

# API 575 Study Guide

## API 653 Cert Prep

This Study Guide has questions to help you learn the content of **API RP-575, Inspection of Atmospheric and Low-Pressure Storage Tanks (4<sup>th</sup> Edition-2020)**. On the API 653 exam, there are about 8-12 questions from this document. We do **NOT** spend time in class discussing this publication. Why? It's relatively easy to read & understand. So, it is important that you become familiar with this content in your personal study sessions.

Questions in this Study Guide are in the same order as the data is presented in API 575. The **Answer Key** is in the back of this guide (*with References*). When you study API 575 do the following

1. Read a number of pages (*maybe 5-15 pages - until you find yourself "zoning out"*).
2. Then STOP & answer the questions that come from those pages.
3. Then grade the questions you completed & look up all you missed.

Guess what, you just did ... "*cataract surgery*" and you are NO longer "*zoned out*"! So now, you probably can now read another 5-15 pages and repeat the above process.

You want to keep practicing this Study Guide until you can score 80+%. **Open book questions are highlighted in yellow.**

### Section 2 - References (API 575 pg 1-4)

	Description of Code	Code
1	<b>Old Code used to build</b> riveted tanks	
2	Fitness for Service	
3	RBI - Risked Based Inspection	
4	CUI - Corrosion Under Inspection & Fireproofing	
5	Construction code for low-pressure tanks	
6	Construction code for atmospheric tanks	
7	Cathodic protection of tanks	
8	Tank linings	
9	Tank venting	
10	Safety precautions for tank entry	
11	UL tank Construction code	

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### **Section 3 – Definitions** (API 575 pg 4-9)

1. A tank alteration is any work that:
  - A. restores a tank to a suitable condition.
  - B. changes the physical dimensions of a tank.
  - C. involves the critical zone of the tank.
  - D. involves the tank shell.
  
2. Per API 653, the generic definition of atmospheric pressure is pressures up to:
  - A. 0.05 psig.
  - B. 0.5 psig.
  - C. 2.5 psig.
  - D. 15 psig.
  
3. Per API 575, a Condition Monitoring Location (CML):
  - A. is a single small area (e.g. 2" diameter) on a tank shell.
  - B. is a single small area (e.g. 1" diameter) anywhere on a tank.
  - C. can be a spot or a plane through a section of a nozzle.
  - D. can be a spot or a plane through a section of a tank shell or nozzle.
  
4. Per API 575, a defect is:
  - A. any indication.
  - B. any imperfection.
  - C. any indication that is measurable.
  - D. any indication that exceeds code acceptance criteria.
  
5. Which of the following can be considered a Release Prevention Barrier? **This may have more than one correct answer, please select all answers that apply.**
  - A. Cathodic protection
  - B. Clay liner
  - C. Double steel bottom
  - D. Leak detection piping under the tank
  
6. A tank repair is any work that:
  - A. restores a tank to a suitable condition.
  - B. changes the physical dimensions of a tank.
  - C. involves the critical zone of the tank.
  - D. involves the tank shell.

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7. What are the basic factors of Risk?
  - A. Consequence and Probability of failure
  - B. Consequence and Probability of sections of the tank being below  $t_{min}$
  - C. Potential costs to repair and Potential impact for a negative public image
  - D. Potential for leaks due to corrosion and leaks due to Operator error

### **Section 4 - Types of Tanks** (API 575 pg 9-28)

1. The inspection guidelines of API 572 should be followed when the operating pressure exceeds:
  - A. 0.05 psig.
  - B. 0.5 psig.
  - C. 2.5 psig.
  - D. 15 psig.
2. As the product temperature increases, the product's vapor pressure:
  - A. decreases.
  - B. decreases only if specific gravity is less than 1.0.
  - C. increases.
  - D. increases only if specific gravity is less than 1.0.
3. A pressure-vacuum vent is installed on a tank. The PV vent will ensure that the inside pressure or inside vacuum does **not** exceed:
  - A. 0.0 psig.
  - B. a few ounces per square inch.
  - C. 2.5 psig.
  - D. 15 ounces per square inch.
  - E. 15 psig.
4. Which is most common type of storage tank?
  - A. Cone roof tank
  - B. Geodesic Dome roof tank
  - C. External floating roof tank
  - D. Internal floating roof tank

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5. While operating, which tank type roof is normally supported by internal members?
  - A. Cone roof
  - B. Dome roof
  - C. Floating roof
  - D. Umbrella
  
6. Fixed-roof tanks are often self-supporting when tank diameter does not exceed:
  - A. 20 feet.
  - B. 40 feet.
  - C. 60 feet.
  - D. 100 feet.
  
7. Which of the following is not an advantage of an umbrella roof or a geodesic dome roof?
  - A. Low cost roof
  - B. Keeps snow and rain off of an internal floating roof
  - C. Can be used on any size of tank
  - D. Does not require internal supports
  
8. What is the primary reason for using a floating roof instead of a cone roof tank?
  - A. Less affected by severe weather
  - B. Less expensive
  - C. Less maintenance issues
  - D. Minimizes vapor emissions
  
9. Which type of floating-roof is the most susceptible to sinking?
  - A. External floater with a Double-deck
  - B. External floater with a Pan (*single-deck*)
  - C. External floater with an Annular Pontoon
  - D. Internal floater with metallic sandwich panels
  
10. Why are internal floating roofs sometimes used?
  - A. Lowers construction costs
  - B. Reduces vapor loss
  - C. Minimizes effects of weather (*rain & snow*)
  - D. Either reduces vapor loss or minimizes effects of weather (*rain & snow*)

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11. Which is the most common type of floating-roof seal?
  - A. Foam log
  - B. Mechanical shoe
  - C. Air bladder
  - D. Wiper
  
12. How does a mechanical shoe work?
  - A. Gravity is used to place the shoe up by the tank shell
  - B. A spring or counterweight pulls the shoe against the tank shell
  - C. A spring or counterweight pushes the shoe against the tank shell
  - D. A low-friction non-metallic is placed between the shoe and the tank shell
  
13. Which of the following floating roofs is normally constructed of aluminum alloys or stainless steels?
  - A. Double-deck
  - B. Internal floater on floats
  - C. Internal metallic pan floating roofs
  - D. Pontoon
  
14. Low-pressure storage tanks are built to which code?
  - A. API 620
  - B. API 650
  - C. API 650 Annex F
  - D. API 650 Annex I
  
15. Low-pressure storage tanks are those with a design pressure from:
  - A. 0.0 - 0.05 psig.
  - B. 0.05 - 2.5 psig.
  - C. 2.5 - 15 psig.
  - D. 5.0 - 25 psig.
  
16. API 620 Appendix R provides design rules for refrigerated tanks with design temperatures between:
  - A. -60 to 40 °F.
  - B. -50 to 32 °F.
  - C. -100 to 0 °F.
  - D. -325 to -60 °F.

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17. API 620 Appendix Q provides design rules for refrigerated tanks with design temperatures between:
- A. -60 to 40 °F.
  - B. -50 to 32 °F.
  - C. -100 to 0 °F.
  - D. -325 to -60 °F.
18. Low-pressure storage tanks are normally used for products that have a:
- A. vapor pressure that exceeds limits of API 650.
  - B. low vapor pressure.
  - C. specific gravity that exceeds limits of API 650.
  - D. low specific gravity.
19. Hemispheroid, spheroid, and noded spheroid tanks are commonly used when the design pressure exceeds:
- A. 2.5 psig.
  - B. 5.0 psig.
  - C. 10.0 psig.
  - D. 125.0 psig.
20. Which code covers refrigerated liquefied gas tank systems?
- A. API 620
  - B. API 625
  - C. API 650
  - D. API 2201
  - E. UL-142

### **Section 5 - Reasons to Inspect** (API 575 pg 28-36)

1. Regulatory requirements typically cover safety & environmental concerns. Some jurisdictions require what is called "RAGAGEP". RAGAGEP stands for:
- A. Recognized And Generally Accepted Good Engineering Practice.
  - B. Rules And Guidelines Adopted by Governmental Enhanced Politics.
  - C. Requirements Accepted, Governed, Adopted by Geographic Engineering Professionals.
  - D. Run And Gun As Guided by Exceptional Performance.

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2. Which of the following codes is not a tank inspection code?
- A. API RP 12R1
  - B. API 653
  - C. STI SP001
  - D. UL-142
3. A tank pad is installed with cinders. What chemical in the cinders can cause bottom-side corrosion when the pad gets wet?
- A. Chlorides
  - B. Iron
  - C. Kryptonite
  - D. Silicon
  - E. Sulfur
4. Which is not a common cause of bottom-side corrosion on a tank floor?
- A. Clay or wood left in sand pad
  - B. Improperly sealed ring wall
  - C. Leaking product that is corrosive
  - D. Operating temperatures below 200 °F
  - E. Poor drainage in tank area
5. A few clay balls are in a tank's sand pad. Which of the following is true about bottom-side corrosion?
- A. Corrosion will occur near the clay ball
  - B. Corrosion will occur under the clay ball
  - C. The clay ball forms a tight seal and prevents corrosion
  - D. Adjacent clay balls form a galvanic cell
6. In order to prevent future bottom-side corrosion, which is not recommended during the construction of a tank?
- A. Asphalt-impregnated fiberboard between ring-wall and tank bottom
  - B. During pad installation, assure pad materials are clean and salt free
  - C. Install sand pad using specified ASTM materials that is 3-4" thick
  - D. Install tank foundation 12" above the tank dike grade

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7. Which of the following often causes external corrosion at the bottom of the lower shell course? **This may have more than one correct answer, select all answers that apply.**
- A. CUI
  - B. Shell covered with crude that leaked when tank was overfilled
  - C. Tank that has settled and the tank grade is higher than the tank bottom
  - D. Tank that has experienced cracks in the tank's ring-wall
8. Concentration cell corrosion may occur in the many niches of:
- A. cone roof tanks.
  - B. internal floating roof tanks.
  - C. low-pressure tanks.
  - D. riveted tanks.
9. Which document helps the inspector understand corrosion mechanisms?
- A. API 571
  - B. ASME PCC-2
  - C. ASTM SA-333
  - D. NACE 1089
10. Most tanks storing petroleum product are made from which metallurgy(s)?
- A. Carbon steel
  - B. Chromes
  - C. Carbon steel or chromes
  - D. Kryptonite
  - E. Austenitic stainless steel
11. Which of the following is a common cause of corrosion in a tank's vapor space? **This may have more than one correct answer, select all answers that apply.**
- A. Hydrogen sulfide vapor
  - B. Oxygen
  - C. Nitrogen
  - D. Water vapor
12. Generally, in the liquid portion of a tank, internal corrosion is worse at the:
- A. bottom of the tank.
  - B. heat affect zones in shell horizontal welds.
  - C. nozzles.
  - D. welds.



