

**Solubility Multiple Choice Provincial Practice**

- Which of the following best describes a saturated solution?
  - It is at equilibrium.
  - It has high energy and is unstable.
  - It has extra capacity to dissolve solute.
  - Its rate of crystallization is less than the rate of dissolving.
  - A. 1
  - B. 2
  - C. 3
  - D. 4
- Which condition is essential to prepare a saturated solution of an ionic salt?
  - an excess of solute
  - any amount of solute
  - a temperature of 25°C
  - a fixed volume of solvent
  - A. 1
  - B. 2
  - C. 3
  - D. 4
- The solubility of a solute is best determined from which type of solution?
  - a saturated solution
  - any solution at 25°C
  - an unsaturated solution
  - a supersaturated solution
  - A. 1
  - B. 2
  - C. 3
  - D. 4

4. What are the ion concentrations that result when  $1.0 \times 10^{-3}$  mol of  $K_3PO_4$  is dissolved to produce  $1.00 \times 10^2$  L of solution?

$[K^+]$	$[PO_4^{3-}]$
A. $3.0 \times 10^{-5}$ M	$1.0 \times 10^{-5}$ M
B. $1.0 \times 10^{-5}$ M	$3.0 \times 10^{-5}$ M
C. $7.5 \times 10^{-4}$ M	$2.5 \times 10^{-4}$ M
D. $3.0 \times 10^{-3}$ M	$1.0 \times 10^{-3}$ M

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

5. What will be the  $[Cl^-]$  when equal volumes of  $0.10$  M NaCl and  $0.20$  M  $AlCl_3$  are combined?

- A.  $0.35$  M
- B.  $0.15$  M
- C.  $0.30$  M
- D.  $0.70$  M

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

6. What is observed when equal volumes of  $0.2$  M  $CuSO_4$  and  $0.2$  M  $Be(NO_3)_2$  are mixed?

- A.  $BeSO_4$  precipitates.
- B. No precipitate forms.
- C.  $Cu(NO_3)_2$  precipitates.
- D. Both  $BeSO_4$  and  $Cu(NO_3)_2$  precipitate.

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

7. What happens when equal volumes of  $0.2$  M  $Na_2SO_3$  and  $0.2$  M CaS are mixed?

- A. Only  $Na_2S$  precipitates.
- B. Only  $CaSO_3$  precipitates.
- C. Both  $CaSO_3$  and  $Na_2S$  precipitate.
- D. No precipitate forms.

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

8.

Which compound will have the greatest solubility?

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

A. 1

B. 2

C. 3

D. 4

9.

Which compound will have the lowest solubility?

- A. FeS
- B. CaSO<sub>4</sub>
- C. AgBrO<sub>3</sub>
- D. Fe(NO<sub>3</sub>)<sub>3</sub>

A. 1

B. 2

C. 3

D. 4

10.

Which of the following is the complete ionic equation for the precipitation reaction between Fe(NO<sub>3</sub>)<sub>3</sub>(aq) and Na<sub>2</sub>CO<sub>3</sub>(aq)?

- A.  $2\text{Fe}^{3+}(\text{aq}) + 3\text{CO}_3^{2-}(\text{aq}) \rightarrow \text{Fe}_2(\text{CO}_3)_3(\text{s})$
- B.  $2\text{Fe}(\text{NO}_3)_3(\text{aq}) + 3\text{Na}_2\text{CO}_3(\text{aq}) \rightarrow \text{Fe}_2(\text{CO}_3)_3(\text{s}) + 6\text{NaNO}_3(\text{s})$
- C.  $\text{Fe}^{3+}(\text{aq}) + 3\text{NO}_3^{-}(\text{aq}) + 2\text{Na}^{+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{Fe}_2(\text{CO}_3)_3(\text{s}) + \text{Na}^{+}(\text{aq}) + \text{NO}_3^{-}(\text{aq})$
- D.  $2\text{Fe}^{3+}(\text{aq}) + 6\text{NO}_3^{-}(\text{aq}) + 6\text{Na}^{+}(\text{aq}) + 3\text{CO}_3^{2-}(\text{aq}) \rightarrow \text{Fe}_2(\text{CO}_3)_3(\text{s}) + 6\text{Na}^{+}(\text{aq}) + 6\text{NO}_3^{-}(\text{aq})$

A. 1

B. 2

C. 3

D. 4

11.

Which equation represents the reaction between 0.2M Na<sub>2</sub>CO<sub>3</sub> and 0.2M Ba(NO<sub>3</sub>)<sub>2</sub>?

- A.  $\text{Na}^{+}(\text{aq}) + \text{NO}_3^{-}(\text{aq}) \rightarrow \text{NaNO}_3(\text{s})$
- B.  $\text{Ba}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{BaCO}_3(\text{s})$
- C.  $\text{Na}_2\text{CO}_3(\text{s}) \rightarrow 2\text{Na}^{+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq})$
- D.  $\text{Ba}(\text{NO}_3)_2(\text{aq}) + \text{Na}_2\text{CO}_3(\text{aq}) \rightarrow \text{BaCO}_3(\text{aq}) + 2\text{NaNO}_3(\text{s})$

A. 1

B. 2

C. 3

D. 4

12.

Which of the following solutions could be used to separate the anions  $\text{SO}_4^{2-}$  and  $\text{CO}_3^{2-}$  from each other by precipitation?

