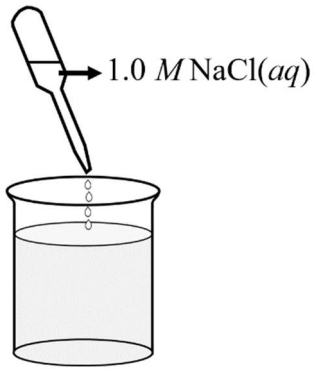
Topics 4.1 – 4.4: MCQ Practice

1. A beaker contains 50 mL of a clear, colorless liquid. A student added a small amount of 1.0 *M* NaCl(*aq*) to the liquid in the beaker. Which of the following is most likely to support the claim that a chemical reaction occurred in this experiment?

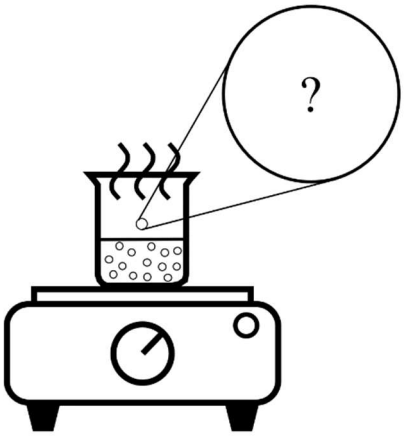


(A) The final volume of the mixture is 51 mL.

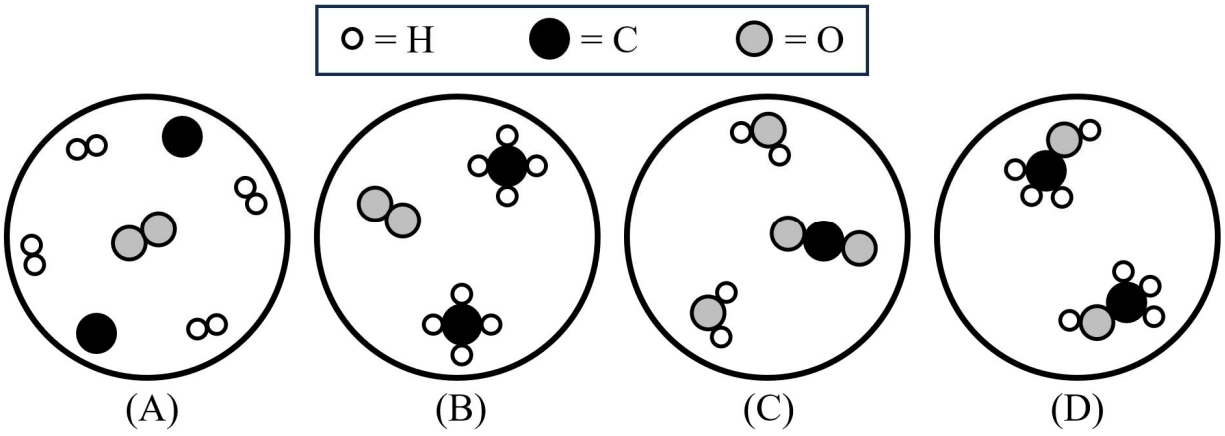
(B) The appearance of the mixture is cloudy.

(C) The mixture conducts electricity.

(D) The concentration of $Cl^-(aq)$ in the mixture is less than 1.0 *M*.



2. A sample of pure liquid methanol, $CH_3OH(l)$, was added to a beaker and placed on a hot plate. The temperature of the liquid increased gradually. Eventually the liquid began to produce bubbles vigorously. Four diagrams are shown below to indicate a particulate representation of the gas produced above the surface of the liquid in this experiment. Which diagram best supports the claim that this experiment is a physical change?



3. A sample of solid sodium metal, $Na(s)$, is added to a sample of liquid water, $H_2O(l)$. A chemical reaction occurs, and bubbles of hydrogen gas, $H_2(g)$, are produced. After the reaction has gone to completion, the reaction mixture appears clear and colorless. Which of the following is the balanced net-ionic equation that best represents the reaction that occurs in this experiment?

(A) $Na(s) + 2\ H^+(aq) \rightarrow Na^+(aq) + H_2(g)$

(B) $2\ Na(s) + 2\ H_2O(l) \rightarrow 2\ NaOH(s) + H_2(g)$

(C) $2\ Na(s) + 2\ H_2O(l) \rightarrow 2\ Na^+(aq) + 2\ OH^-(aq) + H_2(g)$

(D) $2\ Na^+(s) + 2\ H_2O(l) \rightarrow 2\ NaOH(aq) + H_2(g)$

4. When solutions of barium nitrate, $Ba(NO_3)_2(aq)$, and potassium carbonate, $K_2CO_3(aq)$, are combined, a solid precipitate is formed. Which of the following is the balanced net-ionic equation for the reaction that occurs when these two solutions are combined?