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13. Which of the following tank products does not cause stress corrosion cracking?
- A. Benzene
  - B. Caustic
  - C. DEA
  - D. Ethanol
14. Occasionally a tank will be built with alloy materials. Which of the following is a common reason for selecting alloys to build a tank?
- A. High design temperature
  - B. Increased strength
  - C. Lower cost
  - D. Maintain product purity
15. Stress corrosion cracking of austenitic SS can occur in the presence of:
- A. acids.
  - B. chlorides.
  - C. hydrocarbons.
  - D. sulfides.
16. Horizontal uninsulated cylindrical tanks can sometimes experience accelerated external corrosion on:
- A. heads.
  - B. longitudinal welds.
  - C. nozzles.
  - D. saddle-to-tank interface.
17. What type of tank failure has occurred in the past that results in a sudden and complete loss of the product?
- A. Brittle failure
  - B. Failure at deep pitting
  - C. Failure at a localized thin area
  - D. Thermal fatigue
18. Which tank weld is most likely to have a leak that is the result of a weld defect?
- A. Annular plate butt welds
  - B. Bottom fillet welds
  - C. Horizontal shell welds
  - D. Three-plate lap welds

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19. Cracks are most likely to occur in which of the following welds?
- A. Bottom fillet welds
  - B. Bottom-to-shell weld
  - C. Horizontal shell welds
  - D. Vertical shell welds
20. In which of the following areas are cracks least likely to occur?
- A. Around rivet holes
  - B. Bracket welds
  - C. Nozzle welds
  - D. Roof fillet welds
21. What weld is most susceptible to cracking in a hot tank?
- A. Bottom fillet welds
  - B. Bottom-to-shell weld
  - C. Horizontal shell weld
  - D. Roof-to-shell weld
22. A tank experiences excessive uniform tank settlement. Which area of the tank is most likely to be over-stressed?
- A. Nozzles
  - B. Horizontal shell weld
  - C. Roof-to-shell weld
  - D. Vertical shell weld
23. Pressure-vacuum vents and flame arrestors can fail to operate for a variety of reasons. Which of the following is **not** a typical cause?
- A. Deposits by birds or insects (poop, mud, etc.)
  - B. Corrosion between moving parts
  - C. Fouled
  - D. Ice in cold climates
  - E. Tank product is changed to a product with a lower vapor pressure
24. A plugged floating roof drain:
- A. can cause the roof to sink.
  - B. can cause excessive tank settlement.
  - C. will significantly increase the stress in the shell.
  - D. will increase the water in the bottom of the tank.

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### **Section 6 – Inspection Plans** (API 575 pg 36-39)

1. An Inspection Plan is:
  - A. recommended for tanks within the scope of API 653.
  - B. required for tanks inspected within the scope of API 653.
  - C. recommended for the inspection work of tanks built to API 650.
  - D. required for the inspection work of tanks built to API 650.
  
2. The Inspection Plan for a tank should be developed by:
  - A. the Inspector.
  - B. the Engineer.
  - C. both the Inspector and the Engineer.
  - D. a team that includes: Inspector, Engineer, Corrosion Specialist & Operations.
  
3. Which of the following is **not** needed in a tank's Inspection Plan?
  - A. Type of Inspection(s) needed
  - B. Due date for each Inspection Type
  - C. Estimated cost of the needed Inspections
  - D. Extent and locations for any NDE
  
4. Which of the following needs to be included in an Inspection Plan? **This may have more than one correct answer, select all answers that apply.**
  - A. Routine lighting requirements
  - B. Any planned pressure tests
  - C. Any planned repairs
  - D. Name of individual that will perform the inspection
  
5. When developing an Inspection Plan, what are significant issue(s) to determine:
  - A. Cost of recommended NDE.
  - B. Types of anticipated damage.
  - C. Location of anticipated damage.
  - D. Both the types and location of any anticipated damage.
  
6. Prior to conducting either an internal inspection, the inspector should:
  - A. thoroughly review the tank's past inspection records.
  - B. calculate the  $t_{min}$  for each shell course.
  - C. take an API 653 on-line refresher quiz.
  - D. conduct the qualification for all NDE & welders used during this outage.

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7. **Guidance for the inspection** of tank appurtenances and accessories can be found in:
- A. API 579.
  - B. API 2015.
  - C. API 2201.
  - D. API 2610.
8. All RBI assessments should be conducted in accordance with:
- A. API 571.
  - B. API 579.
  - C. API 580.
  - D. API 2016.
9. In the RBI process, what are the two primary factors used to determine risk?
- A. Consequence of Failure and Service Class
  - B. Reliability and the On-stream Percentage
  - C. Likelihood and Consequence of Failure
  - D. Inspection Effectiveness and Corrosion Mechanism
10. During a risk evaluation, which of the following is **not** a factor during the evaluation of the Probability of Failure?
- A. Current condition of the tank
  - B. Effectiveness of past inspections
  - C. Location of environmental receptors
  - D. Potential damage mechanisms
11. During a risk evaluation, which of the following is a factor during the evaluation of the Consequence of Failure? **This may have more than one correct answer, select all answers that apply.**
- A. Current thickness of tank components
  - B. Environmental impacts
  - C. Loss of production
  - D. Process fluid(s)
12. All RBI assessments must be:
- A. repeated every 5 years.
  - B. thoroughly documented.
  - C. approved only by the Authorized Inspector.
  - D. conducted per guidelines in API 583.

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13. An RBI assessment is often used to:
- A. evaluate the effectiveness of the Tank Inspection Program.
  - B. evaluate the effectiveness of Tank Operation.
  - C. update Inspection Procedures.
  - D. update or revise the Inspection Plan.
14. An RBI assessment has been conducted. Which of the following may be an outcome of this Assessment? **This may have more than one correct answer, select all answers that apply.**
- A. Specify the type of Safety Gear needed during a tank outage
  - B. Revision of jurisdictional requirements
  - C. Inspection intervals
  - D. Type and extent of NDE method(s) to use during the next inspection

### **Section 7 - Frequency of Inspection** (API 575 pg 40-45)

1. Which of the following should be immediately addressed by either the inspector or tank engineer?
- A. Isolated pitting up to 0.050" deep on the plate-extension
  - B. Hole in a tank roof
  - C. Insulation on north side of tank with algae growing
  - D. Tight temperature crack in the concrete ring-wall
2. Which of the following should be checked after very high winds or heavy rain? **This may have more than one correct answer, select all answers that apply.**
- A. External floating roof seals
  - B. Foundation deterioration
  - C. Soundness of the floating roof legs
  - D. Water loads on external floating roof tanks
3. Inspection intervals that are based on past and current performance are called:
- A. Condition-Based intervals.
  - B. Fitness-for-Service intervals.
  - C. RBI intervals.
  - D. Time-Based intervals.

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4. Determine the corrosion rate occurring on a shell course based on this data.

	$t_{min}$	10/2021	4/2017
<u>Thickness</u>	0.525"	0.570"	0.588"

- A. 3.6 mpy (mils per year)
- B. 4.0 mpy
- C. 4.5 mpy
- D. 10 mpy

For more info on Corrosion Rates & Remaining Life, see our "The Inspector's Calcs" study guide in Module 8. These are your most important calculations !!!

5. Determine the Remaining Life for a shell course based on the following data.

	$t_{min}$	6/2008	6/2017	11/2021
<u>Thickness</u>	0.344"	0.422"	0.395"	0.368"

- A. 3 years
- B. 4 years
- C. 6 years
- D. 9 years

6. **In the tank construction code**, API 650, the needed shell thickness are calculated. Which of the follow statements is correct?

- A. Calculations are based on a 4-to-1 safety factor.
- B. One calculation applies to all courses. (*one  $t_{min}$  for the entire shell*)
- C. In most cases, the  $t_{min}$  calculate actually has some excess thickness.
- D. The formula always used is called the Variable-Design-Point method.

7. For new tanks built to API 650, the new thickness for the shell plates:

- A. should never be less than  $\frac{1}{2}$ ".
- B. considers only the shell stresses resulting from the product.
- C. considers only the shell stresses resulting from the hydrotest water.
- D. considers both shell stresses resulting from the product & the hydro water.

