

Name: _____
 Blk: _____ Date: _____

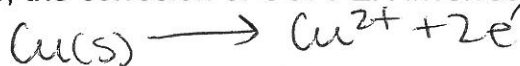
Chemistry 12
 Electrochemistry Lesson #12
CORROSION OF METALS: CAUSE AND PREVENTION

I. CORROSION: A SPONTANEOUS REACTION

A. Process:

Corrosion is simply the oxidation of a metal.
 Oxidation is the loss of electrons, where a solid metal gives rise to a positive ion and electrons.

For example, the corrosion of COPPER involves:



II CORROSION OF IRON ("RUSTING")

The most commonly known form of corrosion is the rusting of iron.
 The two major agents responsible for "rusting" are: oxygen and water.

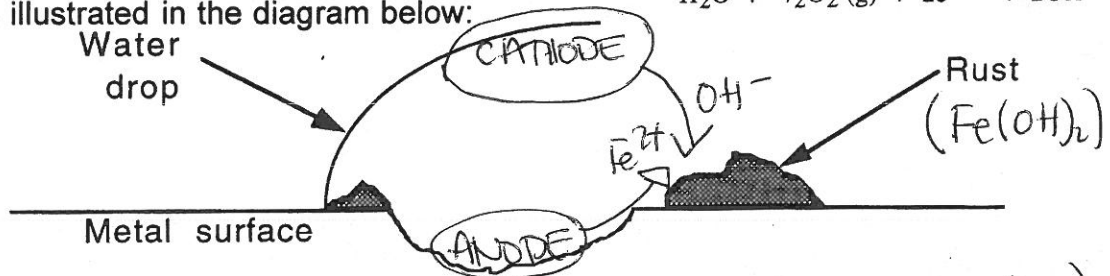
A. Importance:

Iron is the most important structural metal. (eg used to build things)
 → steel (an alloy of iron) Bridges, high rises etc.

B. Occurrence:

Physical strain on structures creates stress points which are more easily oxidized (acts as the anode). The result is that rust may form at points far from where the iron dissolves.

C. The Process is illustrated in the diagram below:



1. Iron dissolves in the pit formed on the metal's surface
2. Electrons travel through the metal to the side of reduction
3. Hydroxide ions form where the water drop meets the metal (red)
4. Rust forms where iron(II) ions meet the OH⁻ ions.
 $\text{Fe}^{2+} + \text{OH}^{-} \rightarrow \text{Fe}(\text{OH})_2(\text{s})$
5. Oxygen from the air oxidizes Fe(OH)₂ to Fe(OH)₃.

D. Factors that determine the RATE of Corrosion:

Corrosion requires: water and oxygen

Corrosion is **enhanced** by:

- 1. Heat an ↑ in temp ↑ rxn rate (tropical)
- 2. Salt Creates a salt bridge & ↑ rxn rate (countries)
- 3. Acid H⁺ ions speed up rxn rate

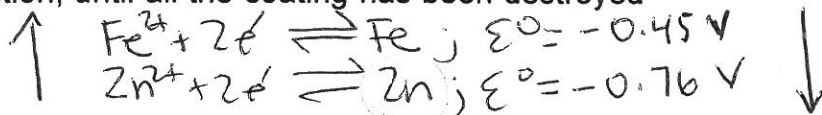
Problem in Industrial Areas (contains gold ∴ salt the roads) industry ∴ acid rain

III. THE PREVENTION OF CORROSION

A. Coating- e.g.: Paint covers metal in cars.

If oxygen cannot make contact with the metal, there will be no corrosion

B. Sacrificial coating e.g.: "galvanizing" → coating with zinc(s)
a coating of a more reactive metal will protect a metal surface from reaction, until all the coating has been destroyed



Because the Zinc half-reaction has a lower ϵ° value it will undergo oxidation instead of the Iron half-reaction

C. Cathodic Protection e.g.: Sacrificial electrode

Metals with a stronger oxidizing ability than iron will become the ANODE and therefore, iron becomes the CATHODE.

HOMEWORK: Answer the questions below along with the PLO's : V1-V4

1. Use the diagram on the front to:
 - a. indicate the motion of electrons in the metal
 - b. Indicate where the water and oxygen molecules come in contact with the electrons.
 - c. indicate the motion Fe²⁺ and OH⁻ ions in solution.
 - d. label the anode and cathode.
2. For the diagram below identify:
 - a. Which is the more active metal.
 - b. Which metal loses electrons more easily.
 - c. Draw the direction of the electrons traveling in the wire
 - d. Label the anode and cathode

