10^{-9}\text{M}$
- B. $5.3 \times 10^{-7}\text{M}$
- C. $5.3 \times 10^{-3}\text{M}$
- D. $1.0 \times 10^{-2}\text{M}$

January 2000

14. Which of the following does **not** define solubility?

- A. the concentration of solute in a saturated solution
- B. the moles of solute dissolved in a given volume of solution
- C. the maximum mass of solute that can dissolve in a given volume of solution
- D. the minimum moles of solute needed to produce one litre of a saturated solution

15. The ion concentrations in 0.25M $\text{Al}_2(\text{SO}_4)_3$ are

	$[\text{Al}^{3+}]$	$[\text{SO}_4^{2-}]$
A.	0.25M	0.25M
B.	0.50M	0.75M
C.	0.75M	0.50M
D.	0.10M	0.15M

16. Which of the following will **not** produce a precipitate when equal volumes of 0.20M solutions are combined?

- A. KOH and CaCl_2
- B. $\text{Zn}(\text{NO}_3)_2$ and K_3PO_4
- C. $\text{Sr}(\text{OH})_2$ and $(\text{NH}_4)_2\text{S}$
- D. Na_2SO_4 and $\text{Pb}(\text{NO}_3)_2$

17. What is observed when H_2SO_4 is added to a saturated solution of CaSO_4 ?

- A. the pH increases
- B. the $[\text{Ca}^{2+}]$ increases
- C. bubbles of H_2 are given off
- D. additional CaSO_4 precipitates

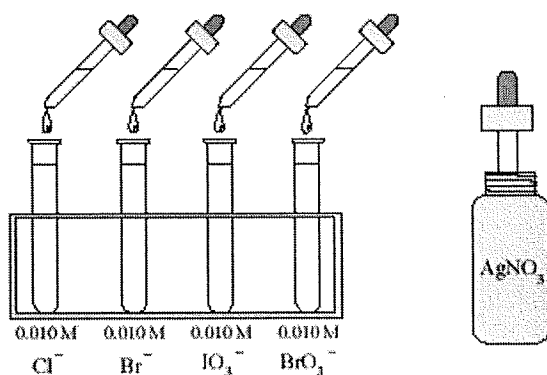
18. The solubility of $\text{CdS} = 2.8 \times 10^{-14}$. The value of K_{sp} is

- A. 7.8×10^{-28}
- B. 2.8×10^{-14}
- C. 5.6×10^{-14}
- D. 1.7×10^{-7}

19. How many moles of solute are dissolved in 200.0 mL of a saturated solution of FeS ?

- A. 1.2×10^{-19}
- B. 6.0×10^{-19}
- C. 1.5×10^{-10}
- D. 7.7×10^{-10}

20. Consider the following 10.0 mL solutions:



Equal moles of AgNO_3 are added to each solution. It is observed that a precipitate forms in all but one solution. Which solution does **not** form a precipitate?

- A. Cl^-
- B. Br^-
- C. IO_3^-
- D. BrO_3^-

21. Which of the following could dissolve a precipitate of CaC_2O_4 in a saturated solution of CaC_2O_4 ?

- A. NaOH
- B. CaC_2O_4
- C. $\text{H}_2\text{C}_2\text{O}_4$
- D. $\text{Ca}(\text{NO}_3)_2$

April 2000

14. Which of the following will dissolve in water to produce a molecular solution?

- A. CaCl_2
- B. NaOH
- C. CH_3OH
- D. $\text{Sr}(\text{OH})_2$

15. In a solubility equilibrium, the

- A. rate of dissolving equals the rate of crystallization.
- B. neither dissolving nor crystallization are occurring.
- C. concentration of solute and solvent are always equal.
- D. mass of dissolved solute is greater than the mass of the solution.

16. Which of the following solutions would have $[\text{Fe}^{+3}] = 0.020 \text{ M}$?

- A. 0.40 L of 0.050 M $\text{Fe}(\text{NO}_3)_3$
- B. 0.80 L of 0.020 M $\text{Fe}_2(\text{SO}_4)_3$
- C. 0.50 L of 0.040 M $\text{FeC}_6\text{H}_5\text{O}_7$
- D. 0.50 L of 0.010 M $\text{Fe}_2(\text{C}_2\text{O}_4)_3$

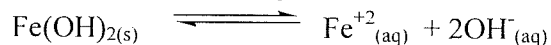
17. Which of the following substances has the lowest solubility?

- A. BaS
- B. CuS
- C. FeS
- D. ZnS

18. The complete ionic equation for the reaction between MgS and $\text{Sr}(\text{OH})_2$ is

- A. $\text{MgS}_{(\text{aq})} + \text{Sr}(\text{OH})_{2(\text{aq})} \rightarrow \text{Mg}(\text{OH})_{2(\text{s})} + \text{SrS}_{(\text{s})}$
- B. $\text{MgS}_{(\text{aq})} + \text{Sr}(\text{OH})_{2(\text{aq})} \rightarrow \text{Mg}(\text{OH})_{2(\text{s})} + \text{SrS}_{(\text{aq})}$
- C. $\text{Mg}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})} + \text{Sr}^{+2}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} \rightarrow \text{Mg}^{+2}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} + \text{SrS}_{(\text{s})}$
- D. $\text{Mg}^{+2}_{(\text{aq})} + \text{S}^{-2}_{(\text{aq})} + \text{Sr}^{+2}_{(\text{aq})} + 2\text{OH}^{-}_{(\text{aq})} \rightarrow \text{Mg}(\text{OH})_{2(\text{s})} + \text{S}^{-2}_{(\text{aq})} + \text{Sr}^{+2}_{(\text{aq})}$

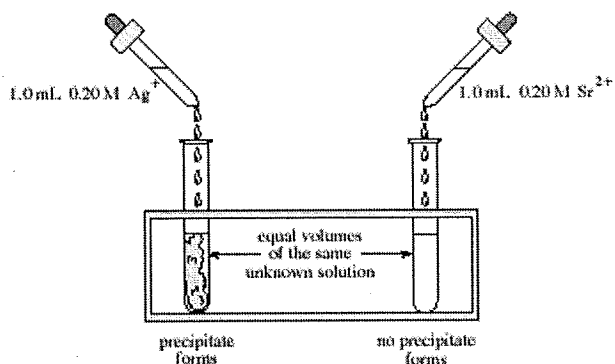
19. Consider the following equilibrium:



Which of the following will cause the equilibrium to shift to the right?