8. While in operation, which tank component has a low membrane stress?

- A. Bottom plates away from the critical zone and any annular plates
- B. Annular plate
- C. Bulged area on the shell
- D. Nozzle-to-shell weld on a tank product nozzle
- E. Shell vertical welds

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9. The Variable-Design-Point method is always used to calculate the  $t_{\min}$  of:
- A. annular plates.
  - B. nozzles.
  - C. tank shells over 200' in diameter.
  - D. all tank shells.
10. If a tank is subject to external pressure (a vacuum), the shell  $t_{\min}$  should be calculated using:
- A. API 650's 1-foot method.
  - B. API 650's Variable-Design-Point method.
  - C. API 653's Annex H.
  - D. API 650's Annex V.
11. A large area on a shell course is corroded below acceptable limits. Which of the following is not an acceptable option?
- A. Change to a product with a lower specific gravity
  - B. Coat the corroded area with a lining
  - C. Lower the fill height
  - D. Replace the corroded area
12. An isolated deep pit in the shell:
- A. does not appreciably weaken the shell.
  - B. must always be repaired.
  - C. never needs to be repaired.
  - D. should be evaluated per API 580.
13. Neither API 650 or API 653 have a method for determining the minimum required thickness of a tank's:
- A. annular plates.
  - B. floor plates.
  - C. nozzles.
  - D. shell plates.
14. Roof supports are normally:
- A. designed per AISC's Steel Construction Manual.
  - B. designed per API 650.
  - C. made from 3/16" steel.
  - D. made from pipe.

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15. The Internal Inspection interval in API 653 is normally controlled by the corrosion on the:
- A. bottom.
  - B. nozzles.
  - C. shell.
  - D. thinnest component.
16. What is an acceptable way of obtaining a suggested corrosion rate for tank components?
- A. Take a wild guess and run with it!
  - B. Obtain corrosion rates from a Professional Engineer
  - C. Obtain corrosion rates from NACE publications
  - D. Use corrosion rates from tanks in Similar Service
17. When using Similar Service to establish corrosion rates, what makes it difficult to obtain a similar-service soil-side corrosion rate?
- A. Difficult to find a tank with similar product
  - B. Don't know if foundations/sand pads are actually the same
  - C. Don't know if CP is being used on either tank
  - D. Inspections can't contrast top-side vs soil-side corrosion rates
18. Similar Service corrosion rate data for soil-side corrosion:
- A. should be from the same site as the Candidate Tank.
  - B. is always higher than top-side corrosion rate.
  - C. is relatively easy to determine.
  - D. is determined by finding the highest soil-side rate at a facility and multiplying it by 1.3.
19. The top-side corrosion rate is normally the result of:
- A. the corrosion from hydrocarbons stored in the tank.
  - B. the corrosion from "water bottoms".
  - C. galvanic corrosion.
  - D. reaction with air when the tank is out-of-service.





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20. Which of the following is often in the "water bottoms" and accelerates top-side corrosion?
- A. Bismuth
  - B. Hydrogen
  - C. Pepper
  - D. Salt
  - E. Sulfur
21. Similar Service data is going to be used to analyze a tank bottom. Which of the following is true about the tank that is providing the Corrosion Rate Data?
- A. This tank must be at the same site as the Candidate Tank.
  - B. The tank must contain exactly the same process as the Candidate Tank.
  - C. One tank may provide soil-side corrosion rate data, and another tank provides top-side corrosion rate data.
  - D. One tank can always be found to provide the both the top-side and soil-side corrosion rate data.
22. Which document can be used during fitness for service assessments?
- A. API 579
  - B. API 580
  - C. API 581
  - D. API 2201

### **Section 8 - Inspection** (API 575 pg 45-80)

1. Safety precautions dealing with tank entry are discussed in:
- A. API 2015.
  - B. API 2201.
  - C. API 2601.
  - D. USDA 4601.
2. Prior to entering a tank, be sure to:
- A. lock out all tank relief devices.
  - B. check condition of overhead structures inside the tank.
  - C. review the API 653 Appendix D checklist.
  - D. take external UT readings on the shell.

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3. Prior to going inside a floating roof tank, be sure to:
  - A. check that there is not a significant amount of liquid on the roof.
  - B. review tank entry guidelines specified in API 579.
  - C. review the API 653 Appendix B checklist.
  - D. take external UT readings on the roof.
  
4. Inspection paint or crayon markers used on SS should be free of:
  - A. bromides.
  - B. chlorides.
  - C. oxides.
  - D. sulfides.
  
5. A detailed checklist for suggested things to do when performing an external inspection is found in:
  - A. API 575 Annex A.
  - B. API 650 Annex I.
  - C. API 653 Annex C.
  - D. API 780 Annex B.
  
6. How should ladders and stairs be inspected? **This may have more than one correct answer, select all answers that apply.**
  - A. Light hammer testing
  - B. PT
  - C. UT
  - D. Visual
  
7. Which handrail member should be given special attention?
  - A. Angle iron
  - B. Bars
  - C. T-bars
  - D. Tubular
  
8. Crevices in structural members should be checked with:
  - A. UT.
  - B. UT or RT.
  - C. MT or PT.
  - D. scrapper or hammer.

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9. Low spots on a platform that collect water are places where corrosion can occur. A simple solution to solve this problem is to:
- A. drill a drain hole.
  - B. replace the platform.
  - C. add an additional support to "cone-up" the platform.
  - D. remove the platform and providing a rope to hang on.
10. Anchor bolt corrosion below the nut can be checked by using:
- A. acoustic emission.
  - B. eddy current.
  - C. hammer testing.
  - D. RT.
11. Tank grounding connections should be checked:
- A. per API 651.
  - B. per API 2601.
  - C. with an ammeter.
  - D. visually.
12. The resistance in tank grounding should **not** exceed:
- A. 5 ohms.
  - B. 25 ohms.
  - C. 50 ohms.
  - D. 250 ohms.
13. Which document provides information concerning the use of tank grounding to prevent static electricity?
- A. API 549
  - B. API 2001
  - C. API 2003
  - D. API 2201
14. Which coating problem is the most difficult to detect?
- A. Blister
  - B. Bonding failure
  - C. Holiday
  - D. Graffiti

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15. Coating bond failure often occurs:
- A. nozzles.
  - B. repads.
  - C. below seam leaks.
  - D. shady side of the tank.
16. A tank is insulated. Where is a likely spot for external shell corrosion?
- A. Nozzles
  - B. Shady side of the tank
  - C. Sunny side of the tank
  - D. Top shell course
17. What technique(s) can be used to find hot or cold spots in insulation?
- A. Acoustic Emission or Neutron back-scatter
  - B. Acoustic Emission or EMAT
  - C. Guided wave UT or EMAT
  - D. Thermography or Neutron back-scatter
18. CUI in carbon steel is most aggressive at a temperature range of:
- A. 10 - 350 °F.
  - B. 50 - 150 °F.
  - C. 170 - 230 °F.
  - D. 180 - 250 °F.
19. CUI in carbon steel can occur at a temperature range of:
- A. 10 - 350 °F.
  - B. 25 - 225 °F.
  - C. 140 - 350 °F.
  - D. 280 - 400 °F.
20. What is a safety issue concerning the external inspection of an insulated warm tank?
- A. Roof may be corroded and too thin to walk on
  - B. Difficult to get vapor free for hot work
  - C. Removal of fiberglass insulations can cause mesothelioma
  - D. Potential for tank brittle failure

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21. Where is a typical place for external corrosion on a tank shell?
- A. At the bottom of the shell
  - B. Near the top
  - C. Below a horizontal weld seam
  - D. There is not a typical location for external shell corrosion
22. Which of the following causes corrosion at the bottom of a tank shell? **This may have more than one correct answer, select all answers that apply.**
- A. Build-up of soil or some foreign material on the shell
  - B. Movement of ground water up the shell by capillary action
  - C. Leakage of a corrosive tank product
  - D. Spalling of concrete ringwall
23. Rigorous hammer testing of the tank shell should:
- A. never be done.
  - B. never be done on a tank that is in service.
  - C. be done only by a ASNT technician.
  - D. be done to stress relieve the hammer tester!
24. The upper shell of a floating roof tank has the potential for atmospheric corrosion on both sides. On floating roof tanks with uncoated shells, special attention should be given to the shell on the upper:
- A. 12".
  - B. 24".
  - C. 36".
  - D. shell course.
25. Where are typical locations for CMLs on a tank shell?
- A. Five readings per shell course at the 4 tank quadrants.
  - B. Six per the lower two shell courses, 2 on each of the remaining courses.
  - C. Use UT crawler on 8 vertical lines, record low reading per course.
  - D. Three per shell course, one near bottom, middle and top of each course.
26. Where is a common location for localized corrosion on a tank shell?
- A. Around nozzle openings
  - B. On the shell wall opposite from a tank mixer
  - C. At the liquid/vapor interface, if tank level is often maintained at one height
  - D. On the inside of the shell opposite external brackets

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27. When monitoring localized corrosion, CML's should be:
- A. monitored by someone with the appropriate SNT-TC-1A certification.
  - B. measured with digital UT to determine exact thickness.
  - C. measured with profile RT when examining nozzles that are < 10 NPS.
  - D. precisely located, so future readings will be at the exact location.
28. What is the best way to take UT thickness readings through a thin-film coating?
- A. Remove the coating at the examination point
  - B. Subtract the thickness of the coating from the UT reading
  - C. Use a multi-echo thickness scope
  - D. Let someone else take the reading!
29. Examiners that take thickness readings on tanks should be:
- A. trained and competent.
  - B. qualified to the Owner/Operators procedures.
  - C. certified to either ASNT SNT-TC-1A or CP-189.
  - D. certified to API QUTE.
30. The required NDE qualifications for UT examiners are specified by the:
- A. API 653 Authorized Inspector.
  - B. Owner/Operator.
  - C. NDE Specialist.
  - D. Tank Engineer.
31. Stiffeners and wind girders are normally:
- A. hammer tested.
  - B. visually inspected.
  - C. hammer tested and visually inspected.
  - D. not inspected.
32. When checking for cracks in a wind girder, which technique should **not** be used to determine the extent of cracking for an in-service tank?
- A. MT with prods
  - B. MT with yoke and dry particles
  - C. MT with yoke and wet particles
  - D. PT

