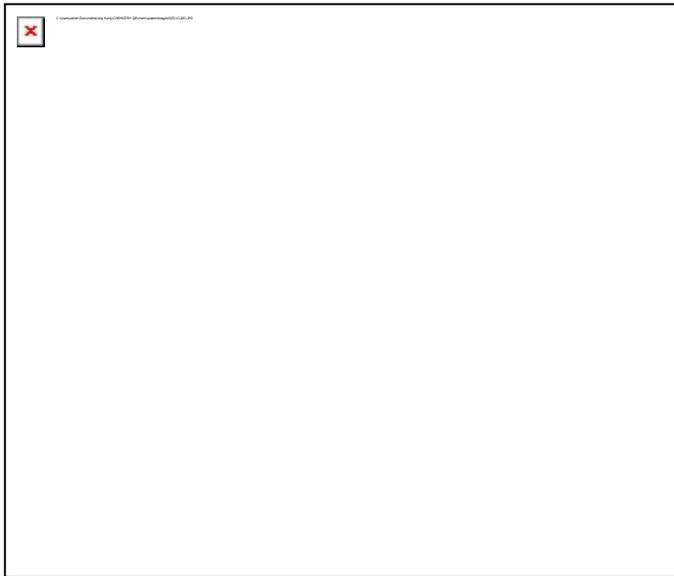


12 Corrosion of metals

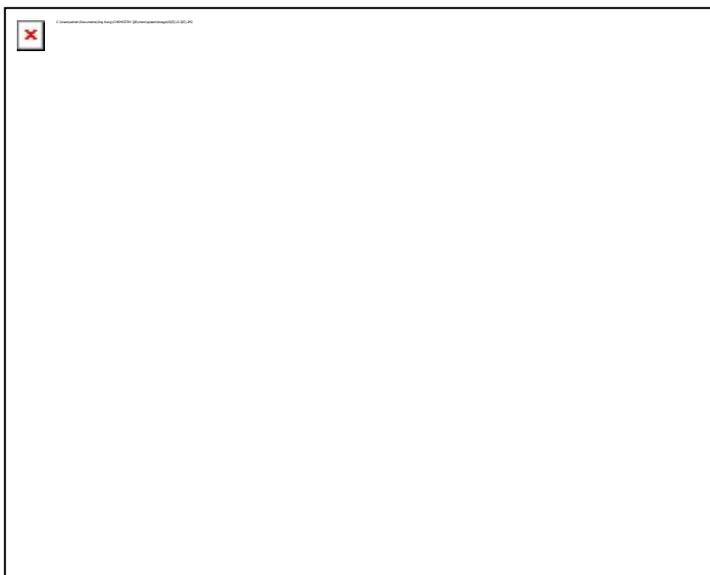
1. The chemical formula of rust is

- A FeO.
- B Fe₂O₃.
- C FeO • xH₂O.
- D Fe₂O₃ • xH₂O.

2. Which of the following iron nails would NOT rust after 3 days?



3. The diagrams below represent four tests in an experiment designed to find out the necessary conditions for rusting. Which diagram represents the most favourable conditions for rust to appear on the nail?



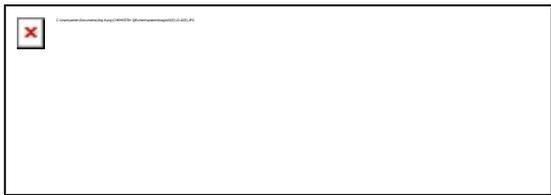
9. Directions: Questions 9 and 10 refer to the following experiment.
Four iron nails were wrapped with different metal strips. Rust indicator solution containing potassium hexacyanoferrate(III) and phenolphthalein was poured into the following glass dishes to cover the iron nails. The dishes were allowed to stand in air for some time.



In which of the dish(es) would the iron nail rust?