- A. adding KOH
- B. adding Na_2S
- C. adding $\text{Fe}(\text{OH})_2$
- D. adding $\text{Fe}(\text{NO}_3)_2$

20. Consider the following experiment:



The unknown solution could contain

- A. 0.20 M OH^-
- B. 0.20 M NO_3^-
- C. 0.20 M PO_4^{3-}
- D. 0.20 M SO_4^{2-}

21. A compound has a solubility of 7.1×10^{-5} M at 25 °C. The compound is

- A. CuS
- B. AgBr
- C. CaCO_3
- D. CaSO_4

June 2000

14. A saturated solution of NaCl contains 36.5 g of solute in 0.100L of solution.
The solubility of the compound is

- A. 0.062 M
- B. 1.60 M
- C. 3.65 M
- D. 6.24 M

15. Calculate the $[\text{Li}^+]$ in 200.0 mL of 1.5 M Li_2SO_4

- A. 0.30 M
- B. 0.60 M
- C. 1.5 M
- D. 3.0 M

16. When equal volumes of 0.20 M RbCl and 0.20 M and M SrS are combined,

- A. no precipitate forms.
- B. a precipitate of Rb_2S only forms.
- C. a precipitate of SrCl_2 only forms.
- D. precipitates of both Rb_2S and SrCl_2 form.

17. A solution contains both Ag^+ and Mg^{2+} ions. During selective precipitation, these ions are removed one at a time by adding

- A. I^- followed by OH^-
- B. OH^- followed by S^{2-}
- C. SO_4^{2-} followed by Cl^-
- D. NO_3^- followed by PO_4^{3-}

18. The K_{sp} expression for a saturated solution of $\text{Mg}(\text{OH})_2$ is

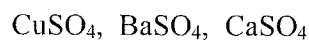
A. $K_{sp} = \frac{[\text{Mg}^{2+}][\text{OH}^-]^2}{[\text{Mg}(\text{OH})_2]}$

B. $K_{sp} = [\text{Mg}^{2+}][\text{OH}^-]^2$

C. $K_{sp} = [\text{Mg}^{2+}][\text{OH}^-]$

D. $K_{sp} = [\text{Mg}^{2+}][2\text{OH}^-]^2$

19. Consider the following saturated solutions:



The order of cation concentration, from highest to lowest, is

- A. $[\text{Ba}^{2+}] > [\text{Ca}^{2+}] > [\text{Cu}^{2+}]$
- B. $[\text{Ca}^{2+}] > [\text{Cu}^{2+}] > [\text{Ba}^{2+}]$
- C. $[\text{Cu}^{2+}] > [\text{Ca}^{2+}] > [\text{Ba}^{2+}]$
- D. $[\text{Cu}^{2+}] > [\text{Ba}^{2+}] > [\text{Ca}^{2+}]$

20. When 1.0×10^{-3} moles of $\text{CuCl}_2(s)$ are added to 1.0 L of $1.0 \times 10^{-3} \text{ M IO}_3^-$, the

- A. Trial $K_{sp} > K_{sp}$ and a precipitate forms.
- B. Trial $K_{sp} < K_{sp}$ and a precipitate forms.
- C. Trial $K_{sp} > K_{sp}$ and no precipitate forms.
- D. Trial $K_{sp} < K_{sp}$ and no precipitate forms.

August 2000

14. Which of the following forms a molecular solution in water?

- A. SrSO_4
- B. Na_3PO_4
- C. $\text{C}_6\text{H}_{12}\text{O}_6$
- D. $\text{NH}_4\text{CH}_3\text{COO}$

15. Which of the following is necessary to form a saturated solution at equilibrium?

- A. excess solute
- B. an ionic solute
- C. solute of low solubility
- D. trial ion product is less than K_{sp}

16. The net ionic equation that describes a saturated solution of Ag_2CrO_4 is

- A. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons \text{Ag}_2\text{CrO}_4 (aq)$
- B. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons 2\text{Ag}^+ (aq) + \text{CrO}_4^{2-} (aq)$
- C. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons 2\text{Ag}^+ (aq) + \text{Cr}^{+6} (aq) + 4\text{O}^{2-} (aq)$
- D. $2\text{Ag}^+ (aq) + \text{CrO}_4^{2-} (aq) + 2\text{H}_2\text{O} (l) \rightleftharpoons 2\text{AgOH} (s) + \text{H}_2\text{CrO}_4 (aq)$

17. Which of the following compounds has the lowest solubility?

- A. SrS
- B. CaCl_2
- C. Rb_2CO_3
- D. $\text{Zn}(\text{OH})_2$

18. Which of the following will form a precipitate when equal volumes of 0.2 M solutions are combined?

- A. HI and Na_2CO_3
- B. SrS and NH_4OH
- C. BaCl_2 and CuSO_4
- D. $\text{Mg}(\text{NO}_3)_2$ and KCl

19. The solute AgBr is least soluble in
- A. H₂O
 - B. 1.0 M FeBr₃
 - C. 1.0 M CaBr₂
 - D. 1.0 M AgNO₃
20. The magnesium and calcium ions in hard water can be removed by the addition of
- A. NaI
 - B. NaNO₃
 - C. Na₂CO₃
 - D. Na₂SO₄
21. The solubility of an AB₂ type salt is 2.3×10^{-6} M. The salt is
- A. PbBr₂
 - B. Fe(OH)₂
 - C. Cu(IO₃)₂
 - D. Mg(OH)₂
22. Which of the following saturated solutions will have the lowest [Pb²⁺]?
- A. PbI₂
 - B. PbCl₂
 - C. Pb(IO₃)₂
 - D. Pb(NO₃)₂

January 2001

14. A saturated solution forms when a 0.10 mol of salt is added to 1.0L of water.
The salt is

- A. Li₂S
- B. CuBr₂
- C. Zn(OH)₂
- D. (NH₄)₂CO₃

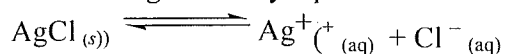
15. Consider the following equilibrium:



Adding which of the following could cause the equilibrium [Ca⁺²⁺] to increase?