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33. A tank is in caustic service. A very common place for caustic cracking is at:
- A. vertical shell welds.
  - B. nozzle to shell welds.
  - C. bottom-to-shell weld.
  - D. connections for internal heating units.
34. Caustic and amine SCC shows up as:
- A. external cracks.
  - B. internal cracks.
  - C. external pits.
  - D. internal pits.
35. Caustic that seeps out of a tank crack will appear as a:
- A. brown oxide.
  - B. green goo.
  - C. red deposit.
  - D. white salt.
36. During an inspection of a caustic tank, cracking has been found at a few nozzles. The inspector develops a repair plan for these cracks. If the metal in the repair area is **not** thoroughly cleaned & neutralized, what might occur during welding?
- A. Additional cracking
  - B. Arc blow
  - C. Creation of pyrophoric iron
  - D. Small fire
37. **Guidelines for preventing and** mitigating ethanol stress corrosion cracking (eSCC) are found in:
- A. API 650 Annex E.
  - B. API 653 Annex H.
  - C. API 939E.
  - D. ASME PCC-1.
38. What NDE technique is often specified for tanks subject to eSCC?
- A. PT
  - B. RT
  - C. UT flaw detection
  - D. WFMT

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39. When inspecting for eSCC, which areas should be examined? This may have more than one correct answer, select all answers that apply.
- A. Uncoated bottom lap welds
  - B. All shell welds
  - C. All shell & nozzle welds below the first horizontal weld
  - D. Roof-to-shell weld
40. WFMT is used to examine specific welds for eSCC. The examination zone is the weld plus:
- A. 1" on both sides of the weld.
  - B. 3" on both sides of the weld.
  - C. 6" on both sides of the weld.
  - D. 12" on both sides of the weld.
41. Hydrogen blistering is most easily found by using:
- A. hammer testing.
  - B. RT.
  - C. UT scan.
  - D. visual and by touch.
42. Hydrogen blistering can easily be found on the shell by:
- A. holding a flashlight perpendicular to the shell.
  - B. holding a flashlight against the shell with the beam parallel to the shell.
  - C. UT A-scan.
  - D. MFL scan.
43. Which of the following welds is the most highly stressed? Any cracking found in this weld on an in-service tank must be addressed immediately?
- A. Bottom-to-shell weld
  - B. Bottom lap welds
  - C. Horizontal shell welds
  - D. Shell-to-roof weld
44. Repad weep holes should be:
- A. threaded and plugged.
  - B. welded up after the initial leak test is performed.
  - C. used for a pressure test of the nozzle welds at every tank outage.
  - D. left open or filled with grease or caulk.



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45. During an external inspection, a leak is found in a tank shell. What is the appropriate action?
- A. Weld a fillet-weld patch over the leak
  - B. Within 3 months take the tank out of service
  - C. If the leak is a result of a crack, quickly take the tank out of service
  - D. If the leak is a result of a through-wall pit, take the tank out of service
46. If a crack is found in a tank weld, the entire suspected area should be:
- A. cleaned and then examined with a visual exam.
  - B. cleaned and then examined with either a MT or PT exam.
  - C. examined by thermography.
  - D. examined by weld quality RT.
47. Which of the following is **not** a cause of tank deformation?
- A. Defective vent
  - B. Earthquake
  - C. Exceeded product fill height
  - D. Settlement
  - E. Wind
48. Which of the following welds is least likely to crack as the result of tank deformation?
- A. Bottom-to-shell weld
  - B. Horizontal shell welds
  - C. Shell-to-Roof weld
  - D. Vertical shell welds
49. When cracking is suspect in an area of tank deformation, which NDE is preferred?
- A. MT
  - B. PT
  - C. RT
  - D. UT
50. How can rivets be checked for tightness?
- A. By lightly tabbing one side and holding a finger on the opposite side
  - B. UT straight beam
  - C. UT shear wave
  - D. Visually

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51. A suitable means of determining the overall integrity of the roof is:
- A. hammer testing.
  - B. hammer testing or MFL.
  - C. UT examination or hammer testing.
  - D. UT examination or MFL.
52. Hammer testing the roof:
- A. is a good way to determine the roof integrity.
  - B. might knock roof scale into the product.
  - C. is a suitable substitute for UT roof scans.
  - D. should be done with a 4 lb hammer.
53. Planks used as a walkway on the roof should span at least:
- A. 2 rafters.
  - B. 3 rafters.
  - C. 10 ft.
  - D. 20 ft.
54. When walking on a roof, it is advisable to walk:
- A. in the center of plates.
  - B. on the weld seams.
  - C. only if the roof thickness was verified with a few random spot UT readings.
  - D. lightly.
55. A floating roof tank is in a volatile service. When walking on the floating roof, it is advisable:
- A. that the tank be high gauged.
  - B. to stay on top of the pontoons.
  - C. to have two individuals on the roof at the same time.
  - D. sneak a smoke!
56. A floating roof tank is in a volatile service and is half full. Which of the following is a requirement when walking on the floating roof?
- A. Only walk on planks.
  - B. Perform a couple of spot UTs on the roof prior to walking on the roof.
  - C. Personnel must wear respiratory equipment unless air is tested.
  - D. Personnel on the roof must be tied off to the shell.

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57. During the external inspection of a floating roof, the grounding connections and electrical shunts should be checked for damage. What is one common cause of grounding wire breaks?
- A. Corrosion
  - B. Freezing weather
  - C. Lightning strike
  - D. Roof has rotated
58. If the maximum operating level is exceeded on a floating roof tank:
- A. excessive tank settlement will occur.
  - B. the stresses on horizontal welds will exceed that allowed by the code.
  - C. the seal may be damaged.
  - D. the roof drain will probably be damaged.
59. A blocked roof drain on a floating tank can cause:
- A. excessive hoop stresses on the tank shell.
  - B. deformation of the roof pontoons.
  - C. water to accumulate on in the bottom of the tank.
  - D. the roof to sink.
60. A floating roof is sitting on its legs. A blocked roof drain can cause:
- A. excessive hoop stresses on the tank shell.
  - B. deformation of the roof pontoons.
  - C. water to accumulate on in the bottom of the tank.
  - D. severe roof damage.
61. External roof corrosion is most common at:
- A. roof seams.
  - B. roof depressions.
  - C. the roof-to shell weld.
  - D. rafter locations.
62. Vapors leaking past floating roof seals or from roof holes can result in: **This may have more than one correct answer, select all answers that apply.**
- A. localized external corrosion.
  - B. static electricity accumulations.
  - C. significant product lost.
  - D. source of ignition during lightning or nearby welding.

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63. What is "doubling" of an UT instrument?
- A. The displayed reading is twice the actual thickness reading
  - B. At least two UT readings are taken at each TML
  - C. Total thickness at fillet weld's lapped area is twice the measured thickness
  - D. The UT instrument takes both thickness and temperature measurements
64. When might "doubling" of an UT instrument occur?
- A. Dual-element transducer used on thin materials
  - B. Single-element transducer used on thin materials
  - C. Dual-element transducer used on thick materials
  - D. Single -element transducer used on thick materials
65. Soil-to-air corrosion can affect tank farm piping. To check for soil-to-air corrosion, the soil around the pipe should be dug back about:
- A. 6 - 12 inches.
  - B. 12 - 24 inches.
  - C. 18 - 36 inches.
  - D. 6 - 8 ft.
66. Which of the following is a possible cause for significant distortion of pipe that is connected to the tank?
- A. Excessive tank settlement
  - B. Over filling the tank
  - C. Nozzle corrosion
  - D. Undersized flange class
67. Which of the following is a potential cause for significant distortion of pipe that is connected to the tank in colder climates?
- A. Frost heave of pipe supports
  - B. Over filling the tank
  - C. Nozzle corrosion
  - D. Thinning of shell
68. What should be done if there is significant distortion discovered at a nozzle?
- A. Must examine entire distorted area with UT scan
  - B. Must examine entire distorted area with PT
  - C. Clean and examine the distorted area for cracks
  - D. Clean and examine the distorted area for thinning

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69. What is a common problem for pressure/vacuum vents? **This may have more than one correct answer, select all answers that apply.**
- A. Excessive external corrosion
  - B. Plugging of discharge side screen
  - C. Buildup of solids on pallets
  - D. Pallet and valve seat corrode and stick
70. When inspecting a pressure-vacuum vent, which of the following is **not** something that needs inspected?
- A. Check for the build-up of solids
  - B. Check that moving parts are free to operate
  - C. Check for corrosion
  - D. Check vent sizing capacity
71. What is a common problem for flame arrestors?
- A. Excessive external corrosion
  - B. Internal caps melt
  - C. Internals get plugged
  - D. Incorrect flange class is used
72. Which of the following is **not** a common way for flame arrestors to get plugged?
- A. Bees, mud daubers or insects
  - B. Tank over pressure
  - C. Corrosion build-up
  - D. Solidification of tank vapors
73. If a flame arrestor gets plugged, which of the following is **not** a possible problem?
- A. Floating roof sucks in
  - B. Tank over pressures
  - C. Tank roof-to-shell weld fails
  - D. Tanks sucks in due to vacuum
74. Which of the following is **not** a reason for lifting a tank?
- A. 100% inspection of the soil-side of the tank floor
  - B. Coat the bottom side of the floor
  - C. Repair the foundation or pad
  - D. Fillet weld the bottom seams on the soil-side

