Answer on Question #73701, Chemistry / General Chemistry:

What statement describes how iron reacts with oxygen dissolved in water

Solution.

When a droplet of water containing a little dissolved oxygen falls on an steel pipe, the solid iron or Fe(s) under the droplet oxidizes:

$Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

The electrons are quickly consumed by hydrogen ions from water (H_2O) and dissolved oxegen or $O_2(aq)$ at the edge of the droplet to produce water:

$4e^- + 4H^+(aq) + O_2(aq) \rightarrow 2H_2O(l)$

More acidic water increases corrosion. If the pH is very low the hydrogen ions will consume the electrons anyway, making hydrogen gas instead of water:

$2H^+(aq) + 2e^- \rightarrow H_2(g)$

But where's the rust? The equations above tell only a small part of the story.

Hydrogen ions are being consumed by the process. As the iron corrodes, the pH in the droplet rises. Hydroxide ions (OH^-) appear in water as the hydrogen ion concentration falls. They react with the iron(II) ions to produce insoluble iron(II) hydroxides or green rust:

$Fe^{2+}(aq) + 2OH^-(aq) \rightarrow Fe(OH)_2(s)$

The iron(II) ions also react with hydrogen ions and oxygen to produce iron(III) ions:

$4Fe^{2+}(aq) + 4H^+(aq) + O_2(aq) \rightarrow 4Fe^{3+}(aq) + 2H_2O(l)$

The iron(III) ions react with hydroxide ions to produce hydrated iron(III) oxides (also known as iron(III) hydroxides):

$Fe^{3+}(aq) + 3OH^-(aq) \rightarrow Fe(OH)_3(s)$

The loose porous rust or $Fe(OH)_3$ can slowly transform into a crystallized form written as $Fe_2O_3.H_2O$ the familiar red-brown stuff that is called "rust". Since these processes involve hydrogen ions or hydroxide ions, they will be affected by changes in pH. With limited O_2, magnetite is formed Fe_3O_4.

Answer: $4Fe + 3O_2 + 6H_2O \rightarrow 4Fe^{3+} + 12OH^- \rightarrow 4Fe(OH)_3$ or $4\ FeO(OH) + 4\ H_2O$