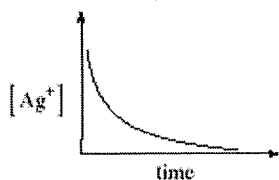
- A. H₂O (l)
- B. HCl (aq)
- C. KOH (s)
- D. Ca(OH)₂ (s)

16. Consider the following solubility equilibrium:

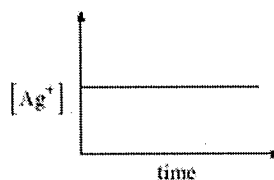


Which of the following graphs represents the $[\text{Ag}^{+}]$ after equilibrium has been established?

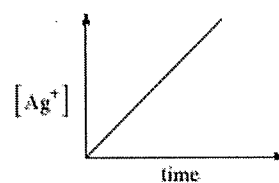
A.



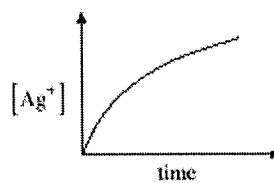
B.



C.



D.



17. The concentrations of the cation and anion in 0.40 M $(\text{NH}_4)_2\text{Cr}_2\text{O}_7_{(aq)}$ are

	Cation	Anion
A.	0.40 M	0.40 M
B.	0.40 M	0.80 M
C.	0.80 M	0.40 M
D.	0.80 M	0.80 M

18. Which of the following will produce a solution with the highest $[\text{OH}^-]$?

- A. AgOH
- B. $\text{Sr}(\text{OH})_2$
- C. $\text{Fe}(\text{OH})_3$
- D. $\text{Mg}(\text{OH})_2$

19. When equal volumes of 0.20 M ZnSO_4 and 0.20 M SrS are combined

- A. a precipitate does not form.
- B. a precipitate of only ZnS forms.
- C. a precipitate of only SrSO_4 forms.
- D. precipitates of both ZnS and SrSO_4 form.

20. What is the concentration of Pb^{2+} in a saturated solution of $\text{Pb}(\text{IO}_3)_2$?

- A. $9.0 \times 10^{-5} \text{ M}$
- B. $5.7 \times 10^{-5} \text{ M}$
- C. $4.5 \times 10^{-5} \text{ M}$
- D. $1.1 \times 10^{-4} \text{ M}$

April 2001

14. Which of the following dissolves in water to form a molecular solution?

- A. KCl
- B. Na_2O
- C. NH_4Br
- D. $\text{C}_2\text{H}_5\text{OH}$

15. A saturated solution is formed by adding 10.0g PbI_2 (s) to 10.0 mL of water in a beaker. Describe the situation which exists in the beaker.

- A. $[\text{Pb}^{2+}] = [\text{I}^-]$
- B. moles PbI_2 (s) = moles Pb^{+2} (aq)
- C. mass of PbI_2 (s) = mass of PbI_2 (aq)
- D. rate of crystallization = rate of dissociation

16. What is the concentration of barium ions in a 1.00 L solution containing 2.08 g of BaCl_2 ?

- A. $1.00 \times 10^{-2} \text{ M}$
- B. $1.21 \times 10^{-2} \text{ M}$
- C. $2.00 \times 10^{-2} \text{ M}$
- D. 2.08 M

17. Which of the following salts has low solubility?

- A. MgS
- B. ZnCl_2
- C. SrSO_4
- D. AgNO_3

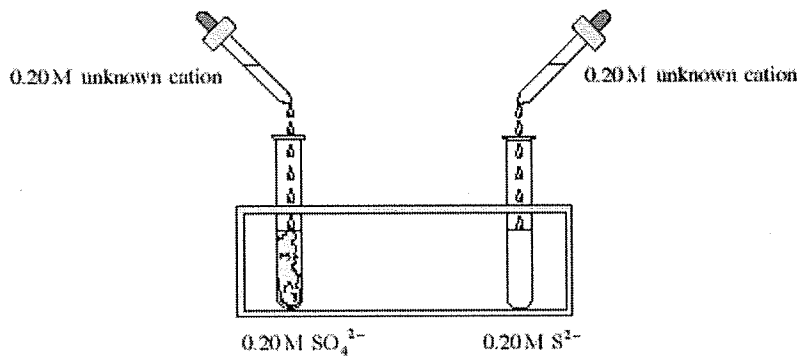
18. Consider the following solubility equilibrium:



Some $\text{NaCl}_{(s)}$ is added to the equilibrium. When equilibrium is reestablished, how have the ion concentrations changed from the original equilibrium?

	$[\text{Ag}^{+}]$	$[\text{Cl}^{-}]$
A.	decreased	increased
B.	decreased	decreased
C.	increased	decreased
D.	increased	increased

19. A precipitate forms when a 0.20 M solution containing an unknown cation is added to SO_4^{2-} , but not when an equal volume is added to S^{2-} .



The unknown cation is

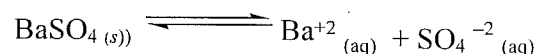
- A. Na^{+}
- B. Ca^{2+}
- C. Pb^{2+}
- D. Zn^{2+}

20. The K_{sp} expression for a saturated solution of $\text{Ni}_3(\text{PO}_4)_2$ is

- A. $K_{sp} = [\text{Ni}^{+2}]^3[\text{PO}_4^{-3}]^2$
- B. $K_{sp} = [\text{Ni}^{+2}]^2[\text{PO}_4^{-3}]^3$
- C. $K_{sp} = [3\text{Ni}^{+2}][2\text{PO}_4^{-3}]$
- D. $K_{sp} = [3\text{Ni}^{+2}]^3[2\text{PO}_4^{-3}]^2$

June 2001

15. Consider the following equilibrium:



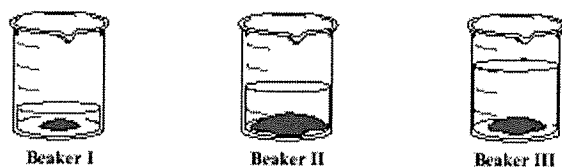
Adding which of the following will cause more solid BaSO_4 to form?

