

ARAMCO VENDOR INSPECTION EXAMINATION

MECHANICAL

- 1) What is a WPS, PQR, WPQ?
- 2) What are the definitions of **essentials** and **non-essentials** variables?
- 3) What is the definition of pre-heating?
- 4) Why is inter-pass temperature control required when welding of austenitic stainless steel?
- 5) List five items that you would expect to find in a Materials Test Report?
Answers:
 - a) Purchase Order Number
 - b) Lot
 - c) Heat Number
 - d) Chemical Analysis
 - e) Mechanical Test Results
 - f) Specification (mat., grade, type/class)
 - g) Manufacturer's Name
- 6) What is Carbon Equivalent and what is its importance in regards to welding?
- 7) Low Hydrogen electrodes are to be maintained in
 - a – their **re-sealed** containers
 - b – electrode holders with an **open** lid.
 - c – electrode oven
- 8) If the root gap have been found too small before welding, a proper corrective action would be
 - a – increase the welding heat,
 - b.– open a wider gap by gouging or grinding ✓
 - c – none of the above
- 9) Circular welds should always be done before longitudinal ones.
TRUE / FALSE
- 10) What the acronyms GTAW/FCAW/SMAW/GMAW/SAW stands for? Explain the basic process.
- 11) Name the three basic steps to be checked prior to welding
- 12) What is the most important to be checked before start welding of clad materials?

- 13) What would be the most appropriate welding process be when welding full penetration joints from only one side?
 - a – FCAW
 - b – GTAW
 - c – SAW
 - d – GMAW
- 14) What is “Interpass Temperature”
- 15) Why is pre-heating important for welding alloy steels?
- 16) What is the purpose of PWHT?
- 17) What extra attention is payed for Low Hydrogen Electrodes?
- 18) What is “P-No” for SA 516 Gr. 70, according to ASME IX?
- 19) What is Thermal Expansion”
- 20) Why the cracks appear: a) Because of Heating while welding; b) because of cooling after welding; c)
- 21) How welding stresses are relieved: a) Heating and quenching the welds; b) Heating at a designed temperature and controlled cooling; c) Drilling holes in weld seam; d) ...
- * 22) What is difference between DCRS and DCES
- 23) Which are the three main attribute mentioned on a Tensile Test Report?
- 24) RT is the most suitable NDT method for detecting the edge wall lack of fusion. TRUE/FALSE
- 25) Why are the bevel edges controlled before welding?
- 26) Which is the most appropriate method for detecting laminations on bevel edge? a) RT; b) PT; c) both; d) NONE
- 27) Name three (3) methods for the transfer of filler material for GMAW
- 28) Describe the position “3G”
- 29) When a welder is qualified for position 5G, in which position can he weld?
- 30) What is Joint Efficiency?
- 31) Name four (4) types of joints
- 32) Which are the most three (3) suitable groove geometries for SAW?
- 33) For PT fluorescent, MT fluorescent and Leak Test is used ultraviolet light. TRUE/FALSE
- 34) For inspection of stainless steels strip lining is used: a) RT; b) MT; c) both; d) None

Aramco Vender Inspection Examination.

Mechanical

1) What is a wps, pqr, and wps?

WPS: welding procedure specification. This is a written procedure, which states essential and some non-essential variables on a specific job.

PQR: this is the record of mechanical and other testing conducted on the test coupon to a given wps.

WPQ: this is the test undertaken by the welder to prove his ability to be certified to weld on a certain welding procedure.

★ 2) What is the definition of the essential and non-essential variables?

Essential variables: changes beyond the limitation of the pqr are essential variables. shall require the requalification of procedure.

Non-Essential variables: changes within the limitation of pqr is not require requalification of procedure.

3) What is the definition of the pre heating?

The application of the heat to the base metal immediately before the welding is pre heating.

4) Why is inter pass temp control required when welding of austenitic stainless steel?

To prevent the hardening in the heat affected zones through the dendrite growth and prevent under bead cracking.

5) List five items that you would expect to find in a material test certificate?

- a) Manufactures name.
- b) Purchase order no.
- c) Specification (mat.gr. type/class)
- d) Mechanical test
- e) Chemical test
- f) Heat no.
- g) Lot no.

6) What is carbon equivalent and what is its important in regards to welding?

$$CE = C + \frac{(Mn + Si)}{6} + \frac{(Cr + Mo + V)}{5} + \frac{(Ni + Cu)}{15}$$

Chemical analysis may be obtained from:

1. Mill test certificate
2. typical production chemistry

- 7) Low Hydrogen electrodes are to be maintained in .
- a) - their rescaled container
 - b) - Electrode holder with an open lid.
 - c) -electrode oven**
- 8) If the root gap have been found to small before welding a proper corrective action would be.
- A - increase the welding heat.
 - B - open a wider gap by gauging or grinding.**
 - C -- non of the above
- 9) Circular welds should always be done before longitudinal ones?

TRUE/FALSE

- 10) What the acronyms GTAW/FCAW/SMAW/GMAW/SAW. Stand for?

GTAW: Gas tungsten arc welding.

FCAW: Flux cored arc welding

SMAW: shielded metal arc welding.

SAW: submerged arc welding.

GMAW: gas metal arc welding.

- 11) Name the three basic steps to be checked before start welding?

1) Edge preparation and cleanness.

2) Consumables.

3) Welder qualification

4) Pre heat (if required).

- * 12) What is most important to check before start welding of clad material?

Weather Condition

Preheating.