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75. A tank is lifted in order to repair the tank's foundation. Based on this activity, which of the following is correct?
- A. The tank will probably need to be hydrotested
  - B. The foundation will need to be spark tested
  - C. This repair must be approved by the engineer and inspection supervisor
  - D. The concrete used in the repair should not slump more than 1-1/2"
76. The owner elects to tunnel under a tank to visually inspect a portion of the soil-side of the tank bottom. What is the primary problem with tunneling?
- A. Cave-ins
  - B. Difficult to refill and compact the fill
  - C. Interference with CP systems
  - D. Increases the likelihood of soil-to-air corrosion
77. Which of the following is **not** a cause of internal roof corrosion?
- A. Corrosive product in the vapor space
  - B. Pyrophoric iron
  - C. Oxygen
  - D. Water vapor
78. Sometimes roof coupons are cut out in order to check the condition of the roof rafters. Which of the following is correct concerning roof coupons?
- A. The activity must be approved by the Engineer and Inspector
  - B. Coupons must be at least 6" x 6"
  - C. Coupons must have rounded corners
  - D. Replacement plate must be stitch-welded at least 1" in every 12"
79. If there are leaks in a floating roof or the pontoons, which of the following is **not** likely to occur?
- A. The roof may sink
  - B. The roof may tilt and damage the seals and roof
  - C. The roof may tilt and turn upside down
  - D. More difficult to prep the tank for inspections

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80. During the external inspection, which of the following components should be checked?
- A. Check roof for leaks
  - B. Check seals for corroded or broken parts
  - C. Check anti-rotation devices for deformation
  - D. Check roof drains for pluggage
  - E. All the above
81. If a floating roof drain gets plugged, the:
- A. roof may sink.
  - B. API 653 Inspector will **not** get blamed. (*you believe in the Easter Bunny too!*)
  - C. API 653 Inspector will win the lottery.
  - D. API 653 Inspector will get a pay raise.
82. Which of the following is **not** commonly installed on a floating roof?
- A. Cathodic Protection
  - B. Drains
  - C. Grounding Connections
  - D. Guides
83. What is likely to occur to a floating roof tank that has landed on its legs and the drain is plugged?
- A. The roof sinks
  - B. The roof collapses
  - C. Excessive top side corrosion occurs
  - D. The roof inspection will be performed with scuba gear!
84. When walking on an aluminum internal floating roof:
- A. it's best to add planking prior to walking on the tank.
  - B. be sure to walk on the seams.
  - C. take thickness readings prior to walking on the roof.
  - D. it's best to use rope access and suspend from the ceiling.
85. Dry pyrophoric material can cause:
- A. cracking.
  - B. general metal loss.
  - C. ignition.
  - D. pitting.

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86. Pyrophoric material tends to collect on the:
- A. floor and top-side of the rafters.
  - B. rafters and bottom side of roof.
  - C. nozzles (360 degrees).
  - D. shell.
87. Pyrophoric material should be:
- A. air dried.
  - B. kept moist until removed.
  - C. removed with a dry vacuum.
  - D. removed per API 2201.
88. Handling pyrophoric material is discussed in:
- A. API 653.
  - B. API 2015.
  - C. NACE 92-432.
  - D. NACE 99-121.
89. Once it is safe to enter a tank, what tank component(s) should be checked first?
- A. Bottom
  - B. Nozzles
  - C. Roof and support system
  - D. Shell
  - E. Any part can be checked first
90. In sour services, corrosion often occurs in the:
- A. floor.
  - B. nozzles.
  - C. shell.
  - D. vapor space.
91. In sour services, corrosive vapors are formed when moisture and air mixes with:
- A. chlorides.
  - B. halogens.
  - C. hydrocarbons.
  - D. hydrogen sulfide.



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92. In a 98% sulfuric acid tank, corrosion often occurs:
- A. on the bottom-side of the floor.
  - B. on the top-side of the floor.
  - C. at the vapor-liquid interface.
  - D. in the vapor space.
93. In a 98% sulfuric acid tank, corrosion often occurs at the vapor-liquid interface. This is the result of:
- A. acid vapors.
  - B. hydrogen sulfide.
  - C. sulfidation.
  - D. water collecting on top of the acid that creates a weaker corrosive acid.
94. In tanks that are rarely used, like pipeline breakout tanks, corrosion often occurs:
- A. behind the tank seal.
  - B. inside nozzles.
  - C. at the center of the floor.
  - D. on the entire shell.
95. A tank has experienced a circumferential band of corrosion on the shell. Which area is often more susceptible to corrosion?
- A. Bottom of band
  - B. Top of the band
  - C. Heat Affected Zones
  - D. Any longitudinal welds in the banded area
96. **Some incomplete penetration** on circumferential shell welds:
- A. was allowed in API 650 prior to the 7<sup>th</sup> edition.
  - B. is allowed only during repairs or alterations.
  - C. is allowed only during repairs.
  - D. has always been rejectable.
97. Which of the following carbon steels are the most susceptible to hydrogen blistering?
- A. Those with mill scale
  - B. Those with dissimilar materials
  - C. Those that are non-normalized
  - D. Those with laminations and slag inclusions

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98. Caustic corrosion becomes prevalent in a carbon steel caustic tank when the temperature exceeds:
- A. 40 °F.
  - B. 125 °F.
  - C. 150 °F.
  - D. 200 °F.
99. A tank is insulated and the inspector has concern about corrosion behind the insulation. What is a cost-effective way to check for this possible corrosion?
- A. Remove & replace 10% of the insulation
  - B. Remove & replace 25% of the insulation
  - C. Remove & replace 100% of the insulation (*Remember "cost effective"!*)
  - D. Take thickness readings on the shell during the internal inspection
100. A common way to completely inspect a tank floor is by:
- A. MFL (Magnetic Flux Leakage).
  - B. MFL (Magnetic Flux Leakage) with UT follow-up in suspect areas.
  - C. Spot UT with a statistical evaluation.
  - D. Visual with a pit gauge.
101. Today's tank bottom scanning equipment can be used to find both top-side and bottom side corrosion:
- A. only on non-lined tank bottoms.
  - B. only on non-lined tank bottoms and bottoms with thin-film linings.
  - C. on non-lined tank bottoms and bottoms with thin-film and thick-film linings.
  - D. on all tank floors.
102. MFL scanning equipment may miss:
- A. uniform corrosion.
  - B. bottom-side pits.
  - C. sharp small diameter isolated pits.
  - D. corrosion within 6" of a weld.
103. On the tank bottom, removing a coupon is an effective method for:
- A. inspecting the tank floor.
  - B. determining root cause of soil-side corrosion.
  - C. determining root cause of product-side corrosion.
  - D. determining root cause of soil-side and product-side corrosion.

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104. MFL is the most common tool used today for tank floor scans. What are some other floor scanning tools? This may have more than one correct answer, select all answers that apply.
- A. Acoustic Emission Oscillated (AEO) scanner
  - B. Eddy Integrated Enveloped Inspection Operation (EIEIO)
  - C. Saturated Low Frequency Eddy Current (SLOFEC) scanner
  - D. Ultrasonics Based scanner
105. Prior to performing a tank floor scan it is a good idea to have the:
- A. grounding devices disconnected.
  - B. bottom sandblasted to a NACE 1 finish.
  - C. floating roof legs placed at the low leg settings.
  - D. scanning personnel tested to demonstrate their ability to use this equipment.
106. Which of the following is a primary advantage of the MFL floor scan?
- A. The technique requires little training
  - B. Inexpensive to perform
  - C. Significant portions of the bottom can be examined
  - D. Thickness reading is highly accurate
107. An Owner/Operator requires all floor scanning technicians to be tested and qualified for the equipment and procedure they are using. Guidance for qualifying this technician can be found in:
- A. API 653 Annex G.
  - B. API 2015.
  - C. ASNT CP-189.
  - D. ASME PCC-2.
108. A statistical method is used to determine the probable minimum remaining thickness of a tank bottom. Typically, how much of the bottom is scanned to gather info for the statistical analysis?
- A. 0.2 - 5%
  - B. 0.2 - 10%
  - C. 5-10%
  - D. 5-25%
  - E. 10-25%

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109. A statistical method is used to determine the probable minimum remaining bottom thickness. What part of the floor should be included in the statistical analysis?
- A. Outer circumference by the shell
  - B. An "X" pattern across the tank
  - C. Samples around the tank not exceeding 32' apart
  - D. Center of the tank
110. When is a statistical analysis of a tank floor effective?
- A. Tanks on pads that have been contaminated with leaking corrosion fluids
  - B. Tanks with a Galvanic CP system
  - C. Tanks on pads that have a number clay balls (*thanks Tankees for tracking that clay in our pad during installation!*)
  - D. Tanks on pads that have uniform consistency
111. What is a useful tool for finding pits on a corroded floor?
- A. 2-lb hammer
  - B. Camera
  - C. Pointed Scrapper
  - D. UT meter
112. Accelerated tank floor corrosion may occur at:
- A. bulges.
  - B. depressions.
  - C. bulges or depressions.
  - D. fillet welds.
113. All pads on a tank floor, e.g. striker plates, roof support bearing places, should be:
- A. 100% fillet-welded to the tank floor.
  - B. stitch-welded to the floor and non-welded areas should be caulked.
  - C. complete lined with a thick-film liner.
  - D. Provided with a plugged weep hole, so the pad fillet welds can be air tested during a tank outage.
114. Which part of the tank shell is considered the highest stressed?
- A. Shell near nozzles
  - B. Shell-to-bottom area
  - C. Shell-to-roof area
  - D. Vertical welds

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115. A method to use when checking for shell cracks is to put penetrant on one side of the shell and developer on the other. How long might it take to detect a crack?
- A. 10 minutes
  - B. 1 hours
  - C. 4 hours
  - D. 24 hours
116. Some tanks have been built with a non-metallic liner. Special liners use rubber, glass, organic and inorganic materials. One method used to check a tank lining is:
- A. holiday testing.
  - B. MFL.
  - C. pressure test.
  - D. statistical analysis.
117. Which of the following makes a very **"Bad Day"** for an inspector? (Note! If you miss this you are **not** ready for the API 653 exam.)
- A. During an internal inspection the bottom has no top-side corrosion.
  - B. When reviewing tank settlement readings, you finding that the whole tank has settled about 1/4". That's uniform settlement.
  - C. You calculate that the maximum corrosion rate on the shell is 0.0001 ipy. (yes 0.1 mpy)
  - D. You performed your first holiday test on a tank lining and found 537 "holidays". Look what I found. Then someone points out that each of the holidays looks a bit "burned". And then they explain that these 537 "holidays" are the result of you having the detector's voltage set too high. You burned up a good lining. (should have read the directions !!!)
118. Which of the following methods should **not** be used on a glass-lined tank? (Note! Another question if you miss, don't take the API 653 exam.)
- A. Hammer testing
  - B. Visual
  - C. Visual
  - D. Visual