- A. $\text{CaCl}_2 (s)$
- B. $\text{K}_2\text{CO}_3 (s)$
- C. $\text{Na}_2\text{SO}_4 (s)$
- D. $\text{Mg}(\text{NO}_3)_2 (s)$

16. Which of the following could **not** be used to represent solubility?

- A. g/mL
- B. mL/L
- C. mol/L
- D. g/min

17. The following three beakers each contain different volumes of a saturated solution of PbI_2 and different masses of solid PbI_2 :



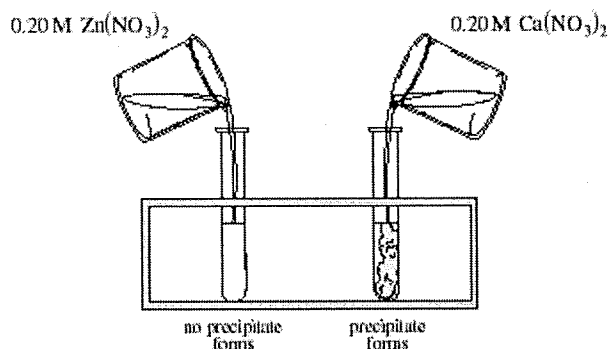
What is the relationship for the $[\text{Pb}^{2+}]$ in the solution in the three beakers?

- A. $\text{I} = \text{II} = \text{III}$
- B. $\text{I} > \text{II} > \text{III}$
- C. $\text{II} > \text{III} > \text{I}$
- D. $\text{III} > \text{II} > \text{I}$

18. The equation that describes the solubility equilibrium of Ag_2CrO_4 is

- A. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons \text{Ag}_2^{+2} (aq) + \text{CrO}_4^{-2} (aq)$
- B. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons 2\text{Ag}^+ (aq) + \text{CrO}_4^{-2} (aq)$
- C. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons 2\text{Ag} (s) + \text{Cr} (s) + 2\text{O}_2 (s)$
- D. $\text{Ag}_2\text{CrO}_4 (s) \rightleftharpoons 2\text{Ag}^+ (aq) + \text{Cr}^{+6} (aq) + 4\text{O}^{-2} (aq)$

19. When 10.0 ml 0.20 M $\text{Zn}(\text{NO}_3)_2$ is added to a 10.0 ml sample of 0.20 M unknown solution, no precipitate forms. When the same volume of 0.20 M $\text{Ca}(\text{NO}_3)_2$ is added to a separate 10.0 mL sample of the unknown solution, a precipitate does form.



The identity of the unknown solution could be

- A. NaCl
- B. Na_2S
- C. Na_2SO_4
- D. Na_2CO_3

20. The solubility of PbS is 1.8×10^{-14} M. The value of K_{sp} is

- A. 3.2×10^{-28}
- B. 1.8×10^{-14}
- C. 3.6×10^{-14}
- D. 1.3×10^{-7}

August 2001

13. At 25°C , which of the following compounds has a low solubility when added to water?

- A. FeS
- B. CuCl_2
- C. ZnSO_4
- D. $\text{NH}_4\text{CH}_3\text{COO}$

14. Which of the following forms a molecular solution?

- A. KCl
- B. NaOH
- C. CH_3OH
- D. $\text{NH}_4\text{CH}_3\text{COO}$

15. List the compounds AgI, KBr and MgCO₃ in order of solubility from lowest to highest.

- A. AgI, MgCO₃, KBr
- B. KBr, AgI, MgCO₃
- C. KBr, MgCO₃, AgI
- D. MgCO₃, AgI, KBr

16. Consider the following K_{sp} expression:

$$K_{sp} = [\text{Cu}^{+2}][\text{IO}_3^-]^2$$

Which of the following does this equilibrium expression represent?

- A. $\text{CuIO}_3 (\text{s}) \rightleftharpoons \text{Cu}^+_{(\text{aq})} + \text{IO}_3^-_{(\text{aq})}$
- B. $\text{CuIO}_3 (\text{s}) \rightleftharpoons \text{Cu}^{2+}_{(\text{aq})} + \text{IO}_3^{2-}_{(\text{aq})}$
- C. $\text{CuIO}_3 (\text{s}) \rightleftharpoons \text{Cu}^{2+}_{(\text{aq})} + \text{IO}_3^-_{(\text{aq})}$
- D. $\text{Cu}(\text{IO}_3)_2 (\text{s}) \rightleftharpoons \text{Cu}^{2+}_{(\text{aq})} + 2\text{IO}_3^-_{(\text{aq})}$

17. The solubility of NiCO₃ is 3.8×10^{-4} mol/L. The K_{sp} value is

- A. 1.4×10^{-7}
- B. 3.8×10^{-4}
- C. 7.6×10^{-4}
- D. 1.9×10^{-2}

18. The $[\text{Ag}^+]$ in a saturated solution of AgBrO₃ is

- A. 2.8×10^{-9} M
- B. 2.6×10^{-5} M
- C. 5.3×10^{-5} M
- D. 7.3×10^{-3} M

19. When solutions of AgNO₃ and NaCl are combined, the Trial K_{sp} for AgCl is 5.6×10^{-11} . Predict what will be observed.

- A. a precipitate will form because Trial $K_{sp} < K_{sp}$
- B. a precipitate will form because Trial $K_{sp} > K_{sp}$
- C. a precipitate will not form because Trial $K_{sp} < K_{sp}$
- D. a precipitate will not form because Trial $K_{sp} > K_{sp}$

20. Calculate the maximum $[\text{CO}_3^{2-}]$ that can exist in a solution without forming a precipitate when $[\text{Mg}^{+2}] = 0.20 \text{ M}$.

- A. $1.4 \times 10^{-6} \text{ M}$
- B. $3.4 \times 10^{-5} \text{ M}$
- C. $2.6 \times 10^{-3} \text{ M}$
- D. $5.8 \times 10^{-3} \text{ M}$

January 2002

15) The equation that describes the solubility equilibrium of $\text{Ca}_3(\text{PO}_4)_2$ is

- A. $\text{Ca}_3(\text{PO}_4)_{2(s)} \rightleftharpoons \text{Ca}_3^{6+}_{(aq)} + 2\text{PO}_4^{3-}_{(aq)}$
- B. $\text{Ca}_3(\text{PO}_4)_{2(s)} \rightleftharpoons 3\text{Ca}^{2+}_{(aq)} + 2\text{PO}_4^{3-}_{(aq)}$
- C. $\text{Ca}_3(\text{PO}_4)_{2(s)} \rightleftharpoons 2\text{Ca}^{3+}_{(aq)} + 3\text{PO}_4^{2-}_{(aq)}$
- D. $\text{Ca}_3(\text{PO}_4)_{2(s)} \rightleftharpoons (\text{Ca}^{2+})_{3(aq)} + (\text{PO}_4^{3-})_{2(aq)}$

16) In a saturated solution of $\text{Ag}_2\text{C}_2\text{O}_4$ the $[\text{Ag}^+] = 2.2 \times 10^{-4} \text{ M}$.

