Practice quiz: API 571 Corrosion and Materials

10 questions. The answer key is on page 2.

Name _____ Date _____

1. **An inspection report says an austenitic stainless steel weld area is sensitized. What does that describe?**
   A. A hard phase has formed that lowers toughness
   B. Chromium carbides at grain boundaries leave them open to attack
   C. Hydrogen has collected at inclusions and formed blisters
   D. Carbon has diffused into the surface at high temperature

2. **Carbon dioxide dissolves in water that condenses inside a carbon steel line. What forms, and what does it do?**
   A. Sulfuric acid, which attacks the steel
   B. A protective oxide film on the steel
   C. Atomic hydrogen that blisters the steel
   D. Carbonic acid, attacking the steel

3. **Which group of materials generally lacks a ductile-to-brittle transition, so brittle fracture is not a usual concern at low temperature?**
   A. Austenitic stainless steels
   B. Carbon and C-0.5Mo steels
   C. Low alloy Cr-Mo steels
   D. Ferritic and martensitic stainless steels

4. **Which combination most promotes ethanol stress corrosion cracking of carbon steel in fuel ethanol service?**
   A. High temperature and no residual stress
   B. Low velocity and fully stress-relieved welds
   C. Dissolved oxygen and residual weld stress
   D. Contact with copper alloy fittings

5. **Where is ammonium bisulfide corrosion most often found in a hydroprocessing unit?**
   A. The reactor feed heater radiant tubes
   B. The fired heater stack
   C. The amine regenerator reboiler
   D. The reactor effluent air cooler

6. **What does naphthenic acid corrosion typically look like in a high-velocity crude transfer line?**
   A. Even thinning under heavy sulfide scale
   B. Clean, sharp-edged pits or grooves
   C. Branching cracks filled with oxide
   D. Bulging that ends in a fishmouth split

7. **How do caustic stress corrosion cracks in carbon steel usually appear?**
   A. Intergranular cracks near unrelieved welds
   B. Smooth gullies lined up with the flow direction
   C. Cup-shaped pits under tubercles
   D. Deep pits full of metal dust

8. **Which practice reduces the risk of brittle fracture during a cold startup of a thick carbon steel vessel?**
   A. Raising pressure fully before heating
   B. Cooling the shell with water for stability
   C. Keeping pressure low until the metal is warm
   D. Pressurizing quickly to shorten the cold period

9. **Which method is best suited to find amine stress corrosion cracking at carbon steel welds?**
   A. Visual examination from a distance
   B. Wet fluorescent magnetic particle testing
   C. Spot ultrasonic thickness readings
   D. Hardness testing of the weld cap

10. **Which technique helps find wet insulation along an insulated line without removing the insulation?**
    A. Liquid penetrant testing
    B. Magnetic particle testing
    C. Replication metallography
    D. Infrared thermography

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Answer key

API 571 Corrosion and Materials. One line of why for each answer.

1. **B** Sensitized stainless steel has chromium carbides along its grain boundaries, which leaves the boundaries low in chromium and open to intergranular attack.
2. **D** CO2 in water forms carbonic acid, which corrodes carbon and low alloy steel.
3. **A** Austenitic stainless steels keep their toughness at low temperature.
4. **C** Ethanol SCC needs tensile stress, typically residual stress at welds that were not stress relieved, and dissolved oxygen makes it more likely.
5. **D** Ammonia and H2S combine in water in the cooling effluent, so the reactor effluent air cooler and its piping are the classic location.
6. **B** Naphthenic acid attack leaves clean, sharp-edged pits, grooves or gouges, worst where velocity is high.
7. **A** Caustic cracking in carbon steel is mostly intergranular and sits near welds that were not stress relieved.
8. **C** Brittle fracture needs low toughness, stress and a flaw together, so holding pressure low until the metal warms above its transition keeps stress down while toughness is low.
9. **B** Amine cracks are fine surface cracks beside welds, and wet fluorescent magnetic particle testing is sensitive to them.
10. **D** Wet insulation changes how heat flows through it, so infrared thermography can show wet areas from outside.

Full explanations

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