Corrosion, Batteries, and Design Evidence

Student Worksheet | `g10_u06_w24`

I can: use redox and supplied mass-loss data to compare bounded corrosion-prevention models.
Supplied models: In a bare-iron corrosion card, $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$ is anodic oxidation and a supplied oxygen-reduction site is cathodic. In a Zn–Fe contact card, Zn is stated to be the anode: $Zn(s) \rightarrow Zn^{2+}(aq) + 2e^-$, so electrons travel Zn → Fe through the contact. A battery uses deliberately separated redox pathways to deliver external electron flow; corrosion can create unintended local galvanic regions. Use only data cards/simulations—no metal, electrolyte, battery, or device work.

card (10 d, same environment)	Fe loss (g)	Zn loss (g)	stated feature
A	0.40	—	bare Fe
B	0.02	—	intact coating on Fe
C	0.30	—	scratched coating on Fe
D	0.05	0.32	scratched coating + Zn–Fe contact

1. In the bare-iron model, identify the oxidation half-reaction.

2. In that half-reaction, are electrons reactants or products? What does that show?

3. Which electrode role is assigned to an iron site where that oxidation occurs?

4. What process occurs at the supplied oxygen-reduction site?

5. Compare a battery model with a corrosion model: what redox feature can they share, and what important purpose difference remains?

6. In the supplied Zn–Fe contact card, which metal is the anode?

7. Which metal is the cathodic/protected surface in that stated model?

8. State the electron-flow direction through the Zn–Fe contact.

9. Which metal should lose mass through anodic oxidation in the supplied contact model?

10. Calculate the Fe mass-loss rate for card A in g/day.

11. Calculate the Fe mass-loss rate for card C in g/day.

12. Calculate the Fe mass-loss rate for card D in g/day.

13. Relative to card C, calculate the percent decrease in Fe mass-loss rate for card D.

14. Calculate the Zn mass-loss rate for card D in g/day.

15. What bounded inference does cards C and D support about the stated Zn–Fe contact model?

16. Explain how an intact coating can reduce exposure in a corrosion model.

17. Why does the scratched-coating card prevent a claim that coating always eliminates corrosion?

18. Critique: "If Zn loses mass, the prevention design has failed." Use the supplied galvanic convention.

19. Choose one prevention model to test further for the same supplied environment. Cite one benefit and one tradeoff, without making a medical, environmental, or device-design claim.

20. Write a cautious CER statement using one redox convention and one data calculation. Include the data/simulation safety boundary and one limitation on generalization.