What is the solubility of $\text{Ag}_2\text{C}_2\text{O}_4$ in this solution?

- A. $4.3 \times 10^{-11} \text{ M}$
- B. $1.1 \times 10^{-4} \text{ M}$
- C. $2.2 \times 10^{-4} \text{ M}$
- D. $4.4 \times 10^{-4} \text{ M}$

17) When equal volumes of 0.2M solutions are mixed, which of the following combinations forms a precipitate?

- A. CaS and $\text{Sr}(\text{OH})_2$
- B. H_2SO_4 and MgCl_2
- C. $(\text{NH}_4)_2\text{SO}_4$ and K_2CO_3
- D. H_2SO_3 and NaCH_3COO

18) A solution contains 0.2 M Zn^{2+} and 0.2M Sr^{2+} . An equal volume of a second solution was added, forming a precipitate with Sr^{2+} but not with Zn^{2+} . What is present in the second solution?

- A. 0.2M Cl^-
- B. 0.2M OH^-
- C. 0.2M SO_4^{2-}
- D. 0.2M PO_4^{3-}

19) The K_{sp} expression for a saturated solution of $Ba_3(AsO_4)_2$ is

- A. $K_{sp} = [Ba^{2+}][AsO_4^{3-}]$
- B. $K_{sp} = [Ba^{2+}]^3[AsO_4^{3-}]^2$
- C. $K_{sp} = [3Ba^{2+}][2AsO_4^{3-}]$
- D. $K_{sp} = [3Ba^{2+}]^3[2AsO_4^{3-}]^2$

20) The solubility of $NiCO_3$ is 4.4×10^{-2} g/L. Determine the K_{sp} value of $NiCO_3$.

- A. 1.4×10^{-7}
- B. 3.7×10^{-4}
- C. 1.9×10^{-3}
- D. 2.1×10^{-1}

21) Calculate the solubility of $PbSO_4$.

- A. 3.2×10^{-16} M
- B. 1.8×10^{-8} M
- C. 3.6×10^{-8} M
- D. 1.3×10^{-4} M

22) When a solution containing Ag^+ is mixed with a solution containing BrO_3^- , the trial ion product is determined to be 2.5×10^{-7} . What would be observed?

- A. A precipitate would form since trial ion product $< K_{sp}$.
- B. A precipitate would form since trial ion product $> K_{sp}$.
- C. A precipitate would not form since trial ion product $< K_{sp}$.
- D. A precipitate would not form since trial ion product $> K_{sp}$.

April 2002

15) Which of the following will dissolve in water to form an ionic solution?

- A. O_2
- B. CH_4
- C. NH_4Cl
- D. CH_3OH

16) The solubility of $SrCO_3$ is 2.4×10^{-5} M. How many moles of dissolved solute are present in 100.0 mL of saturated $SrCO_3$ solution?

- A. 5.6×10^{-10} mol
- B. 2.4×10^{-6} mol
- C. 2.4×10^{-5} mol
- D. 2.4×10^{-4} mol

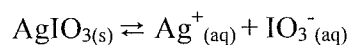
17) What are the ion concentrations in 0.30M CuCl₂?

	[Cu ²⁺]	[Cl ⁻]
A.	0.10 M	0.20 M
B.	0.20 M	0.10 M
C.	0.30 M	0.30 M
D.	0.30 M	0.60 M

18) What is the net ionic equation for the reaction that occurs when equal volumes of 0.20M Ba(NO₃)₂ and 0.20 M Na₂SO₄ are mixed together?

- A. $\text{Ba}^{2+}_{(\text{aq})} + \text{SO}_4^{2-}_{(\text{aq})} \rightarrow \text{BaSO}_{4(\text{s})}$
 B. $\text{Na}^{+}_{(\text{aq})} + \text{NO}_3^{-}_{(\text{aq})} \rightarrow \text{NaNO}_{3(\text{s})}$
 C. $\text{Ba}(\text{NO}_3)_{2(\text{aq})} + \text{Na}_2\text{SO}_{4(\text{aq})} \rightarrow \text{BaSO}_{4(\text{s})} + 2\text{NaNO}_{3(\text{aq})}$
 D. $\text{Ba}^{2+}_{(\text{aq})} + 2\text{NO}_3^{-}_{(\text{aq})} + 2\text{Na}^{+}_{(\text{aq})} + \text{SO}_4^{2-}_{(\text{aq})} \rightarrow \text{BaSO}_{4(\text{s})} + 2\text{Na}^{+}_{(\text{aq})} + 2\text{NO}_3^{-}_{(\text{aq})}$

19) Consider the following equilibrium:



A few crystals of NaIO₃ are added to the above equilibrium. When equilibrium is re-established, how do the new ion concentrations compare with the original equilibrium concentrations?

	[Ag ⁺]	[IO ₃ ⁻]
A.	Decreased	Decreased
B.	Decreased	Increased
C.	Increased	Decreased
D.	Increased	Increased

20) The K_{sp} expression for Zn(OH)₂ is

- A. $K_{\text{sp}} = [\text{Zn}^{2+}][\text{OH}^{-}]^2$
 B. $K_{\text{sp}} = [\text{Zn}^{2+}]^2[\text{OH}^{-}]$
 C. $K_{\text{sp}} = [\text{Zn}^{2+}][2\text{OH}^{-}]$
 D. $K_{\text{sp}} = [\text{Zn}^{2+}][2\text{OH}^{-}]^2$

21) The solubility of CdCO_3 is $2.5 \times 10^{-6} \text{ M}$. Calculate the K_{sp} value for CdCO_3 .

- A. 6.3×10^{-12}
- B. 2.5×10^{-6}
- C. 5.0×10^{-6}
- D. 1.6×10^{-3}

June 2002

15) In every solubility equilibrium, the rate of dissolving is

- A. equal to zero.
- B. equal to the rate of crystallization
- C. less than the rate of crystallization
- D. greater than the rate of crystallization

16) A 3.0 L solution of BaCl_2 has a chloride ion concentration of 0.20 M.
The barium ion concentration in this solution is

- A. 0.067 M
- B. 0.10 M
- C. 0.20 M
- D. 0.60 M

17) Which of the following has the lowest solubility?

