Corrosion Chemistry

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For Teachers:

**Introduction**

This program is aimed at Years 11 and 12 Chemistry students; some sections may be relevant to more able Year 10 students. The production and properties of iron and steel are outlined. The “how, why and how to stop it” of the corrosion of metals is studied, with many relevant examples. The concept of reduction/oxidation is dealt with in detail, starting with basic principles, assuming very little prior knowledge. The reactivity series is used to help students understand how galvanic cells work. Electroplating is described as the “reverse” of galvanic cells.

One sequence that could be used is:

- Check what students know before they view the programme
- Alert them to keywords/terms
- Watch the program making notes on key terms
- Discuss what is seen
- Give out questions
- Answer as many questions as possible
- Watch program again, filling in missing answers/correcting
- Go over student responses, correcting and filling in missed items.

**DVD Timeline**

- 00:00:00 Introduction
- 00:01:38 Introduction to Corrosion
- 00:05:49 Summary
- 00:06:32 Conditions Needed for Corrosion
- 00:10:23 Summary
- 00:11:04 Corrosion and Oxidation
- 00:16:26 Summary
- 00:17:17 Electricity and Redox
- 00:21:54 Summary
- 00:22:28 Corrosion Minimisation
- 00:27:36 Summary
- 00:28:16 Conclusion
- 00:28:52 End credits
- 00:29:16 Program end
Student Worksheet:

Before Viewing the Program

Check “pre-knowledge” of students before viewing the program.

1. Name 5 metals.

2. Give three properties of metals.

3. Metals corrode. Give another name for “corrode”.

4. Name two gases present in the atmosphere.

5. Do metals tend to gain or lose electrons when they react with non-metals?
While Viewing the Program

Have a pen, pencil and paper ready. Consider the following terms:
As these terms occur while watching the program, jot down a quick thought about them.

- Corrosion
  ...
  ...

- Alloy
  ...
  ...

- Blast Furnace
  ...
  ...

- Steel
  ...
  ...

- Hydrated
  ...
  ...

- Air
  ...
  ...

- Rust
  ...
  ...

- Reduction
  ...
  ...

- Oxidation
  ...
  ...

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- Galvanic Cell
  
- Anode
  
- Cathode
  
- Electrolyte
  
- Salt bridge
  
- Passive
  
- Galvanising
  
- Sacrificial
After Viewing the Program

1. After the program has been viewed, answer the following questions:

   a) Name two things that corrosion does to a metal.

   b) Which metal is the major component of steel?

   c) Calcium carbonate is also known as?

   d) Fe₂O₃ is the formula for?

   e) A blast furnace is used to produce which metal?

   f) What is the formula for a hydroxide ion?

   g) In order for iron to rust, which two other substances need to be present?

   h) If salt, sodium chloride (NaCl) is present does corrosion speed up, slow down, or stay the same?

   i) What is transferred in oxidation-reduction reactions?

   j) When a substance is oxidised does it gain or lose electrons?

   k) Which type of cell uses two electrodes (usually metal) to generate a current?

   l) What is the role of the salt bridge in a Galvanic cell?

   m) When iron is galvanised, it is coated with which metal?
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True - false response worksheet:

a) Metals are usually shiny.
   TRUE OR FALSE

b) Corrosion is a desirable process.
   TRUE OR FALSE

c) The major component of steel is carbon.
   TRUE OR FALSE

d) Haematite is an ore of aluminium.
   TRUE OR FALSE

e) Raw materials put into a blast furnace include iron ore, limestone and coke.
   TRUE OR FALSE

f) All metals are very reactive.
   TRUE OR FALSE

g) The atmosphere contains approximately 79% nitrogen.
   TRUE OR FALSE

h) Iron will rust if only oxygen, but no water, is present.
   TRUE OR FALSE

i) Dehydrated means that water is present.
   TRUE OR FALSE

j) Redox reactions involve the sharing of electrons.
   TRUE OR FALSE

k) Ferrous ions are represented by Fe^{2+}.
   TRUE OR FALSE

l) When magnesium metal (Mg) changes to the dipositive magnesium ion (Mg^{2+}), it has been oxidised.
   TRUE OR FALSE

m) Galvanic cells use chemical reactions to produce electricity.
   TRUE OR FALSE

n) The more reactive a metal is, the more easily it is oxidised.
   TRUE OR FALSE

o) Reduction occurs at the cathode in an electrical cell
   TRUE OR FALSE
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Suggested Student Responses

Before Viewing the Program

Check “pre-knowledge” of students before viewing the program.

1. Name 5 metals.
   Iron, copper, silver, gold, aluminium, steel, lead

2. Give three properties of metals.
   Shiny, malleable, ductile, good thermal and electrical conductors

3. Metals corrode. Give another name for “corrode”.
   Rust

4. Name two gases present in the atmosphere.
   Nitrogen, oxygen, carbon dioxide, helium

5. Do metals tend to gain or lose electrons when they react with non-metals?
   They lose electrons
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After Viewing the Program

1. After the program has been viewed, answer the following questions:
   a) Name two things that corrosion does to a metal.
      It spoils the look, can disintegrate
   b) Which metal is the major component of steel?
      Iron
   c) Calcium carbonate is also known as?
      Limestone
   d) Fe₂O₃ is the formula for?
      Iron (II) oxide
   e) A blast furnace is used to produce which metal?
      Iron
   f) What is the formula for a hydroxide ion?
      OH
   g) In order for iron to rust, which two other substances need to be present?
      Air, water
   h) If salt, sodium chloride (NaCl) is present does corrosion speed up, slow down, or stay the same?
      It speeds up
   i) What is transferred in oxidation-reduction reactions?
      Electrons
   j) When a substance is oxidised does it gain or lose electrons?
      Lose
   k) Which type of cell uses two electrodes (usually metal) to generate a current?
      Galvanic
   l) What is the role of the salt bridge in a Galvanic cell?
      It allows the flow of ions
   m) When iron is galvanised, it is coated with which metal?
      Zinc
2. True - false response worksheet:

a) Metals are usually shiny.  
   **True**

b) Corrosion is a desirable process.  
   **False**

c) The major component of steel is carbon.  
   **False**

d) Haematite is an ore of aluminium.  
   **False**

e) Raw materials put into a blast furnace include iron ore, limestone and coke.  
   **True**

f) All metals are very reactive.  
   **False**

g) The atmosphere contains approximately 79% nitrogen.  
   **True**

h) Iron will rust if only oxygen, but no water, is present.  
   **False**

i) Dehydrated means that water is present.  
   **False**

j) Redox reactions involve the sharing of electrons.  
   **False**

k) Ferrous ions are represented by Fe$^{2+}$.  
   **True**

l) When magnesium metal (Mg) changes to the dipositive magnesium ion (Mg$^{2+}$), it has been oxidised.  
   **True**

m) Galvanic cells use chemical reactions to produce electricity.  
   **True**

n) The more reactive a metal is, the more easily it is oxidised.  
   **True**

o) Reduction occurs at the cathode in an electrical cell  
   **True**