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Question: 1209

Calc MAWP adjustment for 10" pipe D=10.02 in, E=0.85, S=15 ksi, Y=0.4, current t=0.188 in, projected loss to next insp=0.028 in (2.33 yr *0.012 ECR), per 7.5.

A. 745 psig
B. 812 psig
C. 685 psig
D. 950 psig

Answer: B
Explanation: Future t=0.188-0.028=0.160 in. MAWP=2SEt/(DY+2tE)=215k0.850.160/(10.020.4 + 20.1600.85)≈812 psig.

Question: 1210

PQR uses 10 mm thick coupon without impact. For 30 mm production with toughness per B31.3, what range per QW-451.1?

A. 5 mm to 20 mm
B. New PQR required with impact and thicker coupon
C. Qualified to 20 mm max
D. Unlimited

Answer: B
Explanation: Supplementary essential variables require impact-tested PQR for toughness applications beyond basic ranges.

Question: 1211

Carburization in HK40 radiant tubes (1100°C, CH4-rich gas). Surface hardness 45 HRC vs. bulk 22 HRC

per API RP 571 5.3.1. Using carbide volume fraction φ = 1 - exp(-kt), k=0.02/h at temp, t=8000h, compute φ and if >0.3, predict creep rate increase factor (CRIF=1/(1-φ)).

A. φ=0.35; CRIF=1.54
B. φ=0.25; CRIF=1.33
C. φ=0.12; CRIF=1.14
D. φ=0.42; CRIF=1.72

Answer: A
Explanation: API RP 571 5.3.1 models carburization carbide precipitation φ = 1 - exp(-0.02*8000/8760) ≈0.35 >0.3; CRIF=1/(1-0.35)=1.54, indicating 54% creep acceleration requiring tube retirement per RP 571 morphology criteria.

Question: 1212

Cavitation erosion in CS pump discharge at 20 m/s, deltaP=5 MPa. Critical factors: V>10 m/s, vapor collapse. Appearance (pitted/wavy), susceptible (CS/SS), mitigation (hard facing 13Cr).

A. Mitigation: reduce NPSH; CS
B. Critical: V<5 m/s; Ti
C. Appearance: pitted; CS; hard coat
D. Appearance: uniform; duplex

Answer: C
Explanation: Cavitation damage impacts carbon steel and austenitics in high-velocity turbulent flow with vapor bubble collapse (deltaP>2 MPa, V>10 m/s), producing pitted or wavy erosion patterns; mitigation applies hardfacing overlays like 13Cr or Stellite to resist mechanical shock from implosions.

Question: 1213

In ASME PCC-2 Article 4.1 for composite repairs, what is the purpose of the taper ratio in laminate buildup?

A. Minimize weight
B. Increase axial strength
C. Facilitate curing
D. Reduce peel stress at edges

Answer: D
Explanation: The specified taper ratio (typically 1:20 or shallower) reduces interlaminar peel stresses at the repair edges, preventing delamination under load.

Question: 1214

A piping system in Class 1 service has the following thickness data at a critical TML: initial thickness 0.500 in (at installation), previous thickness 0.450 in (5 years ago), current thickness 0.400 in (today). The required minimum thickness (t_required) is 0.300 in. Calculate the long-term corrosion rate, short-term corrosion rate, remaining life, and determine the next thickness measurement interval per API 570 rules (assume no RBI).

A. Long-term CR = 0.020 ipy, Short-term CR = 0.010 ipy, Remaining life = 10 years, Next interval = 5 years
B. Long-term CR = 0.010 ipy, Short-term CR = 0.020 ipy, Remaining life = 5 years, Next interval = 5 years
C. Long-term CR = 0.020 ipy, Short-term CR = 0.020 ipy, Remaining life = 5 years, Next interval = 2.5 years
D. Long-term CR = 0.020 ipy, Short-term CR = 0.010 ipy, Remaining life = 10 years, Next interval = 2.5 years

Answer: D
Explanation: The long-term corrosion rate is calculated as (initial thickness - current thickness) / time from initial to current = (0.500 - 0.400) / 10 years = 0.020 ipy. The short-term corrosion rate is (previous thickness - current thickness) / time between previous and current = (0.450 - 0.400) / 5 years = 0.010 ipy. The remaining life is (current thickness - required thickness) / short-term corrosion rate since short-term governs for conservative interval determination when higher = (0.400 - 0.300) / 0.010 = 10 years.

Question: 1215

A stainless steel fitting in chloride service shows pitting under insulation. RP 574 CUI guidance suggests what for pitting detection?

A. Strip insulation and visual/PT
B. Pulsed eddy current
C. Guided wave
D. RT

Answer: A
Explanation: For chloride pitting in SS, insulation removal and surface NDE like PT is direct and effective.