- A. CaS
- B. CuS
- C. FeS
- D. MgS

18) What is the formula equation for the reaction that occurs when equal volumes of 0.20M K_3PO_4 and 0.20M ZnCl_2 are mixed together?

- A. $\text{K}^+_{(\text{aq})} + \text{Cl}^-_{(\text{aq})} \rightarrow \text{KCl}_{(\text{s})}$
- B. $3\text{Zn}^{2+}_{(\text{aq})} + 2\text{PO}_4^{3-}_{(\text{aq})} \rightarrow \text{Zn}_3(\text{PO}_4)_2_{(\text{s})}$
- C. $2\text{K}_3\text{PO}_{4(\text{aq})} + 3\text{ZnCl}_{2(\text{aq})} \rightarrow \text{Zn}_3(\text{PO}_4)_2_{(\text{s})} + 6\text{KCl}_{(\text{aq})}$
- D. $2\text{K}_3\text{PO}_{4(\text{aq})} + 3\text{ZnCl}_{2(\text{aq})} \rightarrow 3\text{Zn}_3(\text{PO}_4)_2_{(\text{aq})} + 6\text{KCl}_{(\text{s})}$

19) Which of the following could be added to a sample of hard water to remove both 0.2M Ca^{2+} and 0.2M Mg^{2+} ?

- A. 0.2 M S^{2-}
- B. 0.2 M Cl^-
- C. 0.2 M OH^-
- D. 0.2M SO_4^{2-}

20) The K_{sp} expression for a saturated solution of Ag_2SO_3 is

- A. $K_{sp} = [2Ag^+][SO_3^{2-}]$
- B. $K_{sp} = [Ag^+]^2[SO_3^{2-}]$
- C. $K_{sp} = [Ag_2^{2+}][SO_3^{2-}]$
- D. $K_{sp} = [2Ag^+]^2[SO_3^{2-}]$

21) The solubility of CaF_2 is 3.3×10^{-4} M. Determine the K_{sp} value of CaF_2 .

- A. 3.6×10^{-11}
- B. 1.4×10^{-10}
- C. 1.1×10^{-7}
- D. 3.3×10^{-4}

22) What is the maximum $[Ag^+]$ that can exist in a solution of 0.010M $NaIO_3$?

- A. 3.2×10^{-10} M
- B. 3.2×10^{-8} M
- C. 3.2×10^{-6} M
- D. 1.8×10^{-4} M

August 2002

15) Which of the following could be used to express solubility?

- A. mol
- B. M/s
- C. g/mL
- D. mL/min

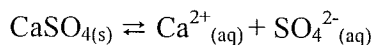
16) When 100.0mL of a saturated solution of BaF_2 is heated and all the water is evaporated, 3.6×10^{-4} mol of solute remains. The solubility of BaF_2 is

- A. 1.9×10^{-10} M
- B. 1.3×10^{-5} M
- C. 3.6×10^{-4} M
- D. 3.6×10^{-3} M

17) A solution contains both 0.2M $Mg^{2+}_{(aq)}$ and 0.2M $Sr^{2+}_{(aq)}$. These ions can be removed separately through precipitation by adding equal volumes of 0.2M solutions of

- A. OH^- , and then S^{2-}
- B. Cl^- , and then OH^-
- C. CO_3^{2-} , and then SO_3^{2-}
- D. SO_4^{2-} , and then PO_4^{3-}

18) Consider the following equilibrium:



Which of the following would shift the above equilibrium to the left?

- A. adding $\text{CaSO}_{4(s)}$
- B. adding $\text{MgSO}_{4(s)}$
- C. removing some $\text{Ca}^{2+}_{(aq)}$
- D. removing some $\text{SO}_4^{2-}_{(aq)}$

19) Calculate the solubility of CaC_2O_4 .

- A. $2.3 \times 10^{-9}\text{M}$
- B. $1.2 \times 10^{-5}\text{M}$
- C. $4.8 \times 10^{-5}\text{M}$
- D. $8.3 \times 10^{-4}\text{M}$

20) How many moles of dissolved solute are present in 100.0mL of a saturated SrCO_3 solution?

- A. $5.6 \times 10^{-11}\text{ mol}$
- B. $2.4 \times 10^{-6}\text{ mol}$
- C. $2.4 \times 10^{-5}\text{ mol}$
- D. $2.4 \times 10^{-4}\text{ mol}$

21) What happens when equal volumes of 0.2M AgNO_3 and 0.2M NaCl are combined?

- A. A precipitate forms because the trial ion product $> K_{sp}$
- B. A precipitate forms because the trial ion product $< K_{sp}$
- C. No precipitate forms because the trial ion product $> K_{sp}$
- D. No precipitate forms because the trial ion product $< K_{sp}$

22) Determine the maximum $[\text{Na}_2\text{CO}_3]$ that can exist in 1.0L of 0.0010M $\text{Ba}(\text{NO}_3)_2$ without forming a precipitate.

- A. $2.6 \times 10^{-12}\text{ M}$
- B. $2.6 \times 10^{-9}\text{ M}$
- C. $2.6 \times 10^{-6}\text{ M}$
- D. $5.1 \times 10^{-5}\text{ M}$

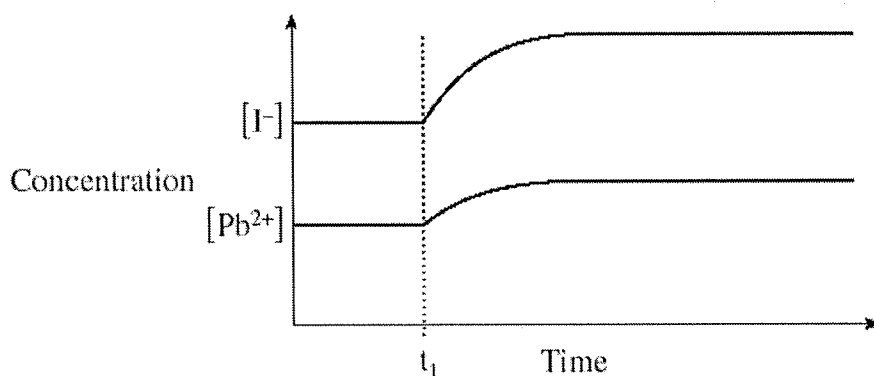
January 2003

15) Solid $\text{Ba}(\text{OH})_2$ is added to water to prepare a saturated solution.

