

HW # 4-4 Types of Redox Reactions WKS KEY

(Taken from book pg. 153-154 #39, 42, 52-54, 56; pg. 157 #122) and a few extra Predicting Products.

4.36 True or false? All combustion reactions are redox reactions.

True. All combustion reactions involve oxidation of a fuel by oxygen (which is then reduced).

4.42 a) What is the requirement for an element to undergo disproportionation reactions?

To undergo disproportionation, an element must be capable of being both oxidized and reduced, so it must have multiple oxidation numbers allowable and be in an intermediate oxidation state.

b) Name 5 common elements that are likely to take part in such reactions.

Five common elements that can do this are Cl, Br, I, S, and N. These elements have multiple oxidation numbers, so they can be oxidized and reduced.

4.52 Use your reduction potential chart to determine which of these metals--Au, Li, Hg, Ni, Ca, Pt—react

a) with acid Li, Ni, Ca

b) with water Li and Ca

4.53 On the basis of oxidation number considerations, one of the following oxides would not react with molecular oxygen: NO, N₂O, SO₂, SO₃, P₄O₆. Which one? Why?

Hint: The highest oxidation number for nitrogen is +5 because N has only 5 valence electrons, so it can only "lose" 5 electrons maximum.

S's highest oxidation # is _____. P's highest oxidation # is _____

SO₃ is the answer because in SO₃, the oxidation number of S is at its maximum value (+6); the sulfur cannot be oxidized further.

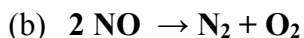
- In order for an oxide to react with molecular oxygen, the oxide must be able to be oxidized, because molecular oxygen can only be reduced.
- All of the other oxides other than SO₃ can be oxidized because they do not have their maximum oxidation numbers.

Here are the oxidation #'s in the other oxides: NO +2; N₂O +1; SO₂ +4; P₄O₆ +3

4.56 Classify the following redox reactions as either combination, decomposition, metal displacement, halogen displacement, hydrogen displacement, combustion or disproportionation.



Combination reaction



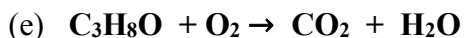
Decomposition reaction



Halogen displacement reaction



Disproportionation reaction



Combustion reaction



Hydrogen displacement

4.54 For each of the reactions below, write **balanced** molecular and net ionic equations. Then, based on the reduction potential chart, determine whether each reaction would actually occur. Briefly justify your answer.



Does the reaction occur? Justify. no reaction, since $\text{Cu}(s)$ is less easily oxidized than H_2



Does the reaction occur? Justify. no reaction, since $\text{I}_2(s)$ is less easily reduced than $\text{Br}_2(l)$.



Does the reaction occur? Justify. yes, since $\text{Mg}(s)$ is more easily oxidized than $\text{Cu}(s)$.

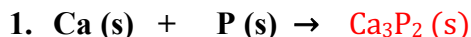


Does the reaction occur? Justify. yes, since $\text{Cl}_2(g)$ is more easily reduced than $\text{Br}_2(l)$



Does a reaction occur? Yes, K (an alkali metals) is much more easily oxidized than H_2 .

A. Predict the products of the following two reactions:



4.122 HCl is not an oxidizing agent in the same sense that sulfuric acid and nitric acid are. Explain why the chloride ion (from HCl) is not an oxidizing agent, but sulfate ions (from H_2SO_4) and nitrate ions (from HNO_3) are.

To be an oxidizing agent, it must itself be reduced.

Cl^- ion (from HCl) has a -1 oxidation #. It cannot get more negative, so it cannot be reduced. However, SO_4^{2-} (from H_2SO_4) has S with a $+6$ oxidation number, so it can be reduced.

NO_3^- has N with a $+5$ oxidation number, so it can be reduced.