Redox and Electrochemistry

12.1

What is meant by a "redox" reaction?	A reaction that involves the transfer of electron density from one atom to another (REDOX = REDuction/OXidation reaction)
Define oxidation and reduction. What mnemonic is used for this?	A loss of electrons is oxidation (leo). A gain of electrons is reduction (ger).
$2H_2 + O_2 \rightarrow 2H_2O$ is a redox reaction. Explain why this is so.	Think of electronegativity. H_2 and O_2 are non-polar (each H in H_2 has the same electronegativity, thus electrons are shared equally). In H_2O, oxygen has a higher electronegativity, thus it has a greater share of the electrons. This change in electron concentration means electrons are being gained and lost – a redox reaction.
Can oxidation occur in the absence of reduction? Explain.	No. Oxidation and reduction always occur together. If one substance is losing electrons (oxidation) another substance must be gaining electrons (electrons cannot exist in isolation).
What is meant by oxidizing agent and reducing agent?	An oxidizing agent is a substance that causes oxidation (by taking electrons). Thus, an oxidizing agent is itself reduced. Similarly, a reducing agent is oxidized in a reaction.
Name a common redox reaction.	Respiration, batteries, burning/combustion, rusting, etc.

12.2, 12.3

Define oxidation number.	"The charge an atom in a compound would have if the electron pairs in the bond belonged entirely to more electronegative atoms".
Why are oxidation numbers used?	They allow us to keep track of the gain or loss of electrons (it's a kind of bookkeeping method). Also, it is helpful in balancing certain complex equations.
How can redox reactions be re-defined with respect to oxidation #.	"A redox reaction is a chemical reaction in which changes in oxidation number occur".
How is an oxidation number of positive one written? Why?	+1 (not 1+). 1+ is how a charge of positive one is written. Oxidation numbers are written differently than charges so that we can easily distinguish between the two.
Give the rules for assigning oxidation numbers. Give examples of each.	1. Any element, when not combined with atoms of a different element, has an oxidation number of zero. (O in O_2 is zero) 2. Any simple monatomic ion (one-atom ion) has an oxidation number equal to its charge (Na^+ is +1, O^{2-} is –2). 3. The sum of the oxidation numbers of all of the atoms in a formula must equal the charge written for the formula. (if the oxidation number of O is –2, then in CO_3^{2-} the oxidation number of C is +4). 4. In compounds, the oxidation number of group IA metals is +1, IIA is +2, and aluminum (in IIIA) is +3. 5. In ionic compounds, the oxidation number of a nonmetal or polyatomic ion is equal to the charge of its associated ion. (In $CuCl_2$, Cl is –1). 6. F is always –1, O is always –2 (unless combined with F), H is usually +1.
Assign oxidation numbers in: HNO_3, $K_2Cr_2O_7$, C_2H_6O, AgI, $H_2PO_4^-$ (the last number to be calculated is highlighted).	$\overset{+1}{H}\overset{\mathbf{+5}}{\mathbf{N}}\overset{-2}{O_3}$, $\overset{+1}{K_2}\overset{\mathbf{+6}}{\mathbf{Cr_2}}\overset{-2}{O_7}$, $\overset{\mathbf{-2}}{\mathbf{C_2}}\overset{+1}{H_6}\overset{-2}{O}$, $\overset{\mathbf{+1}}{\mathbf{Ag}}\overset{-1}{I}$, $\overset{+1}{H_2}\overset{\mathbf{+5}}{\mathbf{P}}\overset{-2}{O_4^-}$