Which of the following is true for this equilibrium system?

- A. $[\text{anion}] = [\text{cation}]$
- B. trial K_{sp} is less than K_{sp}
- C. blue litmus paper would turn red
- D. the rate of dissolving = the rate of crystallization

- 16) A saturated solution of PbI_2 was subjected to a stress and the following graph was obtained.



- Which stress was applied at time t_1 ?
- A. the addition of PbI_2
 - B. a temperature change
 - C. an increase in volume
 - D. the evaporation of water
- 17) Which of the following would be true when equal volumes of 0.2M NaBr and 0.2M AgNO_3 are combined?
- A. No precipitate forms.
 - B. A precipitate of AgBr forms.
 - C. A precipitate of NaNO_3 forms.
 - D. Precipitates of both NaNO_3 and AgBr form.
- 18) Using the solubility table, determine which of the following ions could not be used to separate S^{2-} from SO_4^{2-} by precipitation?
- A. Be^{2+}
 - B. Ca^{2+}
 - C. Ba^{2+}
 - D. Sr^{2+}
- 19) Which of the following is true when solid Na_2S is added to a saturated solution of CuS and equilibrium is reestablished?
- A. $[\text{S}^{2-}]$ increases.
 - B. $[\text{Cu}^{2+}]$ increases.
 - C. $[\text{S}^{2-}]$ does not change.
 - D. $[\text{Cu}^{2+}]$ does not change.

20) Which of the following describes the relationship between the solubility product constant (K_{sp}) and the solubility (s) of PbI_2 ?

- A. $K_{sp} = S^2$
- B. $K_{sp} = 4S^3$
- C. $s = \frac{\sqrt[3]{K_{sp}}}{4}$
- D. $s = \sqrt{K_{sp}}$

21) Which of the following saturated solutions will have the lowest $[S^{2-}]$?

- A. BaS
- B. CaS
- C. CuS
- D. ZnS

22) What is the solubility of SrF_2 ?

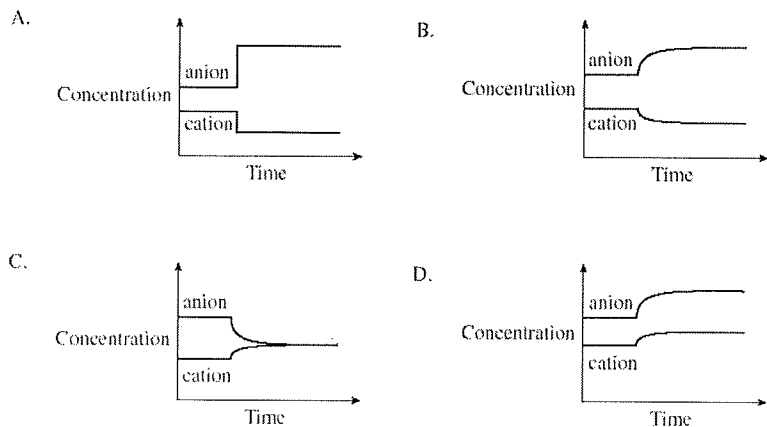
- A. $3.2 \times 10^{-25} \text{ M}$
- B. $1.8 \times 10^{-17} \text{ M}$
- C. $4.3 \times 10^{-9} \text{ M}$
- D. $1.0 \times 10^{-3} \text{ M}$

April 2003

15) Which of the following is a suitable term for representing solubility?

- A. grams
- B. moles
- C. molarity
- D. milliliters per second

16) A saturated solution is prepared by dissolving a salt in water. Which of the following graphs could represent the ion concentrations as the temperature is changed?



17) What is the concentration of OH^- ions in 250mL of 0.20 M $\text{Sr}(\text{OH})_2$?

- A. 0.050 M
- B. 0.10 M
- C. 0.20 M
- D. 0.40 M

18) What happens when 10.0mL of 0.2 M KOH is added to 10.0mL of 0.2M CuSO_4 ?

- A. No precipitate forms.
- B. A precipitate of K_2SO_4 forms
- C. A precipitate of $\text{Cu}(\text{OH})_2$ forms.
- D. Precipitates of K_2SO_4 and $\text{Cu}(\text{OH})_2$ form.

19) Solid NaCl is added to a saturated AgCl solution. How have the $[\text{Ag}^+]$ and $[\text{Cl}^-]$ changed when equilibrium has been reestablished?

	$[\text{Ag}^+]$	$[\text{Cl}^-]$
A.	increased	increase
B.	decreased	increased
C.	increased	decreased
D.	decreased	decreased

20) Which of the following expressions represents $[\text{Fe}^{2+}]$ in a saturated $\text{Fe}(\text{OH})_3$ solution?

A. $\frac{K_{sp}}{3[\text{OH}^-]}$

B. $\frac{K_{sp}}{[\text{OH}^-]^3}$

C. $\sqrt[3]{\frac{K_{sp}}{[\text{OH}^-]}}$

D. $K_{sp} \times [\text{OH}^-]^3$

21) What is the value of K_{sp} for $\text{Zn}(\text{OH})_2$ if the solubility of $\text{Zn}(\text{OH})_2$ is equal to 4.2×10^{-6} M?

- A. 1.0×10^{-2}
- B. 4.0×10^{-3}
- C. 1.8×10^{-11}
- D. 3.0×10^{-16}

22) What is the maximum number of moles of Cl^- that can exist in 500.0 mL of 2.0 M AgNO_3 ?

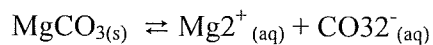
- A. 4.5×10^{-11}
- B. 9.0×10^{-11}
- C. 1.8×10^{-10}
- D. 1.8×10^{-9}

June 2003

15) What is the concentration of the ions in 3.0 L of 0.50 M $\text{Al}_2(\text{SO}_4)_3$?

	$[\text{Al}^{3+}]$	$[\text{SO}_4^{2-}]$
A	0.33 M	0.50 M
B	1.0 M	1.5 M
C	1.5 M	1.5 M
D	3.0 M	4.5 M

16) Consider the following equilibrium:



Adding which of the following would cause the solid to dissolve?

- A. HCl
- B. K_2CO_3
- C. MgCO_3
- D. $\text{Mg}(\text{NO}_3)_2$

17) Which of the following compounds could be used to prepare a solution with a $[\text{S}^{2-}]$ greater than 0.1 M?