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119. What type of lined tanks should be painted on the outside with a unique color or a warning stenciled, that indicates this tank has a special lining?
- A. All lined tanks
  - B. Glass-lined
  - C. Lead-lined
  - D. Rubber-lined
120. A tank bottom is coating with a lining. Without liner removal, which of the following linings does **not** allow the inspector to get any information on the condition of the steel bottom?
- A. Concrete Liner
  - B. Thin-film Liner
  - C. Thick-film Non-reinforce Liner
  - D. Thick-film Reinforce Liner
121. A band of corrosion around the entire tank shell is found on a cone roof tank. The corroded band is about 30' above the floor. The corrosion rate in this area is 4 mils per year (0.004 ipy). The roof support columns should also be inspected. What would you expect to see on these roof columns?
- A. Corrosion throughout the columns
  - B. Corrosion at the 30' level, with a corrosion rate of 4 mils per year
  - C. Corrosion at the 30' level, with a corrosion rate of 8 mils per year
  - D. Corrosion at the 30' level, with an unpredictable corrosion rate
122. What is a good method for checking the soundness of the roof's structural members and check the tightness of roof bolting?
- A. Eddy current
  - B. Light hammer taps
  - C. Hard hammer taps
  - D. 16 lb. sledge hammer taps
123. Tank coils and supports should be inspected visually and using either:
- A. hammer testing or MT.
  - B. MT or PT.
  - C. hammer testing or UT.
  - D. Eddy Current or UT.

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124. During a tank internal inspection, tank coils should be:
- A. hydrotested or pneumatically tested.
  - B. blasted and recoated.
  - C. tested using Acoustic Emission.
  - D. tested to steam to determine their heat transfer coefficient.
125. **Wet steam heating coils** should be inspected using either RT or UT to detect:
- A. build-up of internal deposits.
  - B. caustic embrittlement.
  - C. condensate grooving.
  - D. hydrogen pitting.
126. During an outage, the floating roof drain lines can be pressure tested for  $\frac{1}{2}$  hour. The initial test should normally be conducted at:
- A. 2.5 psig.
  - B. 5.0 psig.
  - C. 15 psig.
  - D. 30 psig.
127. If a drain line contains a swing joint, a second  $\frac{1}{2}$  hour pressure test should be conducted at:
- A. 2.5 psig.
  - B. 5.0 psig.
  - C. 15 psig.
  - D. 30 psig.
128. What is the reason for a 2<sup>nd</sup> pressure test of a drain that has a swing joint?
- A. This is such an important test, that a double check is needed.
  - B. The joint may be self-sealing at low pressures, but leaks at high pressures.
  - C. The joint may be self-sealing at high pressures, but leaks at low pressures.
  - D. Just a good way to collect more inspection man-hours.
129. A hydrotest is performed on a tank of 300 series SS. What is one major concern?
- A. Chloride stress corrosion cracking
  - B. Dirt in the water that will settle on the tank floor
  - C. Flange rating of the nozzle flanges
  - D. Oxygen pitting in the vapor space

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130. An air-test is substituted for a hydrotest. The air pressure should **not** exceed:
- A. 2 inches of water.
  - B. 2 ounces per square inch.
  - C. 2 psig.
  - D. 15 psig. *(there it goes ... a UFTR ... an Unidentified Flying Tank Roof! Oops!)*
131. Vacuum box testing is being performed on the roof welds. What types of leaks might be missed?
- A. Very small leaks
  - B. Large leaks
  - C. Very small leaks and some large leaks
  - D. None will be missed. Any leak can be found with a vacuum box test.
132. The interstitial space on a double-wall tank is to be hydrotested. Care should be given to:
- A. use water with less than 5 ppm of chloride.
  - B. prevent buckling the inside shell (similar to pulling a vacuum).
  - C. prevent excessive edge settlement.
  - D. electrically connect both walls to prevent static electricity discharge.

### **Section 9 - Leak Testing** *(API 575 pg 80-90)*

1. Which of the following is **not** a RPB (release prevention barrier)?
- A. Concrete reinforced pad
  - B. Double bottom tank
  - C. Effective bottom side CP
  - D. Under-tank liner *(yes a diaper!)*
2. **Which of the following** is **not** a leak detection technology?
- A. Acoustic Emission leak detection
  - B. Capillary Soil leak detection
  - C. Mass Balancing
  - D. Tracer Gas injected under the tank bottom



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3. Advance leak detection systems are described in:
- A. API 334.
  - B. API 445.
  - C. API 650 Appendix H.
  - D. API 2201.
4. Tank Hydraulic Integrity:
- A. today should be achieved by building new tanks with a double bottom.
  - B. can only be assured if CP has been installed.
  - C. means the tank has not settled in a swampy area.
  - D. is just a fancy way to say "the tank is not leaking".
5. When visual inspection is performed, the inspector's eyes should be within:
- A. 12 inches of the surface to be examined.
  - B. 24 inches of the surface to be examined.
  - C. 36 inches of the surface to be examined.
  - D. as close as the inspector's truck can get to the surface to be examined.
6. When visual inspection is performed, the inspector's eyes should look relatively straight-on to the surface. The inspector's eyes should **not** be at an angle that is:
- A. < 10 degrees.
  - B. < 30 degrees.
  - C. < 45 degrees.
  - D. < 60 degrees.
7. When visual inspection is performed, the amount of light needed for general viewing should be at least:
- A. 15 foot-candles.
  - B. 30 foot-candles.
  - C. 50 foot-candles.
  - D. 100 foot-candles.
8. When visual inspection is performed, the amount of light needed for inspecting small anomalies should be at least:
- A. 15 foot-candles.
  - B. 30 foot-candles.
  - C. 50 foot-candles.
  - D. 100 foot-candles.

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9. A high-penetrating oil is used to check the initial weld pass on one side of the bottom-to-shell weld. The minimum dwell time for this wicking test is:
- A. 10 minutes.
  - B. 1 hour.
  - C. 4 hours.
  - D. 24 hours.
10. A tank floor is tested with a type of Bubble Test examination. In this test, an indicator solution is sprayed on the top-side of the floor and low-pressure air is added under the floor. The air pressure for this test should **not** exceed:
- A. 1 inch of water.
  - B. 3 inches of water.
  - C. 2.5 psig.
  - D. 15 psig.
  - E. 750 mm of mercury.
11. A tank floor is tested with another type of Bubble Test examination. In this test, about 6" of water is added inside the tank and low-pressure air is added under the floor. The air pressure for this test should **not** exceed:
- A. 1 inch of water.
  - B. 3 inches of water.
  - C. 9 inches of water.
  - D. 2.5 psig.
  - E. 1250 mm of mercury.
12. The effectiveness of a tank floor Bubble Test can be improved by:
- A. increasing the pressure.
  - B. increasing the duration of the examination.
  - C. tapping the entire bottom with an air operated hammer.
  - D. pulsating the air pressure.
13. Another variation of the Bubble Test examination is to build a clay dam around the tank and add water under the tank. (this is basically a "Reverse Hydro") The height of the water in the dam must be at least:
- A. 6 inches above the highest point in the floor.
  - B. 12 inches above the highest point in the floor.
  - C. 24 inches above the highest point in the floor.
  - D. 36 inches above the highest point in the floor (*Anchors away !!!*).

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14. When performing a Magnetic Particle examination on a tank:
- A. the examiner must be qualified to ASNT standards.
  - B. the needed light intensity is 15 foot-candles.
  - C. the examination must include the weld and 6" on each side of the weld.
  - D. discontinuities are most evident near the weld surface.
15. When performing a Magnetic Particle examination, discontinuities are most evident:
- A. in stainless steels.
  - B. when the discontinuity is perpendicular to the magnetic flux.
  - C. when the discontinuity is parallel to the magnetic flux.
  - D. when the discontinuity is subsurface.
16. What is one of the advantages of testing the tank floor with a tracer gas injected under the floor?
- A. Any needed weld repairs can be made immediately
  - B. This technique is inexpensive
  - C. This technique can be used either with the tank in-service or out-of-service
  - D. Useful technique if the water table is extremely high
17. One method to test a tank floor is to inject an inert gas on the bottom-side of the tank floor and use a gas detector on the top-side. A common gas for this test is:
- A. Argon.
  - B. Carbon dioxide.
  - C. Helium.
  - D. Hydrogen Sulfide.
18. A special leak detection method is called Volumetric Technology. The key measurements in this technology are:
- A. Liquid Level and Pressure.
  - B. Liquid Level and Temperature.
  - C. Pressure and Mass.
  - D. Mass and Temperature.