- A.  $\text{NaNO}_3(\text{aq})$
- B.  $\text{AgNO}_3(\text{aq})$
- C.  $\text{Fe}(\text{NO}_3)_3(\text{aq})$
- D.  $\text{Ba}(\text{NO}_3)_2(\text{aq})$

A. 1

B. 2

C. 3

D. 4

13.

What is the  $K_{sp}$  expression for  $\text{Zn}(\text{OH})_2$ ?

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

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

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

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

A. 1

B. 2

C. 3

D. 4

14.

Given the precipitation reaction:



What is the  $K_{sp}$  expression for the saturated solution formed?

A.  $K_{sp} = \frac{[\text{Fe}^{2+}][\text{S}^{2-}]}{[\text{FeS}]}$

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

C.  $K_{sp} = \frac{[\text{FeS}]}{[\text{Fe}^{2+}][\text{S}^{2-}]}$

D.  $K_{sp} = \frac{1}{[\text{Fe}^{2+}][\text{S}^{2-}]}$

A. 1

B. 2

C. 3

D. 4

15.

What is the  $K_{sp}$  for the salt  $\text{Pb}(\text{IO}_3)_2$  if its solubility is  $5.0 \times 10^{-5} \text{ M}$ ?

A.  $5.0 \times 10^{-13}$

B.  $1.3 \times 10^{-13}$

C.  $2.5 \times 10^{-9}$

D.  $5.0 \times 10^{-5}$

A. 1

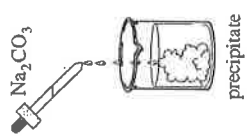
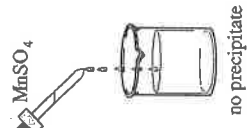
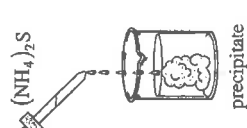
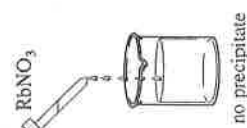
B. 2

C. 3

D. 4

16.

An experiment is conducted to identify an unknown cation that is present in each of four beakers.

			
precipitate	no precipitate	precipitate	no precipitate

Which of the following could be the unknown cation?

- A.  $\text{Ag}^+$
- B.  $\text{Fe}^{+3}$
- C.  $\text{Ba}^{+2}$
- D.  $\text{Be}^{+2}$

A. 1

B. 2

C. 3

D. 4

17.

What is the solubility of  $\text{Fe}(\text{OH})_2$  ?

- A.  $4.9 \times 10^{-17} \text{ M}$
- B.  $1.2 \times 10^{-17} \text{ M}$
- C.  $3.7 \times 10^{-6} \text{ M}$
- D.  $2.3 \times 10^{-6} \text{ M}$

A. 1

B. 2

C. 3

D. 4

18.

A solution is found to have an initial  $[\text{Pb}^{2+}]$  of  $6.6 \times 10^{-3} \text{ M}$  and a  $[\text{Br}^-]$  of  $5.0 \times 10^{-4} \text{ M}$ . What will be observed as the ions interact?

Observation	Reason
A. precipitate	Trial $K_{sp} > K_{sp}$
B. precipitate	Trial $K_{sp} < K_{sp}$
C. no precipitate	Trial $K_{sp} > K_{sp}$
D. no precipitate	Trial $K_{sp} < K_{sp}$

A. 1

B. 2

C. 3

D. 4

19.

What is the maximum  $[\text{IO}_3^-]$  that can exist in a  $6.9 \times 10^{-2} \text{ M Cu}^{2+}$  solution?

- A.  $2.0 \times 10^{-6} \text{ M}$
- B.  $1.0 \times 10^{-6} \text{ M}$
- C.  $1.0 \times 10^{-3} \text{ M}$
- D.  $6.9 \times 10^{-2} \text{ M}$

A. 1

B. 2

C. 3

D. 4

20.

Which relationship can be used to calculate the maximum  $[Ba^{2+}]$  that can exist in a solution of  $Na_3PO_4$ ?

- A.  $[Ba^{2+}] = \sqrt[3]{\frac{K_{sp}}{[PO_4^{3-}]^2}}$
- B.  $[Ba^{2+}] = \sqrt{\frac{K_{sp}}{[PO_4^{3-}]}}$
- C.  $[Ba^{2+}] = \frac{K_{sp}}{[PO_4^{3-}]}$
- D.  $[Ba^{2+}] = \sqrt[3]{K_{sp}[PO_4^{3-}]^2}$

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

21.

What will be the effect of adding some solid  $AgNO_3$  to a saturated solution of  $AgCl$ ?

- A. The  $AgNO_3$  will not dissolve.
- B. More solid  $AgCl$  will dissolve.
- C. More solid  $AgCl$  will be produced.
- D. The  $AgNO_3$  will not affect the  $AgCl$  equilibrium.

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

22.

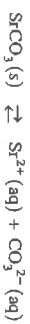
Which of the following substances will have the least effect on the equilibrium in a saturated solution of  $PbI_2(s)$ ?

- A.  $Hl$
- B.  $Na_2S$
- C.  $NaNO_3$
- D.  $Pb(NO_3)_2$

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

23.

Consider the solubility equilibrium:



The addition of which of the following substances will cause the equilibrium to shift right?

- A.  $HCl(aq)$
- B.  $SrCO_3(s)$
- C.  $Na_2CO_3(aq)$
- D.  $Sr(NO_3)_2(aq)$

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