(A) $Ba(NO_3)_2(aq) + K_2CO_3(aq) \rightarrow BaCO_3(aq) + 2\ KNO_3(s)$

(B) $Ba(NO_3)_2(aq) + K_2CO_3(aq) \rightarrow BaCO_3(s) + 2\ KNO_3(aq)$

(C) $K^+(aq) + NO_3^-(aq) \rightarrow KNO_3(s)$

(D) $Ba^{2+}(aq) + CO_3^{2-}(aq) \rightarrow BaCO_3(s)$

$$HCl(aq) \rightarrow H^+(aq) + Cl^-(aq)$$

5. Hydrochloric acid (HCl) is an example of a strong acid that completely ionizes in aqueous solution according to the equation shown above. A student adds an excess amount of $HCl(aq)$ to a sample of solid sodium carbonate, $Na_2CO_3(s)$. A chemical reaction occurs according to the equation shown below.

$$Na_2CO_3(s) + 2\ HCl(aq) \rightarrow 2\ NaCl(aq) + H_2O(l) + CO_2(g)$$

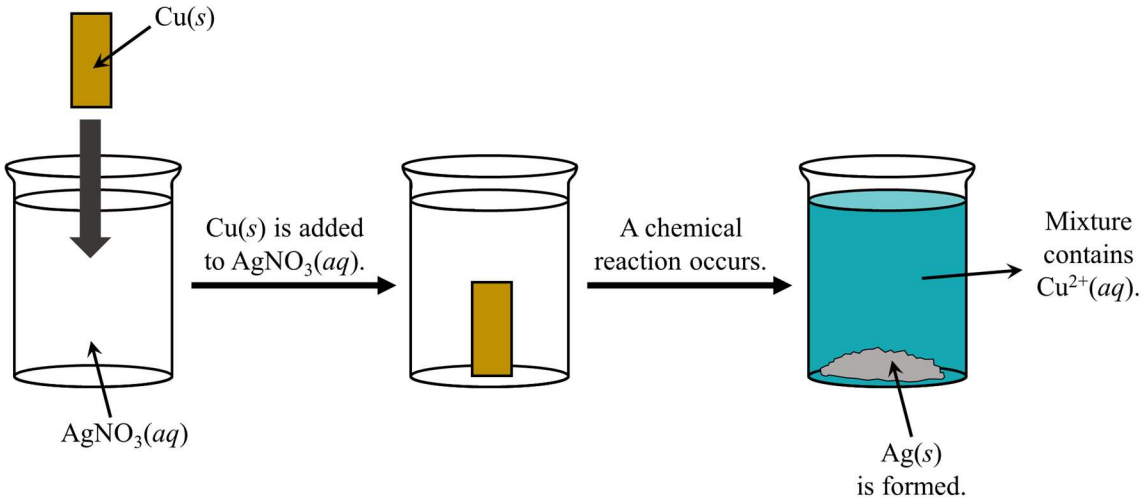
Which of the following is the balanced net-ionic equation for the reaction that occurred in this experiment?

(A) $Na_2CO_3(s) + 2\ H^+(aq) \rightarrow 2\ Na^+(aq) + H_2O(l) + CO_2(g)$

(B) $Na_2CO_3(s) \rightarrow 2\ Na^+(aq) + CO_2(g)$

(C) $Na^+(aq) + Cl^-(aq) \rightarrow NaCl(aq)$

(D) $CO_3^{2-}(aq) + 2\ H^+(aq) \rightarrow H_2O(l) + CO_2(g)$



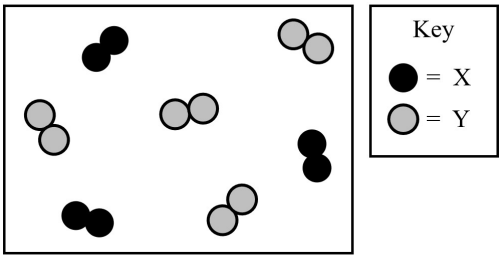
6. A sample of $Cu(s)$ is added to a sample of $AgNO_3(aq)$ as shown in the diagram above. A chemical reaction occurs, resulting in the formation of $Ag(s)$. At the end of the experiment, the reaction mixture contains $Cu^{2+}(aq)$. Which of the following is a balanced equation that represents only the species that react and the species that are produced in this experiment?