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19. Another special leak detection method is called Mass Balancing Technology. The key measurement in this technology is:
- A. Liquid Level.
  - B. Temperature.
  - C. Pressure.
  - D. Specific Gravity.
20. Another leak detection method is called the Chemical Marker Technology. Which of following best describe this method?
- A. Chemical is added below the floor and chemical detection tools are used inside the tank.
  - B. A colored chemical is added below the tank and visual examination is performed on the top-side to find bleed-through.
  - C. Chemical is sprayed on the top-side of the tank, and detectors tubes are spaced on the bottom-side for air sampling.
  - D. Chemical is added to either the hydrotest water, or the tank's product. Detectors tubes are spaced on the bottom-side for air sampling.
21. When the Chemical Marker Technology is used, the typical inoculation concentration is:
- A. 1 to 10 parts per million.
  - B. 40 to 125 parts per million.
  - C. 0.5%.
  - D. 1.0%.
22. **With Chemical Marker Technology**, every part of the bottom should be within:
- A. 3 feet from a detection tube.
  - B. 10 feet from a detection tube.
  - C. 20 feet from a detection tube.
  - D. 32 feet from a detection tube.
23. Acoustic Emission (AE) can also be used to determine if a tank floor is leaking. AE is based upon:
- A. detection of leaking tracer chemical.
  - B. hearing sound from a leak.
  - C. measuring slight changes in liquid height.
  - D. using ultrasonic sound to find the leak.

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24. Acoustic Emission (AE) is being used to check for a tank leak. If a number of sensors are used then:
- A. the exact location of a leak can be determined.
  - B. only the general area of a leak can be determined.
  - C. there is a 100% confidence level that any leaks will be found.
  - D. any noise detected by all sensors is a leak.
25. The sensor used in Acoustic Emission is called a(n):
- A. Accelerometer.
  - B. Acoustometer.
  - C. Ammeter.
  - D. Transducer.
26. What is a primary limitation of the Acoustic Emission technique?
- A. Ability to distinguish sound from a leak from other background noise
  - B. Inability to determine whether a leak was caused from top-side or bottom-side corrosion
  - C. Ability to determine the general location of a leak
  - D. Difficulty in calibrating a sensor

### **Section 10 – Repairs & Alterations** (API 575 pg 90-95)

1. All crack-like flaws found during an inspection:
- A. can be ignored if they are in lower stressed components.
  - B. must be repaired.
  - C. must be repaired in a manner that prevents the crack from reoccurring.
  - D. should be repaired unless they are deemed acceptable per a fitness-for-service evaluation.
2. The seam on a riveted tank has started to leak. Which of the following is **not** an acceptable repair method?
- A. Caulking
  - B. Epoxy coating after an abrasive blast
  - C. Re-riveted
  - D. Soldered
  - E. Welding

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3. The seam on a riveted tank has started to leak. The plan is to repair by welding. What must be part of the repair plan?
  - A. Caulk all rivets and seams within 6" of the welding
  - B. Replace all rivets within 12" of welding with bolts and gaskets
  - C. Use large weld beads
  - D. Welding should be done with the SAW process
  
4. The seam on a riveted tank has started to leak. The plan is to repair by welding. What must be part of the repair plan?
  - A. Use large diameter electrodes
  - B. Set the welding machine for high amperage
  - C. Use back-step bead application
  - D. Weld with one pass
  
5. On a riveted tank, some leaks have developed around a few rivet heads. Which of the following is a common problem when performing weld repairs?
  - A. Welds often crack when welding older materials
  - B. Heat from welding can cause additional leaks in adjacent rivets
  - C. Welding rivet heads creates notches that are stress risers
  - D. It is difficult to inspect or test these fillet welds
  
6. A tank floor is being replaced due to product-side corrosion. Currently the bottom-side of the tank is protected by CP. During this repair the:
  - A. shell should be slotted 6-12" above the old floor.
  - B. floor thickness should be increased to  $\geq 3/8$ ".
  - C. old floor should be removed.
  - D. concrete must be installed between the old and new floors.
  
7. When locating a door sheet, which of the following is true?
  - A. Locate the door sheet in an area where the bottom is relatively level for a distance of 5 feet on either side of the door sheet.
  - B. Door sheets should not cut through any vertical welds.
  - C. Door sheets should not extend all the way to the bottom-to-shell weld.
  - D. Door sheets should not be wider than 10 feet.

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8. Cutting a door sheet all the way down to the bottom-to-shell weld:
  - A. is not allowed.
  - B. may end up requiring a hydrotest to be performed.
  - C. requires Owner/Operator approval.
  - D. always requires extra bracing to be installed.
  
9. In liquid areas of the tank (*shell & bottom*) deep pits that are **not** closely spaced:
  - A. must be repaired by welding.
  - B. can be abrasive blasted and filled with air hardening epoxies.
  - C. can be repaired with either epoxies or soft patches.
  - D. can always be repaired with a fillet weld patch.
  
10. Tanks repairs using soft patches are:
  - A. never allowed.
  - B. are acceptable repairs in all areas of the tank.
  - C. are acceptable repairs only externally on the roof.
  - D. are acceptable repairs only externally on the roof or shell.
  
11. Soft patches on a tank roof should be clearly identified. Why?
  - A. So that more permanent repairs could be made in the future.
  - B. So that they can be removed and reinspected at each external inspection.
  - C. So that no one steps on them and gets mastic on their work boots.
  - D. So that no one steps on them and falls through the roof.

### **Section 11 – Records** (API 575 pg 95-97)

1. Why are good tanks records needed? **Select all answers that apply.**
  - A. Predict when repairs will be needed
  - B. Reduce environmental hazards
  - C. Reduces the interval between inspections
  - D. Basis of an effective inspection program
  
2. Inspection reports shall document which of the following? **This may have more than one correct answer, select all answers that apply.**
  - A. Name of person performing the inspection
  - B. Nozzle schedule
  - C. Results of the inspection (*inspection findings*)
  - D. Tank dimensions

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3. Tank records:
  - A. must be all upgraded to an electronic format.
  - B. should always be managed by an Authorized API 653 inspector.
  - C. should be readily available at the tank facility.
  - D. need to cover only the results of Internal & External inspections.

### Annex A - NDE (API 575 pg 98-99)

1. Dual-element UT transducers have the ability to measure thin sections from:
  - A. 0.025" - 1.000".
  - B. 0.025" - 2.000".
  - C. 0.050" - 0.500".
  - D. 0.050" - 1.000".
  - E. 40°F to 125°F. (*Oops, right answer for a different question!*)
2. Which of the following is correct concerning the use of dual-element UT transducers?
  - A. If wall thicknesses less than 0.100" the meter accuracy is +/- 10%.
  - B. If thickness < 0.050", the meter will provide no reading or a false reading.
  - C. These transducers are used in the "Echo-to-Echo mode".
  - D. These transducers are commonly used in Phased Array inspections.
3. Which of the following is **not** an advantage of a Single-crystal UT transducers?
  - A. Possible to determine wall thickness even with coatings up to 0.100".
  - B. Can be used in the "Echo-to-Echo mode".
  - C. Has very good resolution for small diameter deep pits.
4. When UT corrosion mapping is performed, the recommended minimum transducer overlap between scanning passes is:
  - A. 5% of the transducer diameter.
  - B. 10% of the transducer diameter.
  - C. 25% of the transducer diameter.
  - D. 0.250".



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5. When UT scanning is performed, larger diameter transducers:
  - A. will not find small diameter deep pits.
  - B. are more difficult to calibrate (compared to smaller transducers).
  - C. have a slower maximum scanning speed (compared to smaller transducers).
  - D. work best in the "Echo-to-Echo mode".
6. Phased Array Ultrasonics is often used:
  - A. also as a PMI tool.
  - B. as a substitute for RT after weld repairs.
  - C. for thickness mapping and detection of mid-wall discontinuities.
  - D. for solving world hunger.
7. Angle Beam Ultrasonics is often used:
  - A. also as a PMI tool.
  - B. as a substitute for RT after weld repairs.
  - C. for thickness mapping and detection of mid-wall discontinuities.
  - D. to provide a C-Scan image.
8. MFL floor scans typically cover:
  - A. 80% of the floor.
  - B. 85% of the floor.
  - C. 90% of the floor.
  - D. 98% of the floor.
9. A robotic tool is used to scan the floor while the tank is in service. Which of the following is true?
  - A. This scan normally covers about 80% of the floor.
  - B. This is relatively an inexpensive floor scan.
  - C. This tool normally uses Eddy Current technology.
  - D. Data from the scan is inputted into a statistical model to project the thinnest remaining thickness of the bottom.

# API 575 Study Guide - Answer Key

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### Section 2.2

1. API 12A
2. API 579
3. API 580
4. API 583
5. API 620
6. API 650
7. API 651
8. API 652
9. API 2000
10. API 2015
11. UL-142

### Section 3

1. B (3.1)
2. C (3.3)
3. C (3.8)
4. D (3.14)
5. BC (3.41)
6. A (3.42)
7. A (3.43)

### Section 4

1. D (4.1.1)
2. C (4.2.2)
3. B (4.2.2)
4. A (4.2.3.1)
5. A (4.2.3.1)
6. C (4.2.3.1)
7. A (4.2.3.1/2)
8. D (4.2.3.3.1)
9. B (4.2.3.3.1)
10. D (4.2.3.3.2)
11. B (4.2.3.3.3)
12. C (4.2.3.3.3)
13. B (4.2.3.4.e)
14. A (4.3.1)
15. C (4.3.1)
16. A (4.3.1)

17. D (4.3.1)
18. A (4.3.2)
19. B (4.3.3.1)
20. B (4.3.4)

### Section 5

1. A (5.1.4.1)
2. D (5.1.4.3)
3. E (5.2.2.2)
4. D (5.2.2.2)
5. B (5.2.2.2)
6. A (5.2.2.2)
7. AC (5.2.2.2/3)
8. D (5.2.2.4)
9. A (5.2.3.1)
10. A (5.2.3.2)
11. ABD (5.2.3.2)
12. A (5.2.3.2)
13. A (5.2.3.2)
14. D (5.3.4)
15. B (5.3.4)
16. D (5.3.5)
17. A (5.4.2)
18. D (5.4.3)
19. B (5.4.4)
20. D (5.4.4)
21. B (5.4.4)
22. A (5.4.6)
23. E (5.5.1)
24. A (5.5.2)