- A. ZnS
- B. PbS
- C. Ag_2S
- D. Rb_2S

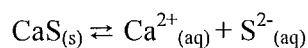
18) Which of the following will not form a precipitate when mixed with an equal volume of 0.2 M AgNO_3 ?

- A. 0.2 M NaBr
- B. 0.2 M NaIO_3
- C. 0.2 M NaNO_3
- D. 0.2 M NaBrO_3

19) A solution is prepared containing both 0.2 M OH^- and 0.2 M PO_4^{3-} ions. An equal volume of a second solution is added in order to precipitate only one of these two anions. The second solution must contain which of the following?

- A. 0.2 M Cs^+
- B. 0.2 M Zn^{2+}
- C. 0.2 M Pb^{2+}
- D. 0.2 M Sr^{2+}

20) Consider the following equilibrium:



When $\text{Ca}(\text{NO}_3)_{2(aq)}$ is added to this solution, the equilibrium shifts to the

- A. left and $[\text{S}^{2-}]$ increases.
- B. left and $[\text{S}^{2-}]$ decreases.
- C. right and $[\text{S}^{2-}]$ increases.
- D. right and $[\text{S}^{2-}]$ decreases.

21) How many moles of Pb^{2+} are there in 500.0mL of a saturated solution of PbSO_4 ?

- A. 3.2×10^{-16}
- B. 9.0×10^{-9}
- C. 6.7×10^{-5}
- D. 1.3×10^{-4}

22) Which of the following compounds is least soluble in water?

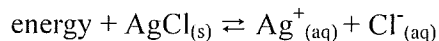
- A. CuI
- B. BeS
- C. CsOH
- D. AgBrO_3

August 2003

15) Which of the following will dissolve to form a molecular solution?

- A. H_2SO_4
- B. AgNO_3
- C. $\text{Ca}(\text{OH})_2$
- D. $\text{C}_6\text{H}_{12}\text{O}_6$

16) Consider the following equilibrium:



Addition of which of the following will increase the solubility of AgCl?

- A. heat
- B. HCl
- C. AgNO₃
- D. a catalyst

17) What is the [Cl⁻] when 15.0g of NaCl is dissolved in enough water to make 100.0mL of solution?

- A. 0.150 M
- B. 0.390 M
- C. 2.56 M
- D. 3.90 M

18) An equal number of moles of Na₂CO₃ is added to four different 10.0mL samples.

Sample 1	Sample 2	Sample 3	Sample 4
0.50 M Ba ²⁺ _(aq)	0.50 M Ca ²⁺ _(aq)	0.50 M Mg ²⁺ _(aq)	0.50 M Sr ²⁺ _(aq)

A precipitate forms in only one of the samples. Identify the cation which is present in the precipitate.

- A. Ba²⁺
- B. Ca²⁺
- C. Mg²⁺
- D. Sr²⁺

19) What is the net ionic equation of the reaction between BaS_(aq) and Sr(OH)_{2(aq)}?

- A. Sr²⁺_(aq) + S²⁻_(aq) → SrS_(s)
- B. Ba²⁺_(aq) + 2OH⁻_(aq) → Ba(OH)_{2(s)}
- C. Ba²⁺_(aq) + S²⁻_(aq) + Sr²⁺_(aq) + 2OH⁻_(aq) → Ba(OH)_{2(s)} + SrS_(s)
- D. Ba²⁺_(aq) + S²⁻_(aq) + Sr²⁺_(aq) + 2OH⁻_(aq) → Ba(OH)_{2(s)} + Sr²⁺_(aq) + S²⁻_(aq)

20) In which of the following would PbCl_{2(s)} be least soluble?

- A. 1 M HCl
- B. 1 M BaCl₂
- C. 1 M K₂SO₄
- D. 1 M Pb(NO₃)₂

21) The solubility of ZnCO_3 is 6.4×10^{-9} M. What is the value of K_{sp} for ZnCO_3 ?

- A. 4.1×10^{-17}
- B. 6.4×10^{-9}
- C. 1.3×10^{-8}
- D. 8.0×10^{-5}

22) When equal volumes of 0.20 M NaOH and 0.20 M CaS are mixed together,

- A. a precipitate forms and the Trial K_{sp} would be less than K_{sp} .
- B. no precipitate forms and the Trial K_{sp} would be less than K_{sp} .
- C. a precipitate forms and the Trial K_{sp} would be greater than K_{sp} .
- D. no precipitate forms and the Trial K_{sp} would be greater than K_{sp} .

Solutions

August 1998	
13	A
14	D
15	B
16	C
17	C
18	D
19	D

January 1999		April 1999		June 1999		August 1999	
14	B	14	B	14	D	14	B
15	D	15	A	15	B	15	C
16	D	16	B	16	D	16	B
17	B	17	D	17	B	17	C
18	B	18	A	18	D	18	D
19	D	19	C			19	B
20	C	20	C			20	A
						21	C

January 2000		April 2000		June 2000		August 2000	
14	B	14	C	14	D	14	C
15	B	15	A	15	D	15	A
16	C	16	D	16	A	16	B
17	D	17	B	17	A	17	D
18	A	18	D	18	B	18	C
19	C	19	B	19	C	19	B
20	D	20	A	20	D	20	C
21	A	21	C			21	B
						22	C

January 2001		April 2001		June 2001		August 2001	
14	C	14	D	15	C	13	A
15	B	15	D	16	D	14	C
16	B	16	A	17	A	15	A
17	C	17	C	18	B	16	D
18	B	18	A	19	C	17	A
19	D	19	B	20	A	18	D
20	C	20	A			19	C
						20	B

January 2002		April 2002		June 2002		August 2002	
15	B	15	C	15	B	15	C
16	B	16	B	16	B	16	D
17	A	17	D	17	B	17	D
18	C	18	A	18	C	18	B
19	B	19	B	19	C	19	C
20	A	20	A	20	B	20	B
21	D	21	A	21	B	21	A
22	C	22	C	22	C	22	C

January 2003		April 2003		June 2003		August 2003	
15	D	15	C	15	B	15	D
16	B	16	D	16	A	16	A
17	B	17	D	17	D	17	C
18	A	18	C	18	C	18	D
19	A	19	B	19	D	19	B
20	B	20	B	20	B	20	B
21	C	21	D	21	C	21	A
22	D	22	A	22	A	22	C