Path #4. API 571. In this path we will see 52 closed book questions to be studied for the API 653 Certification Examination. They are all based on API 571, a summary of important damage mechanisms in the industry.

The following questions were extracted from the standards by me, ~~or remembered by me or other students that took the exam before~~.
The format is a Q&A one, different from the multiple choice question format from other courses I have seen online. I prefer this method because it takes away all the clutter that leads to confusion when treating these standards. I advise you to copy this info and paste it in a spaced repetition software like Anki or Supermemo, as the Q&A format allows, and start studying right away. You could choose to print flashcards too. When days pass by, you will see who you remember all of the information with no problem.

The following questions correspond to Brittle fracture

151. Q: _____ _____ is the sudden rapid fracture under stress where the material exhibits little or no evidence of ductility or plastic deformation
A: Brittle fracture Ref: API 571 4.2.7.1

152. Q: Which 3 types of steel are susceptible to Brittle fracture?
A: Carbon, low alloy and 400 series SS steels Ref: API 571 4.2.7.2

153. Q: First of five critical factors that make a material susceptible to brittle fracture
A: Existence of flaws in the material Ref: API 571 4.2.7.3

154. Q: In materials with flaws, the most important variable in resistance to brittle fracture is
A: Material fracture toughness Ref: API 571 4.2.7.3

155. Q: Give an example of an embrittlement phase, which raises a material´s susceptibility to brittle fracture
A: Cementite Ref: API 571 4.2.7.3

156. Q: A lower grain size affects brittle fracture by lowering _____
A: Ductile-brittle transition temperature Ref: API 571 4.2.7.3

157. Q: Thicker material sections have a higher/lower resistance to brittle fracture
A: Lower Ref: API 571 4.2.7.3

158. Q: Brittle fracture occurs at temperatures _____ the ductile-brittle transition temperature
A: Below Ref: API 571 4.2.7.3

159. Q: Let´s review all 5 critical factors affecting brittle fracture
A: Flaws, embrittling phases, steel cleanliness and grains size, thickness and temperature Ref: API 571 4.2.7.3

160. Q: Which type of damage mechanism can be present at equipment manufactured prior to 1987 and designed according to the ASME BPVC Section VIII, div 1?
A: Brittle fracture Ref: API 571 4.2.7.4

161. Q: After the 1987 Section VIII, div 1 addenda, equipment made to this code was also subject to the requirements of _____
A: UCS 66 (impact exemption curves) Ref: API 571 4.2.7.4

162. Q: Main concern of brittle fracture is during which events in an equipment´s life cycle?
A: Start-up, shutdown or hydrotest/tightness testing Ref: API 571 4.2.7.4

163. Q: Why is susceptible an equipment to brittle fracture during ambient temperature hydrotesting?
A: Due to high stresses and low toughness at the testing temperature Ref: API 571 4.2.7.4

164. Q: Brittle fracture can be present in units processing light hydrocarbons because of _____
A: Autorefrigeration Ref: API 571 4.2.7.4

165. Q: Brittle fracture cracks tend to be _____
A: Straight, non branching and without plastic deformation Ref: API 571 4.2.7.5

166. Q: Preventative measures against brittle fracture can be taken in several parts of an equipment´s _____ _____
A: Life Cycle Ref: API 571 4.2.7.6

167. Q: Brittle fracture is an "_____ _____" damage mechanism, meaning that
A: Event driven Ref: API 571 4.2.7.6

168. Q: If the morphology of a fracture surface is composed largely of cleavage, with limited intergranular cracking an little microvoid coalescence, then the damage mechanism is
A: Brittle fracture Ref: API 571 4.2.7.6

169. Q: Performing a PWHT will improve/worsen the resistance to brittle fracture
A: Improve Ref: API 571 4.2.7.6

170. Q: For existing equipment, resistance to brittle fracture of existing carbon and low alloy steel can be evaluated with
A: Api 579-1 section 3 level 1 or 2 Ref: API 571 4.2.7.6

171. Q: Can inspection mitigate brittle fracture?
A: No Ref: API 571 4.2.7.7

The following questions correspond to Mechanical fatigue

172. Q: Fatigue cracking is a mechanical form of degradation that occurs when a component is exposed to _____ _____ for an extended period
A: Cyclical stresses Ref: API 571 4.2.16.1

173. Q: Mechanical loading can cause Mechanical Fatigue. Which other phenomena causes Mechanical Fatigue.
A: Thermal cycling Ref: API 571 4.2.16.1