Question: 1216

In a high-temperature CO-rich environment, carburization rate for Alloy 800H is 5 mpy at 1600°**F.** If temperature rises to 1700°F, approximate rate increase factor per API RP 571 diffusion kinetics?

A. 1.5 times
B. No change
C. ~3-4 times higher due to activation energy
D. Half rate

Answer: C
Explanation: Carburization is diffusion-controlled with high activation energy; rates increase exponentially with temperature, typically 3-5 times per 100°F rise in austenitic alloys per API RP 571 data trends for carbon activity environments.

Question: 1217

A local thin area on a 12-inch pipe has measured minimum thickness 0.195 in over a 3.5-inch diameter area, with surrounding average 0.360 in and t_required = 0.240 in. Per API 570 7.4 referencing API 579 Level 1 criteria for small local thin areas, if local $t \geq 0.75 \times t_{required}$ and extent meets length limits (e.g., $< \sqrt{(3Dt)}$), is the LTA acceptable without repair?

A. Unacceptable unless averaged thickness used
B. Acceptable since $0.195 < 0.75 \times 0.240 = 0.180$
C. Unacceptable; requires Level 2 FFS due to diameter
D. Acceptable since $0.195 > 0.75 \times 0.240 = 0.180$ and area small

Answer: D
Explanation: Per API 570 7.4 and API 579 Level 1 simple criteria for local thin areas, acceptance allowed if local minimum thickness $\geq 0.75 \times t_{required}$ for limited extent areas (small diameter and length < structural limits like $\sqrt{(Dt)}$ approximations); here $0.195 > 0.180$ and area qualifies as small, so acceptable as-is without repair if profile smooth and no other concerns.

Question: 1218

Per API 570 and ASME PCC-2, temporary repairs like composite wraps require what monitoring frequency if left in place >1 year?

A. Monthly visual
B. Annual only
C. No monitoring
D. Inspection per qualified plan, often quarterly

Answer: D
Explanation: API 570 requires temporary repairs (including nonmetallic wraps) to have an inspection/monitoring plan per ASME PCC-2, typically more frequent than annual for long-term use.

Question: 1219

Welder performance qualification on 3-inch pipe 6G GTAW expired after 7 months no welding. Retest on 8-inch 6G passes visual/RT but fails macro-etch due to incomplete fusion. Per ASME Section IX QW-456, for pipe WPQ, what specimen type was used and retest requirement?

A. Nick breaks; visual re-inspection
B. Side bends; two additional side bends
C. Face/guided bends; radiography repeat
D. Root bends; hardness traverse

Answer: B
Explanation: Per ASME Section IX Table QW-456 for >3-inch pipe 6G GTAW, side bend tests are required; single failure mandates retest with two side bend specimens from new coupon, per QW-302.2, to requalify the welder for the position and diameter range.

Question: 1220

A 16-inch NPS Class 1 injection point shows 0.040 inches loss in 2 years; compute CR and required TM interval if t_corr = 0.250 inches, using API 570 7.1.2 CR = (TA - TB)/(TB - T years).

A. CR=0.080 in/yr; interval 2 years
B. CR=0.020 in/yr; interval 1 year
C. CR=0.040 in/yr; interval 1 year
D. CR=0.020 in/yr; interval 3 years

Answer: C
Explanation: API 570 mandates injection TM every year if CR >0.02 in/yr threshold in practice for Class 1.

Question: 1221

In CUI scenario, carbon steel pipe at 250°F with wet insulation shows localized thinning of 0.120 in over 6 years. Calculate CUI rate and compare to typical 10–50 mpy range in API RP 571 for active wet/dry cycling.

A. 5 mpy, low
B. 20 mpy, within typical severe range
C. 60 mpy, extreme
D. 2 mpy

Answer: B
Explanation: Rate = 0.120 in / 6 yr = 0.020 in/yr = 20 mpy, consistent with moderate to severe CUI rates under wet insulation with temperature cycling in the critical range.

Question: 1222

Remaining life calculation when rates differ significantly: use STCR if > 2× LTCR per some interpretations for integrity.

A. Average
B. RBI only
C. Always STCR if higher
D. Always LTCR

Answer: C
Explanation: Conservative use higher rate per API 570 7.1.3.

Question: 1223

Pipe fittings elbow per API RP 574 section 9 has internal pitting; compute corrosion rate for TML data t1=0.322 in (2020), t2=0.292 in (2026), Y=4 per API 570 7.1.2 for localized pitting, CR=(t1-t2)/(Y×6), if CR>0.005 in/yr recommend inspection technique for pit depth.

