

Electrochemistry uses the idea that electrons are transferred during a chemical reaction.

- If a reaction is spontaneous, an electron really wants to move from one atom/molecule to another.
- If you separate the two species and make a wire the only route an electron can travel, then you've made a battery (galvanic cell).
- To make an electron go in a way it doesn't want to (sort of like rolling it uphill) you need energy. You can force an unfavorable electrochemical reaction to occur if you give an electron enough of a push. That's how an electrolytic cell works.
- Okay, so electrochemistry is about the transfer of electrons.
- Redox reactions are just that (**LEO goes GER**, Loss of **E**lectrons is **O**xidation, **G**ain of **E**lectrons is **R**eduction). You have to be very good at taking apart Redox reactions to see who is oxidized (called the reducing agent because its oxidation causes somebody else's reduction) and which species is reduced (the oxidizing agent).

First off you've got to be good at figuring out each atom's oxidation number.

Here are the general rules and remember the oxidation number is not a real charge. It's an artificially assigned charge that we use to do bookkeeping on electron transfer.

Oxidation Number Rules

Know these rules; you need them.

Use them to assign as many oxidation states of atoms in the reaction as possible. Then look at the rest of the molecule and use them to calculate all the other oxidation numbers of atoms that you don't know.

Follow these, in order!

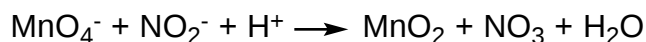
1. Pure elements have an oxidation number = 0
2. The oxidation number of a pure elemental ion = charge of the ion
3. Group IA metals have oxidation number = +1
4. Group IIA metals have oxidation number = +2
5. Fluorine has oxidation number = -1
6. Oxygen has oxidation number = -2 except in O_2^{2-} (peroxide) where it = -1
7. Hydrogen has an oxidation number = +1 except in metal hydrides where it = -1
8. The sum of all the oxidation numbers in a neutral molecule = 0
9. The sum of all the oxidation numbers in an ion = charge of the ion

Student Packet: 8.1: Oxidation Numbers: AssessMe questions

1) What is the oxidation state of arsenic in H_3AsO_3 ?

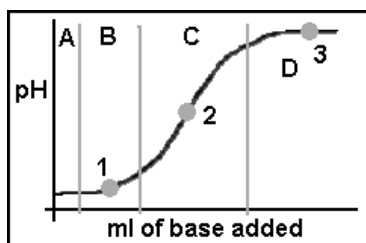
- A) +1 B) +3 C) +5 D) +7 E) I'm clueless

2) When the reaction below is balanced, what is the coefficient of H^+ ?



- A) 2 B) 4 C) 6 D) 8 E) I'm clueless

3) Which point represents the midpoint of a titration?



- A) point 1
B) point 2
C) point 3
D) not marked
E) I'm clueless

4) At which point is the solution pH equal to the pK_a of the acid?

- A) none B) point 2 C) point 3 D) region D E) I'm clueless

5) At STP hydrogen gas is

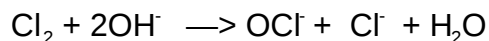
- A) 1/8 as heavy as oxygen gas.
B) 8 times heavier than oxygen gas.
C) 1/10 as heavy as air.
D) 1/16 times as heavy as oxygen gas.
E) I'm clueless

6) If the density of a gas is 1.43 g/l at STP, what is the density of the gas at 25°C and 1 atm pressure?

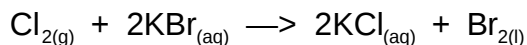
- A) 1.95 g/l
B) 1.31 g/l
C) 1.57 g/l
D) none of the above
E) I'm clueless

Student Packet: 8.1: Oxidation Numbers: ShowMe questions

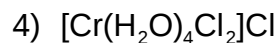
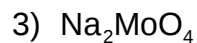
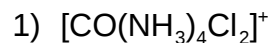
- 1) What is the oxidation state of chlorine in the following reaction?



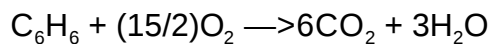
- 2) What are the oxidation states of Cl and Br in the following reaction?



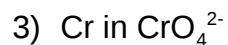
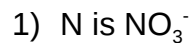
- 3) What is the oxidation state of the central metal in the following coordination compounds?



- 4) What is the oxidation state of C in the reactant and in the product of?



- 5) What are the oxidation states for the following elements?



Student Packet: 8.1: Oxidation Numbers: TestMe questions

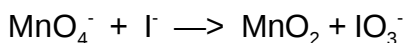
1) What is the oxidation state of Br in KBrO_4 ?

- A) 1
- B) 3
- C) 5
- D) 7
- E) -3

2) What is the oxidation state of Cl in ClO_3^- ?

- A) +1
- B) -1
- C) +3
- D) +5
- E) +7

3) What are the oxidation states of Mn and I in the following reaction?



- | | <u>Mn</u> | <u>I</u> |
|----|-----------|----------|
| A) | +5/+7 | -1/+7 |
| B) | +5/+4 | 0/+7 |
| C) | +7/+2 | -1/0 |
| D) | +7/+4 | -1/+5 |
| E) | +7/+4 | -1/+6 |

4) What is the oxidation state of Fe in $\text{K}_3\text{Fe}(\text{CN})_6$?

- A) 0
- B) +2
- C) +3
- D) +5
- E) +8

5) What is the oxidation state of oxygen in H_2O_2 ?

- A) 0
- B) -1
- C) -2
- D) +1
- E) +2