(A) $Cu(s) + Ag^{+}(aq) \rightarrow Ag(s) + Cu^{2+}(aq)$

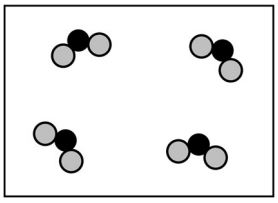
(B) $Cu(s) + 2\ AgNO_3(aq) \rightarrow 2\ Ag(s) + Cu(NO_3)_2(aq)$

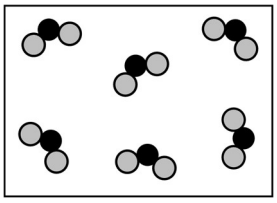
(C) $Cu(s) + 2\ Ag^{+}(aq) \rightarrow 2\ Ag(s) + Cu^{2+}(aq)$

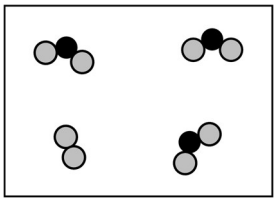
(D) $Cu^{2+}(s) + 2\ Ag(aq) \rightarrow 2\ Ag^{+}(s) + Cu(aq)$

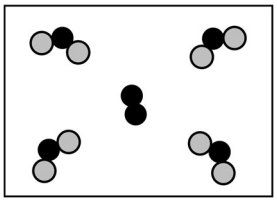


7 A mixture of $X_2(g)$ and $Y_2(g)$ is placed in a reaction vessel as shown above. A reaction between $X_2(g)$ and $Y_2(g)$ occurs, forming $XY_2(g)$. Which of the following best represents the contents of the reaction vessel after the reaction has proceeded as completely as possible?

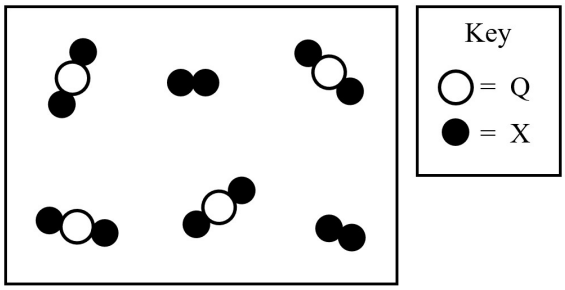

(A)


(B)

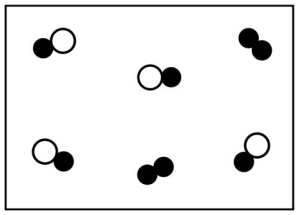

(C)

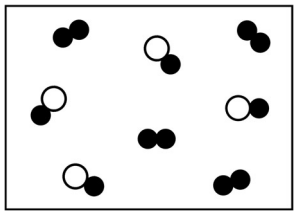

(D)

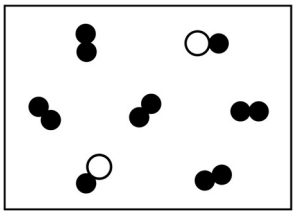
$$2\ QX(g) + X_2(g) \rightarrow 2\ QX_2(g)$$

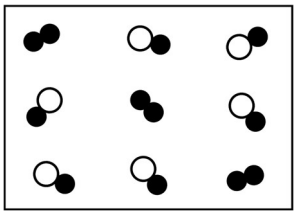


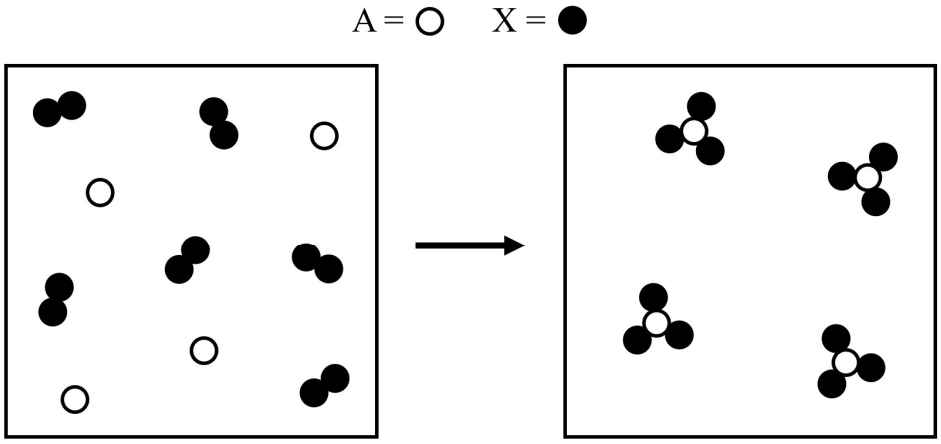
8 The particle-level diagram shown above is a representation of the substances present in a reaction vessel at the completion of a reaction between $QX(g)$ and $X_2(g)$. Which of the following diagrams represents the reaction mixture that would yield the product mixture shown above?


(A)


(B)


(C)


(D)



Reactant Mixture Product Mixture

9 Based on the information in the particle diagrams above, which of the following represents the correct balanced chemical equation for the reaction that occurred?

(A) $2\ A(g) + 6\ X(g) \rightarrow 2\ AX_3(g)$

(B) $2\ A(g) + 3\ X_2(g) \rightarrow 2\ AX_3(g)$

(C) $A_2(g) + 6\ X(g) \rightarrow 2\ AX_3(g)$

(D) $A_2(g) + 3\ X_2(g) \rightarrow 2\ AX_3(g)$