A. 0.0048 in/yr; SWUT
B. 0.0071 in/yr; IRIS
C. 0.00125 in/yr; LTOF UT
D. 0.0055 in/yr; EMAT

Answer: C
Explanation: CR = (0.322-0.292)/(4×6) = 0.03/24 = 0.00125 in/yr.

Question: 1224

Max misalignment for butt weld 1-inch wall per ASME B31.3 Table 341.3.2A is lesser of?

A. 1/16 + t/20 = 0.1 inch
B. 3/32 inch
C. 1/8 inch
D. t/4

Answer: A
Explanation: Table 341.3.2A misalignment ≤1/16 inch + (t/20) = 0.0625 + 0.05 = 0.1125 inch for t=1; API 570 uses for visual.

Question: 1225

In MEA amine piping, cracking occurs preferentially in which location due to highest temperature/stress combination?

A. Absorber bottoms only
B. Rich amine lines exclusively
C. Ambient temperature sections
D. Regenerator reboiler inlet/outlet and high-turbulence areas with lean amine

Answer: D
Explanation: Amine cracking most severe in lean amine at high temperatures/stresses, such as regenerator/reboiler circuits with turbulence and concentration.

Question: 1226

For NPS 4 Class 150 slip-on flange, minimum hub diameter per Table 10 is what approximate value?

A. 5.25 inches
B. 4.50 inches
C. 6.00 inches
D. 4.88 inches

Answer: D
Explanation: ASME B16.5 dimensional tables (e.g., Table 10 for slip-on) specify minimum hub diameters to ensure structural integrity.

Question: 1227

Calculate the heat affected zone (HAZ) width approximation for a GTAW autogenous weld on 0.25-inch 304SS piping using E = ηVA / (S × 1000) where η=0.8, V=12, A=120, S=15 ipm, per API RP 577

metallurgy formulas. If HAZ width >0.040 inch risks sensitization, what process parameter adjustment is required per WPS?

A. Heat input 13.44 kJ/in; lower current to 100A
B. Heat input 7.68 kJ/in; reduce voltage to 10V
C. Heat input 9.6 kJ/in; increase travel speed to 18 ipm
D. Heat input 11.52 kJ/in; switch to pulsed GTAW

Answer: C
Explanation: HAZ approximation uses heat input formula per API RP 577 Annex A: (0.8 × 12 × 120 × 60) / (15 × 1000) = 7.68 kJ/in; for 304SS, >5-7 kJ/in risks Cr-carbide precipitation (sensitization); adjust by increasing travel speed to reduce heat input, requalifying WPS if essential variable change.

Question: 1228

For in-service thickness trending where corrosion rate exceeds 0.005 in/yr, what NDE interval adjustment per API 570 Table 1?

A. External visual every 5 years
B. RBI reassessment required
C. Reduce to half remaining life or 5 years
D. UT thickness every 2 years

Answer: C
Explanation: API 570 Table 1 requires Class 1 piping thickness measurements at intervals not exceeding half remaining life or 5 years max when high corrosion rates apply.

Question: 1229

During shutdown, 304 SS piping in polythionic acid service (from sulfide scale hydrolysis) develops intergranular cracking without external stress. API RP 571 PASCC indicates susceptible material condition, temperature for acid formation, and primary mitigation during downtime?

A. Duplex; high oxygen
B. Low carbon; <50°F
C. Stabilized grades only; >200°F; water wash
D. Sensitized 300 series SS (from welding/PWHT); 100–300°F during shutdown; neutralize with soda ash or use stabilized grades (321/347)

Answer: D
Explanation: Polythionic Acid Stress Corrosion Cracking (PASCC) affects sensitized austenitic SS (from

thermal exposure) in sulfide-containing services during shutdowns. Critical factors are sensitization, polythionic acid formation (from wet sulfide scale hydrolysis at 100–300°F), tensile stress (residual sufficient). Appearance is intergranular cracking. Mitigation includes using stabilized/low-carbon grades, nitrogen purging, or soda ash neutralization during shutdowns.

Question: 1230

Calculate adjusted remaining life for Class 1 pipe using API 570 7.2 formula with multiple readings: t1=0.420 (yr0), t2=0.390 (yr2.5), t3=0.370 (yr5), yielding CR=(t1-t3)/5=0.010 in/yr short-term, but long-term avg 0.008. Tmin=0.300, current=0.360. Use which for interval?

A. 0.012 in/yr
B. 0.008 in/yr
C. (t2-t3)/2.5
D. 0.010 in/yr

Answer: D
Explanation: API 570 7.1.2 specifies short-term CR=(t1-t3)/(time between first/last) =0.010 in/yr for conservative interval setting. PRL=6 years.

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