

Revision Questions for Standard Grade Chemistry

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Topic 12

Corrosion

General Level

1. Each year corrosion costs our country millions of pounds.

- Explain what is meant by corrosion.
- What special term is applied to the corrosion of iron?
- Consider this list of substances:

glass, magnesium, sandstone, sulphur, zinc,
calcium carbonate, sodium, aluminium, plastic, calcium

Copy the table and place each of the substances in the appropriate column.

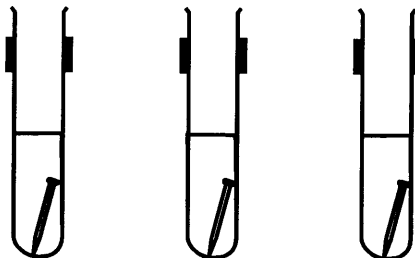
Substances which corrode	Substances which do not corrode

- Apart from iron, what **two** substances are necessary for rusting to occur?
 - When iron rusts, what happens to the iron atoms?

3. Acid rain is common in industrial areas.

How does acid rain affect the rate of corrosion of metals?

4. Three test-tubes were set up as shown.



A - iron nail
in salt water

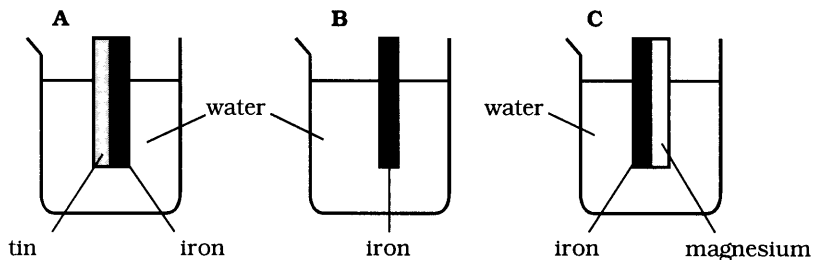
B - iron nail
in water

C - iron nail
in glucose solution

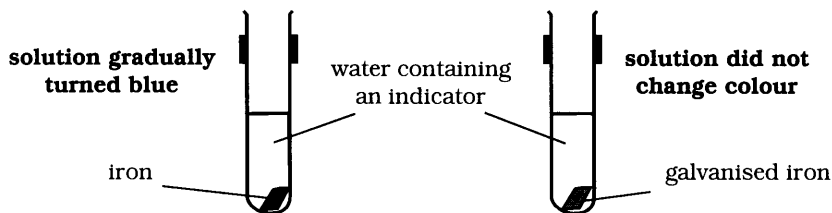
Ferroxyl indicator was added to each of the tubes. On inspection it was found that the nail in tube **A** had corroded most. The amount of corrosion in tubes **B** and **C** was much the same.

- How does ferroxyl indicator help to compare the rates of corrosion?
- Explain why salt in the water speeds up the rate of corrosion whereas glucose does not.

5. A pupil set up the following experiment.

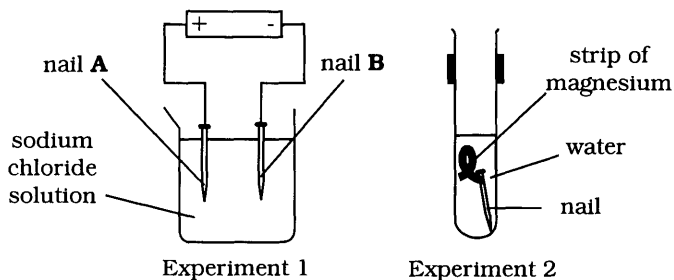


- (a) In which experiment would the corrosion of iron be fastest?
(b) Explain your answer.
6. Explain each of the following.
- (a) A ship corrodes faster at sea than on a fresh-water loch.
 - (b) The hulls of ships often have blocks of magnesium attached to them.
 - (c) It is inadvisable for a plumber to attach copper piping to an iron storage tank.
 - (d) Iron railings which are painted corrode less rapidly than unpainted railings.
 - (e) It is inadvisable for a plumber to use solder containing lead to join copper pipes.
 - (f) A motor car body is often connected to the negative terminal of the car battery.
 - (g) Scrap magnesium can be used to protect underground storage tanks but scrap copper **cannot** be used.
7. The experiment shown was carried out to investigate the rusting of iron.