174. Q: Which materials can suffer mechanical fatigue?

    A: All engineering alloys Ref: API 571 4.2.16.2

175. Q: What is the most important factor in determining a component´s resistance to fatigue cracking?

    A: Design of the component Ref: API 571 4.2.16.3

176. Q: Which materials exhibit and endurance limit to mechanical fatigue cracking?
    A: Carbon steel an d titanium Ref: API 571 4.2.16.3

177. Q: Does 300 series SS exhibit endurance limit to mechanical fatigue cracking?
    A: No Ref: API 571 4.2.16.3

178. Q: For alloys with endurance limit to mechanical fatigue cracking, the ratio of endurance limit over Ultimate Tensile Strength is between ___ and _____
    A: 0,4 and 0,5 Ref: API 571 4.2.16.3

179. Q: Inclusions in metal decelerate/accelerate fatigue cracking
    A: Accelerate Ref: API 571 4.2.16.3

180. Q: How does heat treatment improve the toughness of a metal?
    A: Reducing grain size and eliminating embrittlement phases Ref: API 571 4.2.16.3

181. Q: In mechanical fatigue, the finer the grain, the worst/better for mechanical fatigue resistance
    A: Better Ref: API 571 4.2.16.3

182. Q: Which are the 2 types of load that originate mechanical fatigue?
    A: Thermal cycling and mechanical loading Ref: API 571 4.2.16.4

183. Q: If you see fracture and a "clam shell" type fingerprint with "beach marks" emanating from the crack initiation, that is _____ _____
A: Mechanical fatigue Ref: API 571 4.2.16.5

184. Q: Definition of endurance limit in mechanical fatigue
A: An amplitude value under which fatigue cracking will not occur, regardless of the number of cycles Ref: API 571 4.2.16.3

185. Q: What is the best defense against mechanical fatigue cracking of components in cyclic service?
A: Good design that reduces stress concentration Ref: API 571 4.2.16.6

186. Q: Use of low stress stamps and marking tools is a measure you would take to prevent _____
A: Mechanical fatigue Ref: API 571 4.2.16.6

187. Q: Besides PT and UT, what other NDE can be used to detect fatigue cracks in stress concentration areas?
A: SWUT Ref: API 571 4.2.16.7

188. Q: Which are the 3 NDE methods you can use to detect fatigue cracks in stress concentration areas?
A: PT, MT and SWUT Ref: API 571 4.2.16.7

The following questions correspond to Atmospheric Corrosion

189. Q: Atmospheric corrosion occurs from _____ associated with atmospheric conditions
A: Moisture Ref: API 571 4.3.2.1

190. Q: Atmospheric corrosion can affect which materials?
A: Carbon steels, low alloy steels and copper alloyed aluminum Ref: API 571 4.3.2.2

191. Q: Which is the most important measure against atmospheric corrosion?
A: Surface preparation an proper coating application Ref: API 571 4.3.2.6

192. Q: Atmospheric corrosion can affect which kind of metallic connections?
A: Bimetallic connections, such as copper to aluminum electrical connections Ref: API 571 4.3.2.4

193. Q: What is the average corrosion rate in marine environments?
A: 20mpy Ref: API 571 4.3.2.3

194. Q: What is the average corrosion rate in industrial environments that contain acids or sulfur compounds that can form acid?
A: 5-10mpy Ref: API 571 4.3.2.3

195. Q: As opposed to corrosive marine environments, what is the average corrosion rate in inland locations?
A: 1 to 3mpy Ref: API 571 4.3.2.3

196. Q: What is the average corrosion rate in dry rural environments?
A: Less than 1mpy Ref: API 571 4.3.2.3

197. Q: Corrosion rates increase with proximity with which equipment?
A: Cooling towers and furnace stacks Ref: API 571 4.3.2.3

198. Q: Corrosion rates increase with temperature up to _____
A: 250°F Ref: API 571 4.3.2.3

199. Q: Over 250°F, why is atmospheric condition less probable?
A: Over that temperature, surfaces are too dry for corrosion to occur Ref: API 571 4.3.2.3

200. Q: Designs that trap water or moisture in crevices are prone to _____ _____
A: Atmospheric corrosion Ref: API 571 4.3.2.3

201. Q: Which are the 2 NDE techniques you can use to detect atmospheric corrosion?
     A: VT and UT Ref: API 571 4.3.2.7

202. Q: Can UT be used to detect atmospheric corrosion? (Yes/no)
     A: Yes Ref: API 571 4.3.2.7

For more articles on the API 653 questions series, see the following

1. Path #1
2. Path #2
3. Path #3

For more information and more questions go to www.apiexam.com