Exam : **AMPP-CP1**

Title : Cathodic Protection Tester (NACE-CP1-001)

Version : DEMO

1.Scenario: A technician is evaluating an impressed current cathodic protection (ICCP) system operating in constant voltage mode. The rectifier output is initially recorded at 24 Volts and 12 Amps. A subsequent survey reveals that soil desiccation has caused the total circuit resistance to increase to 3.0 Ohms. Based on fundamental electrical principles, what is the expected power consumption of the system under these new environmental conditions?

A. 72 Watts of continuous system power consumption

B. 192 Watts of continuous system power consumption

C. 288 Watts of continuous system power consumption

D. 576 Watts of continuous system power consumption

Answer: B

Explanation:

This question tests Domain 1.1 (Electrical Fundamentals) and the integration of Ohm's Law with Power equations. The initial resistance was 2.0 Ohms (24V /12A). The scenario states the resistance increases to 3.0 Ohms while the rectifier maintains a constant 24 Volts. The new current is calculated using Ohm's Law (I = V /R), which equals 8 Amps (24V /3.0 Ohms). Power is calculated as P = V * I. Therefore, 24V * 8A = 192 Watts.

Option A is incorrect because it uses the formula P = I^2 * R but applies the new resistance to a flawed current assumption (3A * 24V = 72W, or similar math error).

Option C is incorrect as it represents the original power consumption (24V * 12A) before the resistance shift.

Option D is incorrect because it mistakenly squares the voltage without dividing by resistance, or squares the original current (12^2 * 4).

2.Scenario: A submerged pipeline is protected by an impressed current system utilizing a high silicon chromium iron (HSCI) anode groundbed. The rectifier is configured to deliver a continuous current of 15 Amps. The total installed mass of the HSCI groundbed is 150 kilograms.

Given the standard electrochemical consumption rate for HSCI is 0.5 kg/A-yr, what is the theoretical operational lifespan of this groundbed before complete depletion?

A. 10.0 years of continuous groundbed operation

B. 15.0 years of continuous groundbed operation

C. 20.0 years of continuous groundbed operation

D. 30.0 years of continuous groundbed operation

Answer: C

Explanation:

This question maps to Domain 1.2 (Electrochemical Basics) and requires the application of Faraday's Law (Wt = K * I * T). The given variables are the total weight loss allowable (Wt = 150 kg), the electrochemical equivalent (K = 0.5 kg/A-yr), and the current (I = 15 A). Solving for Time (T): 150 = 0.5 * 15 * T. This simplifies to 150 = 7.5 * T, resulting in T = 20 years.

Option A is incorrect because it mistakenly applies the consumption rate of a different material (like high potential magnesium or a misremembered constant of 1.0 kg/A-yr).

Option B is incorrect as it merely echoes the current value as a distractor.

Option D is incorrect because it applies mathematical division erroneously, likely calculating (15 /0.5) instead of multiplying the variables correctly before dividing the mass.

3.Scenario: An installation crew is deploying a localized galvanic cathodic protection groundbed to mitigate external corrosion on a valve station. Three individual zinc anodes are installed and electrically bonded in a parallel configuration to a common junction box. The individual resistances to earth for the three anodes are measured independently at 6.0 Ohms, 6.0 Ohms, and 3.0 Ohms.
What is the total equivalent circuit resistance of this specific groundbed architecture?
A. 1.50 Ohms of equivalent total circuit resistance
B. 3.00 Ohms of equivalent total circuit resistance
C. 5.00 Ohms of equivalent total circuit resistance
D. 15.0 Ohms of equivalent total circuit resistance
Answer: A
Explanation:
This question tests Domain 1.1 (Electrical Fundamentals) regarding Kirchhoff's Laws and parallel circuit configurations. The formula for total resistance (Rt) in a parallel circuit is 1/Rt = 1/R1 + 1/R2 + 1/R3. Substituting the measured values: 1/Rt = 1/6 + 1/6 + 1/3. Finding a common denominator (6): 1/Rt = 1/6 + 1/6 + 2/6 = 4/6. The inverse of 4/6 is 6/4, which equals 1.5 Ohms.
Option B is incorrect because it merely identifies the lowest individual anode resistance, ignoring parallel circuit dynamics.
Option C is incorrect due to a fundamental arithmetic error, likely averaging the sum incorrectly.
Option D is incorrect because it calculates the total resistance using the series circuit formula (Rt = R1 + R2 + R3 = 6 + 6 + 3), which represents a completely different and invalid physical topology for this groundbed.

4.Scenario: A newly installed carbon steel pipeline is electrically bonded to a high-potential magnesium anode in a low-resistivity soil environment. Initial native structure-to-electrolyte potential was -0.450 V CSE. After 72 hours of continuous operation, the potential is measured at -1.150 V CSE.
What electrochemical phenomenon is primarily responsible for this specific shift in the measured potential?
A. Cathodic polarization of the carbon steel pipeline
B. Anodic depolarization of the magnesium groundbed
C. Electrolytic ionization of the adjacent soil matrix
D. Passivation of the carbon steel structure boundary
Answer: A
Explanation:
This question maps to Domain 1.2 (Electrochemical Basics). The shift from a native potential (-0.450 V) to a more negative potential (-1.150 V) following the application of CP current is the definition of cathodic polarization. The magnesium anode forces electrons onto the steel structure, altering the electrochemical state at the metal-to-electrolyte interface.
Option B is incorrect; while the anode itself depolarizes as it discharges current, the measured shift on the pipeline structure represents cathodic polarization.
Option C is a fabricated distractor; soil ionization is a phenomenon associated with high-voltage electrical faults or lightning strikes, not standard galvanic CP systems.
Option D is incorrect; passivation refers to the formation of a protective oxide film (common in aluminum or stainless steel), not the standard negative potential shift induced by sacrificial anodes on carbon steel.

5.Scenario: A technician conducts a close-interval potential survey (CIPS) on a cathodically protected transmission line. Despite rectifier outputs operating at maximum design capacity, localized pipe segments exhibit structure-to-electrolyte potentials of -0.300 V CSE. Subsequent excavation reveals intact but disbonded shrink sleeves with trapped groundwater underneath.

Which factor is preventing effective corrosion mitigation?

A. Premature depletion of the impressed current groundbed

B. Interference current from foreign metallic structures

C. Dielectric shielding by the disbonded shrink sleeves

D. Differential aeration cells in the adjacent soil matrix

Answer: C

Explanation:

This targets Domain 1.5 (Influencing Factors - Shielding). Disbonded solid film coatings (such as shrink sleeves or specific tapes) act as electrical insulators (dielectrics). They physically block the CP current from reaching the underlying pipe surface while simultaneously allowing moisture to penetrate, creating a highly corrosive micro-environment that the CP system cannot protect.

Option A is incorrect because the scenario explicitly states the rectifier is at maximum capacity, indicating the groundbed is actively delivering current to the surrounding earth, but it simply cannot penetrate the shielding.

Option B is incorrect; stray current interference typically manifests as localized, highly anodic potential shifts (often fluctuating), not uniform CP failure explicitly tied to coating disbondment.

Option D is a valid secondary corrosion mechanism under the coating, but the primary root cause preventing the CP current from mitigating it is dielectric shielding.