- (a) Suggest a name for the indicator used.
(b) Explain what is meant by galvanised iron.
(c) Why does galvanised iron hardly rust even when badly scratched?
8. Both zinc and tin are used to protect iron and steel containers from corrosion. Metal dustbins are made from iron which has been dipped into molten zinc; cans for food are tin-plated.
- (a) What name is given to the process of coating iron with zinc?
(b) Explain why zinc is preferred to tin for protecting dustbins.

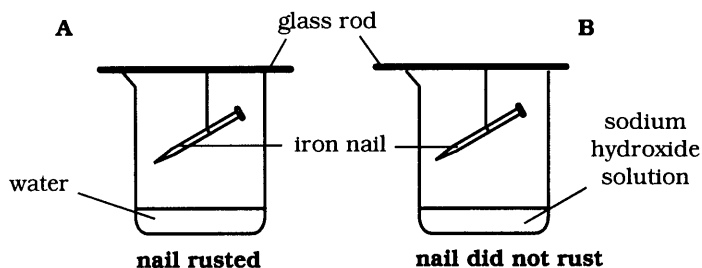
9. Two corrosion experiments with iron nails are shown.



- (a) In experiment 1, which nail, **A** or **B**, will be protected against rusting?
- (b) In experiment 2, how does the magnesium protect the nail from rusting?
- (c) For each of these experiments describe how the method is actually used to protect iron or steel on a large scale.
10. Oil rigs, made of iron and steel, corrode readily at sea.
State **one** method which could be used to help prevent corrosion of oil rigs and explain briefly how the method works.
11. Galvanising could be said to provide 'double protection' against corrosion of iron. This is because the process provides both physical protection and electrochemical protection.
Explain whether or not a coating of copper instead of zinc would be as effective in providing
- (a) physical protection,
- (b) electrochemical protection.
12. **X** and **Y** are two metals. When each is attached to iron only **Y** decreases the speed of rusting of iron.
- (a) Which metal is more reactive, **X** or **Y**?
- (b) Which metal would be most effective in sacrificially protecting iron?
13. Both silver and gold are used to cover objects made of steel. As well as providing an attractive finish, the steel is protected against corrosion.
- (a) What name is given to the process of coating steel with silver or gold?
- (b) Explain why the coating protects the iron against corrosion.
14. Equipment used by Scott in his expedition to the South Pole nearly eighty years ago has been found recently. It shows very little sign of rusting.
Explain why iron rusts so slowly when the temperature is below 0 °C.
15. Steel can be protected from rusting by coating it with other substances. One method is dipping it in molten plastic.
- (a) Why does coating steel with plastic prevent rusting?
- (b) Chromium plated steel rusts quickly if scratched.
What does this tell you about the reactivity of chromium?

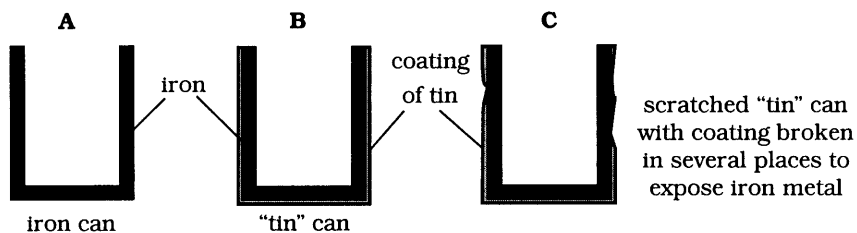
Credit Level

16. Corrosion involves atoms at the surface of a metal losing electrons and changing to metal ions.
- State the name of this kind of reaction.
 - Write ion-electron equations to show what happens to the metal atoms during the corrosion of
 - iron,
 - zinc,
 - magnesium,
 - aluminium.
 - Write the ion-electron equation to show what can happen to the iron(II) ions which are formed during the corrosion of iron.
 - Write the ion-electron equation to show how hydroxide ions are formed during corrosion of a metal.
17. Two experiments are set up as shown.