### Section 6

1. A (6.1.1)
2. D (6.1.1)
3. C (6.1.1)
4. BC (6.1.1)
5. D (6.1.2)
6. A (6.2.1)
7. D (6.2.5)

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- 8. C (6.3.1)
- 9. C (6.3.1)
- 10. C (6.3.2)
- 11. BCD (6.3.3)
- 12. B (6.3.4)
- 13. D (6.3.5)
- 14. CD (6.3.5)

### **Section 7**

- 1. B (7.1.2.1)
- 2. ABD (7.1.2.2)
- 3. A (7.2.1)
- 4. B (7.2.2 - see calc pg 54)
- 5. B (7.2.2 - see calc pg 54)
- 6. C (7.3.1.2)
- 7. D (7.3.1.3)
- 8. A (7.3.1.3)
- 9. C (7.3.1.3)
- 10. D (7.3.1.3)
- 11. B (7.3.1.4)
- 12. A (7.3.2.1)
- 13. C (7.3.2.2)
- 14. A (7.3.2.3)
- 15. A (7.4.1)
- 16. D (7.4.1)
- 17. B (7.4.2)
- 18. A (7.4.3.2)
- 19. B (7.4.3.3)
- 20. D (7.4.3.3)
- 21. C (7.4.3.4)
- 22. A (7.5)

### **Section 8**

- 1. A (8.1.1)
- 2. B (8.1.3)
- 3. A (8.1.3)
- 4. B (8.1.4 - Table 1)
- 5. C (8.2.1)
- 6. AD (8.2.2)

- 7. D (8.2.2)
- 8. D (8.2.2)
- 9. A (8.2.3)
- 10. C (8.2.5)
- 11. D (8.2.6)
- 12. B (8.2.6)
- 13. C (8.2.6)
- 14. B (8.2.7)
- 15. C (8.2.7)
- 16. B (8.2.8)
- 17. D (8.2.8)
- 18. C (8.2.8)
- 19. A (8.2.8)
- 20. A (8.2.8)
- 21. A (8.2.9.1)
- 22. AC (8.2.9.1)
- 23. B (8.2.9.1)
- 24. B (8.2.9.2.3)
- 25. D (8.2.9.2.4)
- 26. C (8.2.9.2.5)
- 27. D (8.2.9.2.5)
- 28. C (8.2.9.2.6)
- 29. A (8.2.9.2.6)
- 30. B (8.2.9.2.6)
- 31. C (8.2.9.3)
- 32. A (8.2.9.3)
- 33. D (8.2.9.4.1)
- 34. B (8.2.9.4.1)
- 35. D (8.2.9.4.1)
- 36. A (8.2.9.4.1)
- 37. C (8.2.9.4.2)
- 38. D (8.2.9.4.2)
- 39. AC (8.2.9.4.2)
- 40. C (8.2.9.4.2)
- 41. D (8.2.9.5)
- 42. B (8.2.9.5)
- 43. A (8.2.9.6.1)
- 44. D (8.2.9.6.2)
- 45. C (8.2.9.6.3)
- 46. B (8.2.9.6.4)

# API 575 Study Guide - Answer Key

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### **Section 8** *(continued)*

- |        |                 |         |             |
|--------|-----------------|---------|-------------|
| 47. C  | (8.2.9.6.5)     | 85. C   | (8.4.2.2)   |
| 48. B  | (8.2.9.6.5)     | 86. A   | (8.4.2.2)   |
| 49. A  | (8.2.9.6.5)     | 87. B   | (8.4.2.2)   |
| 50. A  | (8.2.9.7)       | 88. B   | (8.4.2.2)   |
| 51. D  | (8.2.10.1.1)    | 89. C   | (8.4.3)     |
| 52. B  | (8.2.10.1.1)    | 90. D   | (8.4.4)     |
| 53. A  | (8.2.10.1.1)    | 91. D   | (8.4.4)     |
| 54. B  | (8.2.10.1.1)    | 92. C   | (8.4.4)     |
| 55. A  | (8.2.10.1.1)    | 93. D   | (8.4.4)     |
| 56. C  | (8.2.10.1.2)    | 94. A   | (8.4.4)     |
| 57. B  | (8.2.10.2)      | 95. C   | (8.4.4)     |
| 58. C  | (8.2.10.3)      | 96. A   | (8.4.4)     |
| 59. D  | (8.2.10.4)      | 97. D   | (8.4.4)     |
| 60. D  | (8.2.10.4)      | 98. C   | (8.4.4)     |
| 61. B  | (8.2.10.5)      | 99. D   | (8.4.4)     |
| 62. AD | (8.2.10.3/6)    | 100. B  | (8.4.5.1/2) |
| 63. A  | (8.2.10.6)      | 101. C  | (8.4.5.1)   |
| 64. B  | (8.2.10.6)      | 102. C  | (8.4.5.1)   |
| 65. A  | (8.2.11.1.1)    | 103. B  | (8.4.5.2)   |
| 66. A  | (8.2.11.1.2)    | 104. CD | (8.4.5.2)   |
| 67. A  | (8.2.11.1.2)    | 105. D  | (8.4.5.2)   |
| 68. C  | (8.2.11.1.3)    | 106. C  | (8.4.5.2)   |
| 69. BC | (8.2.11.2)      | 107. A  | (8.4.5.2)   |
| 70. D  | (8.2.11.2)      | 108. B  | (8.4.5.3)   |
| 71. C  | (8.2.11.3)      | 109. A  | (8.4.5.3)   |
| 72. B  | (8.2.11.3)      | 110. D  | (8.4.5.3)   |
| 73. A  | (8.2.11.3)      | 111. C  | (8.4.5.4)   |
| 74. D  | (8.3.1.2)       | 112. B  | (8.4.5.6)   |
| 75. A  | (8.3.1.2)       | 113. A  | (8.4.5.6)   |
| 76. B  | (8.3.1.3)       | 114. B  | (8.4.6)     |
| 77. B  | (8.3.3.2.1)     | 115. D  | (8.4.7)     |
| 78. C  | (8.3.3.3)       | 116. A  | (8.4.8)     |
| 79. C  | (8.3.3.4)       | 117. D  | (8.4.8)     |
| 80. E  | (8.3.3.4/5/6/7) | 118. A  | (8.4.8)     |
| 81. A  | (8.3.3.7)       | 119. B  | (8.4.8)     |
| 82. A  | (8.3.3 Various) | 120. A  | (8.4.8)     |
| 83. B  | (8.3.3.7)       | 121. C  | (8.4.9)     |
| 84. A  | (8.4.2.2)       | 122. B  | (8.4.9)     |
|        |                 | 123. C  | (8.4.10.1)  |
|        |                 | 124. A  | (8.4.10.1)  |

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### **Section 8** *(continued)*

- 125. C (8.4.10.1)
- 126. D (8.4.10.5)
- 127. B (8.4.10.5)
- 128. C (8.4.10.5)
- 129. A (8.5.2.2)
- 130. A (8.5.2.2)
- 131. C (8.5.2.2)
- 132. B (8.5.2.4)

### **Section 9**

- 1. C (9.1.1)
- 2. B (9.1.2 - Fig 58)
- 3. A (9.1.3)
- 4. D (9.1.4)
- 5. B (9.2.1)
- 6. B (9.2.1)
- 7. A (9.2.1)
- 8. C (9.2.1)
- 9. C (9.2.2)
- 10. B (9.2.3)
- 11. C (9.2.3)
- 12. C (9.2.3)
- 13. A (9.2.3)
- 14. D (9.2.6)
- 15. B (9.2.6)
- 16. A (9.2.7.1)
- 17. C (9.2.7.1)
- 18. B (9.3.2.1)
- 19. C (9.3.2.2)
- 20. D (9.3.3.2)
- 21. A (9.3.3.3)
- 22. C (9.3.3.5)
- 23. B (9.3.4.1)

- 24. B (9.3.4.1)
- 25. A (9.3.4.3)
- 26. A (9.3.4.5)

### **Section 10**

- 1. D (10.2.2)
- 2. D (10.2.3)
- 3. A (10.2.3)
- 4. C (10.2.3)
- 5. B (10.2.3)
- 6. C (10.2.4)
- 7. A (10.2.5.1.a)
- 8. B (10.2.5.1.c)
- 9. B (10.3.1)
- 10. C (10.3.2)
- 11. D (10.3.2)

### **Section 11**

- 1. ABD (11.1)
- 2. AC (11.2)
- 3. C (11.2)

### **Annex A**

- 1. D (A.1)
- 2. B (A.1)
- 3. C (A.1)
- 4. B (A.2)
- 5. A (A.2)
- 6. C (A.2)
- 7. B (A.3)
- 8. A (A.4)
- 9. D (A.5)

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### Section 7

#4 Time Period = 2021-10/12 - 2017-4/12 = 2021.83 - 2017.33 = 4.5 yrs  
Corr Rate = Metal Lost / Time = (588 - 570) / 4.5 = 18 / 4.5 = 4 mpy (or 0.004 ipy)

#5 **Calculate Long Term Corrosion Rate:**

Time Period = 2021-11/12 - 2008-6/12 = 2021.92 - 2008.5 = 13.42 yrs  
Corr Rate = Metal Lost / Time = (422 - 368) / 13.42 = 54 / 13.42 = 4 mpy (or 0.004 ipy)

**Calculate Short Term Corrosion Rate:**

Time Period = 2021-11/12 - 2017-6/12 = 2021.92 - 2017.5 = 4.42 yrs  
Corr Rate = Metal Lost / Time = (395 - 368) / 4.42 = 27 / 4.42 = 6.1 mpy (or 0.0061 ipy)

**Select Controlling Corrosion Rate:**

Larger of Long or Short = 6.1 mpy

**Calculate Remaining Life:**

Life = Remain Corr Allowance / Rate = (368 - 344) / 6.1 = 3.94 yrs Round up to 4 yrs

SDG