ANSWER KEY.

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Intro to Redox Reactions

Chemistry | ANSWER KEY

Free elements are 0 and a one-atom ion equals its charge. Fill in the atoms you know first (O = −2, H = +1, F = −1, group 1 = +1, group 2 = +2), then solve for the unknown. Always write the sign.

1. Give the oxidation number of each atom or ion.

(a) N_2

0

(b) Ca^{2+}

+2

(c) Br^{-}

−1

(d) Zn

0

(e) Al^{3+}

+3

(f) P_4

0

2. Find the oxidation number of the named element in each compound. Show your setup.

(a) S in SO_2

x + 2(−2) = 0, so S = +4

(b) N in HNO_3

(+1) + x + 3(−2) = 0, so N = +5

(c) Mn in $KMnO_4$

(+1) + x + 4(−2) = 0, so Mn = +7

(d) C in CH_4

x + 4(+1) = 0, so C = −4

(e) P in H_3PO_4

3(+1) + x + 4(−2) = 0, so P = +5

(f) C in Na_2CO_3

2(+1) + x + 3(−2) = 0, so C = +4

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3. Find the oxidation number of the named element in each polyatomic ion. Show your setup.

(a) S in SO_4^{2-}

x + 4(−2) = −2, so S = +6

(b) N in NO_2^{-}

x + 2(−2) = −1, so N = +3

(c) P in PO_4^{3-}

x + 4(−2) = −3, so P = +5

(d) Mn in MnO_4^{-}

x + 4(−2) = −1, so Mn = +7

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4. Is each change oxidation or reduction? Explain using electrons or oxidation numbers.

(a) $Cu \rightarrow Cu^{2+} + 2e^{-}$

Oxidation. Electrons are a product (lost), and Cu goes 0 to +2.

(b) $Br_2 + 2e^{-} \rightarrow 2Br^{-}$

Reduction. Electrons are a reactant (gained), and Br goes 0 to −1.

(c) $Sn^{4+} + 2e^{-} \rightarrow Sn^{2+}$

Reduction. Sn gains electrons and goes down from +4 to +2.

(d) $Fe^{2+} \rightarrow Fe^{3+} + e^{-}$

Oxidation. Fe loses an electron and goes up from +2 to +3.

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5. In $2Na + Cl_2 \rightarrow 2NaCl$, which element is oxidized and which is reduced? Explain why one cannot happen without the other.

Na is oxidized (0 to +1, loses an electron). Cl is reduced (0 to −1, gains an electron). Electrons cannot just disappear, so the electrons Na loses must be gained by Cl. Oxidation and reduction always happen together.

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