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**Corrosion in Civil Structures**

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**Acknowledgement**

Mr John Gibson is a highly regarded educator and engineer. John taught Industrial Arts at a number of high schools before taking a position at Sydney Teachers’ College, then University of Sydney. He had an engineering education consultancy and has extensive experiencing working with NESA on Engineering Studies syllabus development and the HSC examination committee. The STEM Industry School Partnerships (SISP) Program asked John for his responses to the iTeachSTEM topic discussion questions. SISP is grateful to John for submitting these example discussion responses.

# Discuss the negative effects that corrosion can have on structures.

Corrosion is a chemical process that occurs between a metallic structural member (such as iron) and its environment. The process results in wasting away some of the metal and, can lead to catastrophic failure of the structure.

1. **Describe methods used to minimise corrosion.**

One of the main methods of minimising corrosion is to remove the metallic member from its environment. In some cases, this can be achieved by coating the member with a resistant coating such as paint. Other coatings include:

* cladding
* galvanising
* anodising
* electroplating

1. **Describe the electrochemistry of corrosion.**

There are a number of mechanisms that cause corrosion, two of which are oxidation (dry) corrosion and electrochemical (wet) corrosion.

* **Oxidation corrosion** occurs where the metal reacts with oxygen in the atmosphere to produce an oxidation product. For iron/steel we refer to the oxidation product as rust; most of the transition metals corrode in this way with their own corrosion product.
* **Chemical corrosion** is more complex as it requires two metals, electrically connected to one another, to exist in an electrolytic environment, often where the environment may have different chemical concentrations. Some examples of this type include pitting corrosion, cavitation corrosion, crevice corrosion, stress corrosion cracking, galvanic corrosion.

1. **Compare various materials based on their electrochemical activity.**

As corrosion is an electrochemical process, it is possible to group the engineering metals into a list arranged in increasing order of electrode action.

Such a series is the ‘galvanic series of metals and their alloys in seawater’. The series has magnesium at the top, followed by zinc, aluminium and, cadmium. At the lower end of the series, it lists gold, platinum and titanium.