Oxidation Numbers Quiz Questions and Answers PDF

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

- ◯ +1
- ◯ **0 ✓**
- ◯ -1
- ◯ +2

> The oxidation number of an element in its elemental form is always zero. This is because the atoms in their elemental state are not combined with other elements and thus have no charge.

Which elements can have multiple oxidation states? (Select all that apply)

- ☐ **Iron ✓**
- ☐ Oxygen
- ☐ **Copper ✓**
- ☐ Sodium

> Many transition metals, as well as some main group elements like nitrogen, phosphorus, and sulfur, can exhibit multiple oxidation states due to their ability to lose different numbers of electrons.

Which of the following elements always has an oxidation number of +1 in compounds?

- ◯ Oxygen
- ◯ Hydrogen
- ◯ **Sodium ✓**
- ◯ Chlorine

> The element that always has an oxidation number of +1 in compounds is sodium (Na). This is due to its position in Group 1 of the periodic table, where all alkali metals consistently exhibit a +1 oxidation state.

Which of the following statements about oxidation numbers is true? (Select all that apply)

- [x] **The sum of oxidation numbers in a neutral compound is zero. ✓**
- [ ] The oxidation number of hydrogen is always +1.
- [x] **The oxidation number of a monatomic ion is equal to its charge. ✓**
- [ ] Oxygen always has an oxidation number of -2.

> Oxidation numbers are used to indicate the degree of oxidation of an atom in a compound, and they follow specific rules such as the oxidation number of an element in its standard state is zero and the sum of oxidation numbers in a neutral compound is zero.

What is the typical oxidation number of oxygen in most compounds?

- ◯ +1
- ◯ 0
- ◯ -1
- ◯ **-2 ✓**

> The typical oxidation number of oxygen in most compounds is -2. This value is commonly observed in oxides and many other oxygen-containing compounds.

What is the oxidation number of sulfur in SO_4^{2-}?

- ◯ +2
- ◯ +4
- ◯ **+6 ✓**
- ◯ -2

> In the sulfate ion (SO_4^{2-}), the oxidation number of sulfur is +6. This is determined by considering the overall charge of the ion and the typical oxidation states of oxygen.

Which of the following compounds contains oxygen with an oxidation number of -1?

- ◯ H_2O
- ◯ CO_2
- ◯ **Na_2O_2 ✓**
- ◯ O_2

> Oxygen typically has an oxidation number of -2, but in peroxides, such as hydrogen peroxide (H2O2), it has an oxidation number of -1. Therefore, compounds like H2O2 contain oxygen with an oxidation number of -1.

In the compound $KMnO_4$, what is the oxidation number of manganese (Mn)?

- ◯ +2
- ◯ +4
- ◯ **+7 ✓**
- ◯ +5

> In $KMnO_4$, the oxidation number of manganese (Mn) is +7. This is determined by considering the oxidation states of potassium (K) and oxygen (O) in the compound.

What is the oxidation number of chlorine in Cl_2?

- ◯ +1
- ◯ **0 ✓**
- ◯ -1
- ◯ +2

> In Cl_2, each chlorine atom is in its elemental form, which means it has an oxidation number of 0. This is because the oxidation number of an element in its natural state is always zero.

Which of the following elements typically have a fixed oxidation number in compounds? (Select all that apply)

- ☐ **Sodium ✓**
- ☐ Oxygen
- ☐ Chlorine
- ☐ **Potassium ✓**

> Elements in Group 1 (alkali metals) and Group 2 (alkaline earth metals) typically have fixed oxidation numbers of +1 and +2, respectively, in compounds. Additionally, elements like aluminum usually have a fixed oxidation state of +3.

In which of the following compounds does oxygen have an oxidation number different from -2? (Select all that apply)

- ☐ H_2O
- ☐ **H_2O_2 ✓**
- ☐ **Na_2O_2 ✓**
- ☐ CO_2

> Oxygen typically has an oxidation number of -2 in most compounds, but in peroxides (like H2O2) and superoxides (like KO2), it has oxidation numbers of -1 and -1/2, respectively. Therefore, compounds containing these forms of oxygen will have oxidation numbers different from -2.

In which compound does hydrogen have an oxidation number of -1?

- ◯ H_2O
- ◯ HCl
- ◯ **NaH ✓**
- ◯ NH_3

> Hydrogen has an oxidation number of -1 in compounds where it is bonded to metals, such as in metal hydrides. A common example of this is sodium hydride (NaH).

Explain why the oxidation number of oxygen is typically -2 in compounds, but -1 in peroxides.

> **Oxygen is typically -2 due to its high electronegativity, but in peroxides, each oxygen is bonded to another oxygen, sharing electrons equally, resulting in a -1 oxidation state.**

Describe the process of determining the oxidation number of an element in a compound.

> **Assign known oxidation numbers based on rules, use algebra to solve for unknowns, ensuring the sum matches the compound's charge.**

How do oxidation numbers help in balancing redox reactions? Provide an example.

They identify oxidized and reduced species, allowing for the balancing of electron transfer. Example: Balancing MnO_4^- + Fe^{2+} → Mn^{2+} + Fe^{3+}.

Why do transition metals often have multiple oxidation states? Give an example of a transition metal and its oxidation states.

Transition metals have d orbitals that allow for various electron configurations. Example: Iron can be +2 or +3.

Discuss the significance of oxidation numbers in identifying oxidizing and reducing agents in a chemical reaction.

Oxidation numbers indicate electron transfer; the substance whose oxidation number decreases is reduced (oxidizing agent), and vice versa.

Explain how the oxidation number of an element in a polyatomic ion is determined, using sulfate (SO_4^{2-}) as an example.

Assign known oxidation numbers (O = -2), solve for the unknown (S), ensuring the sum equals the ion's charge. For SO_4^{2-}, S is +6.

Which of the following compounds contain hydrogen with an oxidation number of +1? (Select all that apply)

- [x] **H_2O** ✓
- [x] **CH_4** ✓
- [ ] NaH
- [x] **HCl** ✓

Compounds that contain hydrogen typically have an oxidation number of +1 when hydrogen is bonded to nonmetals. However, when hydrogen is bonded to metals, it can have an oxidation number of -1.

In which of the following ions is the sum of oxidation numbers equal to the charge of the ion? (Select all that apply)

- [x] **NH_4^+** ✓
- [x] **SO_4^{2-}** ✓
- [x] **NO_3^-** ✓
- [x] **ClO_4^-** ✓

The sum of oxidation numbers in an ion must equal the overall charge of that ion. Therefore, when evaluating ions, one must ensure that the calculated oxidation states align with the ion's charge.