**Rating Guide**
**Chemistry**

**1** [1] Allow 1 credit for 2.

**2** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The potassium ions are compressed into small spaces in the glass and are unable to move.

The amount of space in the structure of the glass prevents the potassium ions from being able to move.

**Note:** Do not accept that immobile potassium ions cannot conduct electricity without reference to the structure of the glass.

**3** [1] Allow 1 credit for 19.50 g. Both the mathematical representation *and* calculated answer *must* be correct to receive credit. Acceptable mathematical representations include, but are not limited to:

$$10.32 \text{ g Al} \times \frac{1 \text{ mole Al}}{26.98 \text{ g Al}} \times \frac{2 \text{ moles } Al_2O_3}{4 \text{ moles Al}} \times \frac{101.96 \text{ g } Al_2O_3}{1 \text{ mole } Al_2O_3}$$

$$\frac{10.32}{26.98} = 0.3825 \text{ mol Al} \qquad 0.3825 \times \frac{2}{4} = 0.1913 \text{ mol } Al_2O_3 \qquad 0.1913 = \frac{x}{101.96}$$

**Note:** Significant figures do not need to be shown.

**4** [1] Allow 1 credit for 4.

**5** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Electrons are gained by $Co^{+4}$ to form $Co^{+3}$.

The oxidation state of cobalt changes from +4 to +3.

$e^-$ is only on the left side of the equation

## Item Alignment
## Physical Science: Chemistry
## Smartphone Chemistry Cluster

| Item Number | Performance Expectation |
|---|---|
| 1 | HS-PS1–1 |
| 2 | HS-PS2–6 |
| 3 | HS-PS1–7 |
| 4 | HS-ETS1–1 |
| 5 | HS-PS1–12 |

**Rating Guide**
**Chemistry**

**1** [1] Allow 1 credit for 2.

**2** [1] Allow 1 credit for 4.

**3** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

Acid: $NH_4^+(aq)$ Base: $H_2O(l)$

Comparison of Behaviors:

$NH_4^+$ is an acid and donates a proton to the water to become $NH_3$. Water is the base and accepts a proton and becomes $H_3O^+$.

$NH_4^+$ is an acid and donates a proton to the water. Water is the base and accepts a proton.

$NH_4^+$ donates an $H^+$, while $H_2O$ accepts an $H^+$.

**4** [1] Allow 1 credit for 3.

**5** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

There is one nitrogen atom, four hydrogen atoms, and four oxygen atoms on each side of the equation.

1N, 4O, 4H atoms $\rightarrow$ 1N, 4O, 4H atoms

Nitrogen – 1 atom on each side
Hydrogen and Oxygen – 4 atoms of each on each side

**Note:** Do *not* accept there are an equal number of atoms on each side.

## Item Alignment
## Physical Science: Chemistry
## A Profitable Blueberry Field Cluster

| Item Number | Performance Expectation |
|---|---|
| 1 | HS-PS1–11 |
| 2 | HS-PS1–11 |
| 3 | HS-PS1–11 |
| 4 | HS-PS1–7 |
| 5 | HS-PS1–7 |

**Rating Guide**
**Chemistry**

**1** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

The pattern of the chemical property for the combustion of a hydrocarbon is to react with oxygen to produce carbon dioxide and water.

hydrocarbon or methane + oxygen → carbon dioxide + water

$CO_2$ and water are products in any combustion reaction

$CH_4 + O_2$ produces $CO_2 + H_2O$

**Note:** The corrected explanation can be in words or chemical formulas, balanced or not balanced.

**2** [1] Allow 1 credit for 1.

**3** [1] Allow 1 credit. Acceptable responses include, but are not limited to:

| Claim | Evidence |
|---|---|
| Methane should be limited to reduce global warming. | • Methane has an 18.2% global warming potential.<br>• Methane combustion produces carbon dioxide and those two gases have over an 80% global warming potential.<br>• $CH_4$ gas has 28 times higher GWP than $CO_2$. |
| Methane should not be limited to reduce global warming. | • Methane's GWP (28) is much smaller than most other greenhouse gases such as $SF_6$ at over 20,000.<br>• Other gases with larger GWPs are thousands of times more damaging to the environment.<br>• The radiative forcing for methane is about a third of that for carbon dioxide. |

**Note:** Evidence must match the claim and include *both* quantitative *and* qualitative evidence.

**4** [1] Allow 1 credit for 1.

**5** [1] Allow 1 credit.

| Reactants | Energy | Products |
|---|---|---|
| ☑ $CO_2$ | ☑ electromagnetic energy → | ☑ $C_6H_{12}O_6$ |
| ☑ $H_2O$ | | ☑ $O_2$ |

**Item Alignment**
**Physical Science: Chemistry**
**Evaluating Gas Stoves Cluster**

| Item Number | Performance Explanation |
|---|---|
| 1 | HS-PS1–2 |
| 2 | HS-PS1–1 |
| 3 | HS-PS4–4 |
| 4 | HS-PS4–4 |
| 5 | HS-LS1–5 |