- A Dish 1 only
B Dishes 1 and 3 only
C Dishes 2 and 4 only
D Dishes 2, 3 and 4 only
- 10 Which of the following combinations is correct?
- | | <u>Dish</u> | <u>Colour change of rust indicator</u> |
|---|-------------|--|
| A | 1 | no colour change |
| B | 2 | a blue colour appeared |
| C | 3 | a brown colour appeared |
| D | 4 | a pink colour appeared |
11. The process of rusting is speeded up
- (1) in the presence of sodium chloride solution.
 - (2) at a higher temperature.
 - (3) in the presence of dilute sulphuric acid.
- A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)

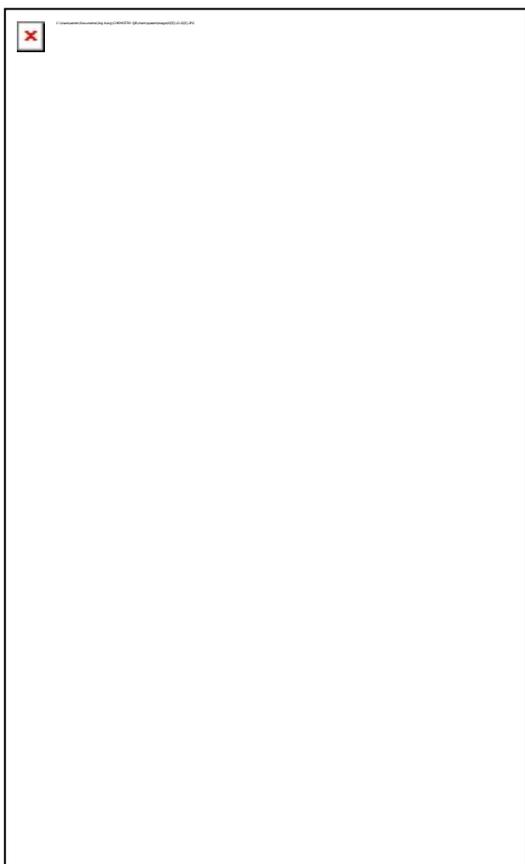
12. The iron rod shown is coated with tin, but part of the tin scratched to expose the iron underneath. The iron rod is placed in gel with a rust indicator containing potassium hexacyanoferrate(III) and phenolphthalein.



Which of the following observations are correct?

- (1) The exposed iron rusts.
 - (2) A blue colour appears near the scratched area.
 - (3) A brown colour appears near both ends of the iron rod.
- A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)

13. In which of the following beakers would the iron rust after two days?



- A (1) only
B (2) only
C (1) and (3) only
D (2) and (3) only

14. In which of the following cases will the iron nail rust after 1 week?



- A (1) and (2) only
- B (1) and (3) only
- C (2) and (3) only
- D (1), (2) and (3)

15. Which of the following methods CANNOT prevent iron from rusting?

- A Chromium-plating
- B Wrapping a copper wire around the iron object
- C Coating with oil
- D Coating with plastic

16. Tin-plating can prevent iron from rusting because

- A tin protects iron from air and water.
- B tin corrodes instead of iron.
- C tin is higher than iron in the reactivity series.
- D tin is less reactive than iron.

17. The hull of a ship can be protected from corrosion by attaching a piece of metal to it. The metal could be

- A iron.
- B potassium.
- C tin.
- D zinc.

18. Which of the following methods can be used to prevent a bicycle gear wheel from rusting?

- A Coating with paint
- B Coating with grease
- C Attaching a piece of zinc to it
- D Coating with plastic

19. Which of the following combinations is INCORRECT?

<u>Iron article</u>	<u>Method for protecting iron from rusting</u>
A Car body	impressed current cathodic protection
B Coat hanger	plastic coating
C Food can	galvanized iron
D Surgical instrument	stainless steel

20. Zinc coating can prevent iron from rusting because

- A zinc is more reactive than iron.
- B zinc is harder than iron.
- C zinc forms a protective layer on the surface of iron.
- D zinc loses electrons more readily than iron.