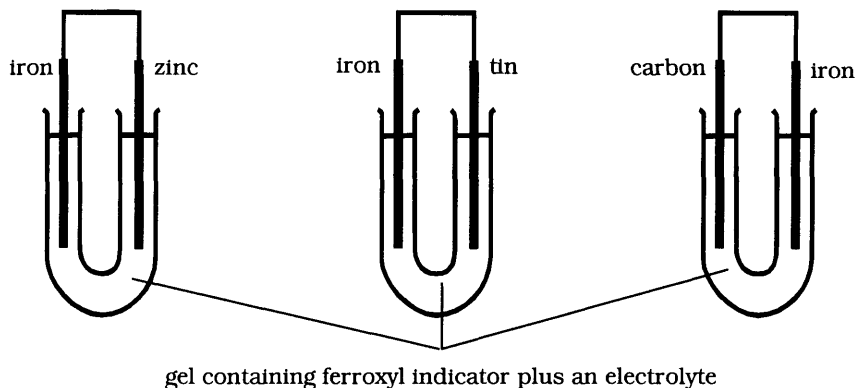
Explain why the nail in experiment B did not rust.

18. Acid mists lead to faster corrosion of metals.
- Write ion-electron equations for each of the reactions which occur when iron is corroded by acid.
 - Explain why galvanising does **not** protect iron permanently from corrosion by acid.
19. Three experiments were set up outside to investigate the corrosion of "tin" cans. These cans are made of iron which has been coated with tin.



- In which experiment will the iron not rust?
 - Explain your answer.
- In which experiment will the iron rust fastest?
 - Explain your answer.

20. Consider the following cells.



- (a) Name the ion which reacts with ferroxyl indicator to produce
- a blue colour,
 - a red colour.
- (b) What colour, if any, will be observed at each of the electrodes in the three cells?
- (c) Write the ion-electron equation to show the reaction at each electrode in the three cells
- (d) What is the direction of electron flow in each of the cells?
21. Archaeologists found some corroded silver coins and a badly rusted sword.
- (a) The silver coins were restored by wrapping them in zinc foil in a beaker of salt solution.
What type of reaction took place?
- (b) The iron blade was attached to its handle by a copper band.
Explain why, although the copper was uncorroded, the iron had rusted badly.
22. Dental amalgam is a mixture of metals including mercury, silver and tin. The amalgam slowly corrodes in the mouth. Corrosion is more rapid if the amalgam makes contact with a gold filling in a neighbouring tooth.
Explain why contact with gold increases the rate of corrosion of the dental amalgam.
23. In the 19th century, Humphrey Davy suggested that the Royal Navy could protect the copper sheeting on the hulls of its ships from corrosion by attaching small patches of iron to them.
- (a) Write the ion-electron equation to show what happens to the atoms when copper corrodes.
- (b) Explain why attaching patches of iron would have prevented the copper from corroding.

24. "OLD COPPER BOTTOM"

"Old Copper Bottom" was the nickname of William Forbes of Stirling, who lived during the 18th century.

Forbes made his fortune by buying up all the available copper in the country when he heard rumours that the Navy was planning to experiment with copper sheeting on the hulls of its wooden warships. He sold the copper to the Navy at a large profit and when the experiment failed because of the use of iron nails, he bought the copper back at a lower price.

Forbes then pointed out the obvious fact that copper nails should have been used. After this he was able to resell the copper to the Admiralty, and made a second large profit.

Explain why it is "obvious" that copper nails and **not** iron nails should have been used in the experiment.