

Assigning Oxidation Numbers Worksheet Questions and Answers PDF

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Part 1: Foundational Knowledge

What is the oxidation number of any element in its pure elemental form?

Hint: Consider the state of the element.

- +1
- 0 ✓
- 1
- +2

■ The oxidation number of any element in its pure elemental form is 0.

Which of the following statements are true about oxidation numbers?

Hint: Think about the common oxidation states of elements.

- The oxidation number of oxygen is always -2. ✓
- The oxidation number of hydrogen is +1 when bonded with non-metals. ✓
- The oxidation number of fluorine is always -1. ✓
- The oxidation number of alkali metals is +2.

■ The true statements include the oxidation number of oxygen being -2, hydrogen being +1 with non-metals, and fluorine being -1.

Explain why the oxidation number of oxygen is different in peroxides compared to other compounds.

Hint: Consider the bonding and structure of peroxides.

In peroxides, the oxidation number of oxygen is -1, unlike the usual -2 in most compounds due to the presence of an O-O bond.

List the oxidation numbers for the following elements in their most common compounds:

Hint: Think about the common compounds these elements form.

1. Sodium (Na)

+1

2. Chlorine (Cl)

-1

3. Calcium (Ca)

+2

Sodium typically has an oxidation number of +1, chlorine -1, and calcium +2.

Part 2: Understanding and Interpretation

In which of the following compounds does hydrogen have an oxidation number of -1?

Hint: Consider the compounds where hydrogen is bonded to metals.

- H₂O
- NaH ✓
- HCl
- NH₃

Hydrogen has an oxidation number of -1 in sodium hydride (NaH).

Which of the following rules apply when assigning oxidation numbers?

Hint: Think about the general principles of oxidation states.

- The sum of oxidation numbers in a neutral compound is zero. ✓
- The oxidation number of a monatomic ion is equal to its charge. ✓
- The sum of oxidation numbers in a polyatomic ion is zero.
- Fluorine always has an oxidation number of +1.

The correct rules include that the sum of oxidation numbers in a neutral compound is zero and that the oxidation number of a monatomic ion equals its charge.

Describe how you would determine the oxidation number of sulfur in the compound H₂SO₄.

Hint: Consider the known oxidation states of hydrogen and oxygen.

To determine the oxidation number of sulfur in H₂SO₄, you would set up an equation based on the known oxidation states of hydrogen (+1) and oxygen (-2) and solve for sulfur.

Part 3: Applying Knowledge and Analyzing Relationships

What is the oxidation number of chromium in the dichromate ion (Cr₂O₇²⁻)?

Hint: Consider the overall charge of the ion and the oxidation states of oxygen.

- +3
- +6 ✓
- +7
- +4

■ The oxidation number of chromium in the dichromate ion is +6.

In the reaction between hydrogen peroxide (H₂O₂) and potassium permanganate (KMnO₄), which of the following elements undergo a change in oxidation state?

Hint: Think about the oxidation states of the elements in the reactants and products.

- Oxygen ✓
- manganese ✓
- Potassium
- Hydrogen

■ In this reaction, both oxygen and manganese undergo a change in oxidation state.

Calculate the oxidation number of nitrogen in the compound NH₄⁺.

Hint: Consider the known oxidation states of hydrogen.

■ The oxidation number of nitrogen in NH₄⁺ is -3.

In the reaction 2H₂ + O₂ → 2H₂O, which element is reduced?

Hint: Think about the changes in oxidation states of the elements.

- Hydrogen
- Oxygen ✓
- Both hydrogen and oxygen
- Neither hydrogen nor oxygen

In this reaction, oxygen is reduced as its oxidation state decreases.

Which of the following statements correctly describe the redox process?

Hint: Consider the definitions of oxidation and reduction.

- Oxidation involves the gain of electrons.
- Reduction involves the loss of electrons.
- The substance that is oxidized loses electrons. ✓
- The substance that is reduced gains electrons. ✓

The correct statements are that oxidation involves the loss of electrons and the substance that is oxidized loses electrons.

Analyze the following reaction and identify the oxidizing and reducing agents: $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$.

Hint: Consider the changes in oxidation states of zinc and copper.

In this reaction, zinc is the reducing agent and copper(II) sulfate is the oxidizing agent.

Part 4: Synthesis and Reflection

Which of the following reactions is a redox reaction?

Hint: Think about the transfer of electrons in the reactions.

- $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{NaNO}_3 + \text{AgCl}$
- $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ ✓
- $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
- $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

The reaction $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ is a redox reaction as magnesium is oxidized and oxygen is reduced.

Evaluate the following statements about redox reactions and select those that are correct:

Hint: Consider the definitions and characteristics of redox reactions.

- In a redox reaction, one substance is oxidized and another is reduced. ✓
- Redox reactions involve the transfer of protons.
- Redox reactions are essential for cellular respiration. ✓
- All combustion reactions are redox reactions. ✓

The correct statements are that in a redox reaction, one substance is oxidized and another is reduced, and that redox reactions are essential for cellular respiration.

Create a balanced redox equation for the reaction between iron (Fe) and chlorine gas (Cl_2) to form iron(III) chloride (FeCl_3). Include the oxidation states of each element in your answer.

Hint: Consider the oxidation states of iron and chlorine in the reactants and products.

The balanced equation is $2\text{Fe} + 3\text{Cl}_2 \rightarrow 2\text{FeCl}_3$, with iron going from 0 to +3 and chlorine from 0 to -1.