21. Which of the following CANNOT protect iron from rusting?

- A Iron coated with tin
- B Iron alloyed with chromium
- C Iron covered with plastic
- D Iron connected to lead

22. Stainless steel is seldom used to make large objects because

- A it is not strong enough.
- B it is not malleable enough.
- C it is too expensive.
- D it is difficult to produce.

23. Which of the following methods can prevent iron from rusting?

- (1) Anodization
 - (2) Tin-plating
 - (3) Galvanization
- A (1) and (2) only
 - B (1) and (3) only
 - C (2) and (3) only
 - D (1), (2) and (3)

24. Which of the following processes could be used to slow down the corrosion of an iron nail?

- (1) Painting the nail
 - (2) Coating a layer of zinc on the nail
 - (3) Putting the nail in distilled water
- A (1) and (2) only
 - B (1) and (3) only
 - C (2) and (3) only
 - D (1), (2) and (3)

25. Which of the following are examples of sacrificial protection against rusting?
- (1) Iron dustbins coated with tin
 - (2) Underground iron pipes connected to magnesium bars
 - (3) Hull of a ship connected to zinc blocks
- A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)
26. Which of the following processes CANNOT slow down the corrosion of an iron nail?
- (1) Wrapping a copper wire around the iron nail
 - (2) Putting the iron nail in oil
 - (3) Attaching a piece of lead to the iron nail
- A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)
27. Why is aluminium a good choice for the manufacture of outdoor structures?
- A Aluminium is easily reduced.
B Aluminium is not easily oxidized.
C Aluminium is easily reduced, but forms a protective coating.
D Aluminium is easily oxidized, but forms a protective coating.
28. A food can corrodes quickly in sea water while a soft drink can does not. Which of the following explanations is correct?
- A Aluminium is more reactive than iron.
B Aluminium has a protective oxide layer on its surface.
C Aluminium is lighter than iron.
D A food can reacts with sodium chloride while a soft drink can does not.
29. Which of the following statements concerning the anodization of aluminium is INCORRECT?
- A Aluminium object to be anodized is made the positive electrode.
B The negative electrode is made of an aluminium sheet.
C Dilute sulphuric acid can be used as an electrolyte.
D Aluminium oxide on the surface of the object is reduced to aluminium.
30. Which of the following substances are usually made of anodized aluminium?
- (1) Milk bottle caps
 - (2) Window frames
 - (3) Bumpers of cars
- A (1) and (2) only
B (1) and (3) only
C (2) and (3) only
D (1), (2) and (3)

Structured questions

1. An iron nail is placed in a gel containing a rust indicator, a mixture of potassium hexacyanoferrate(III) and phenolphthalein. Blue and pink colours develop around the iron nail after two days.

✖

- a) What is the chemical nature of rust? (1 mark)
- b) State the essential conditions for the rusting of iron. (1 mark)
- c) i) Name the ion that gives a blue colour with the rust indicator. (1 mark)
- ii) Write an equation for the formation of the ion named in (i). (1 mark)
- d) i) Name the ion that gives a pink colour with the rust indicator. (1 mark)
- ii) Write an equation for the formation of the ion named in (i). (1 mark)
- e) Iron rods X and Y are coated with lead and zinc separately. However, part of the coating metal has been scratched to expose the iron underneath in each case.

✖

The iron rods are allowed to stand in air for some time.

- i) Predict whether iron rod X will rust. Explain your answer. (2 marks)
- ii) Predict whether iron rod Y will rust. Explain your answer. (2 marks)
- f) For each of the following iron object, suggest a suitable method to protect it from rusting:
- i) a ship's hull (1 mark)
- ii) bicycle gear wheel (1 mark)
- g) Explain why connecting the steel structure of a pier to the negative terminal of a battery can help protect the steel structure from corrosion. (2 marks)