- 13) What would the most appropriate welding processes be when welding full penetration joint from one side?

1) FCAW 2)GTAW 3) SAW 4)GMAW

- 14) What is inter-pass temperature?

* In a multi pass weld, the welding temperature of the weld area between weld passes is known as interpass temp.

15) Why is pre heating important for welding alloy steels?

- a) To reduce the cooling rate during the welding.
- b) To prevent entrapment of hydrogen gas.
- c) To prevent formation of hardenable microstructures that will result in brittleness.
- d) To eliminate the under bead cracking.

16) What is the purpose of the PWHT?

Purpose of the PWHT is to relieve the residual stress in the welding. PWHT of weldment is heating the weldment gradually to required soak temperature and holding for specific time and cool down to required cooling rate is PWHT.

17) What extra attention is paid for low hydrogen electrodes?

Should be kept in the electrode oven, not to be exposed to open atmosphere.

20) Why the crack appears?

- a) Because of heating while welding.
- b) **Because of cooling after welding.**

21) How welding stress is relieved?

- a) Heating and quenching the weld.
- b) Heating at a designed temperature and controlled cooling.**
- c) Drilling a hole in weld seams.

22) What is the diff. Between DCRS and DCES?

23) Which are the 3 main attribute mentioned on a tensile test report?

- 1) elongation
- 2) ultimate stress
- 3) yield stress
- 4) gross section area.

24) RT is the most suitable NDT method for detecting the edge wall lack of fusion?
TRUE /FALSE.

25) Why are the bevel edges controlled before welding?

To increase the joint efficiency and to eliminate the weld defects

26) Which is the most appropriate method for detecting lamination on bevel edge?

1) RT 2) PT 3) BOTH 4) NONE.

27) Name three methods for the transfer of filler material for GMAW?

1) GLOBULAR 2) SPRAY 3) DROPLET 4) DIP.

28) Describe the position "3G".

3 G is the position groove weld on the plate in vertical direction; the arc is started at the root of the joint at lowest side of the groove and carried upwards.

29) When a welder is qualified for position 5G in which position can he weld?

1G, 2G, & 5G.

30) Name four types of joints?

1) Butt-joint 2) T-joint 3) lap-joint 4) corner joint.

31) For PT fluorescent, MT fluorescent and leak test is used ultraviolet light?

TRUE / FALSE

32) Which are the most three suitable grooves geometric for SAW welding. ?

1) single v-groove weld. 2) single bevel groove 3) double v groove.

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ANSWERS TO PARENTS

QUESTIONS & ANSWERS

PIPE FABRICATION

SECTION L
PAGE 1

ANSWERS
17/6/82

- 1) What is the difference between a consumable insert and a backing ring in regard to pipe fabrication?
 - A consumable insert, after welding, becomes an integral part of the weld, a backing ring does not.
- 2) Why are vent holes put in reinforcement pads?
 - To provide venting during welding and heat treating operations and to reveal leakage in the weld between the branch and main run of the pipe.
- 3) Does ANSI 31.3 permit peening on both the root and cover passes?
 - Peening is not permitted on the root or cover passes.
- 4) What are some ways of visually identifying piping material on the shop floor?
 - Color code, stamping.
- 5) What is one of the serious faults with the use of MIG or MAG welding of pipe joints particularly in out of position welding?
 - Proper weld bevel, root gap, bore alignment, *Root Fusion / Ø*
OVER PENETRATION
- 7) How would you ensure radiograph have been taken on specific pipe welds?
 - Identification which has been entered on films and sometimes drawings.
- 8) On welds requiring 100% radiograph what is the minimum number of shots required on 3" diameter pipe?
 - 3.

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ANSWERS

PIPE FABRICATIONSECTION L
PAGE 2

- 9) How should dimensional checks be made on fabricated spool pieces?
- Jack stands, V-blocks, or other methods of supporting spool pieces in a level position.
- 10) What are some of the precautions which should be taken when welding piping materials of alloy material such as 1 1/4 chrome, 5 chrome, etc.?
- Preheat, interpass temperature and postweld heat treatment requirements are to be complied with.
- 11) What information should be contained in a radiograph of a pipe weld?
- Penetrameter, joint number, welder symbol, ISO number.
- 12) What is meant by double wall radiography technique?
- Source is offset approximately 5 - 15 degrees from perpendicular (depending on diameter) with film located on O.D. at far wall - Used on small bore and larger bore with no access to inside.
- 13) What type of system should the Inspector use for record keeping if assigned full time to shop inspection of fabricated piping?
- Use ISOS - marked ISOS showing location of X-rays, etc. In addition, separate records should be maintained of welders performance showing number of X-rays, repairs, etc.

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LANCLO TEST PAPERS

QUESTIONS ET REPONSES

Answers

PIPE AND FITTINGS

SECTION K
PAGE 1

- 1) Of what does pipe inspection at the mill consist?
 - Hydrostatic tests, non-destructive tests, destructive tests, surface visual inspection, dimensional inspection, marking. *6 steps*
- 2) What is included in a dimensional inspection of a length of pipe?
 - Length, diameter, wall thickness, end weld prep.
- 3) Does a pipe mill hydrostatically test each length of pipe or are hydrostatic tests done on a random basis?
 - Each length is tested.
- 4) Do the ASTM Standards require pipe to be weighed?
 - Yes.
- 5) What is the purpose of a flattening test?
 - The first step of a flattening test is a test for ductility. The second step is a test for soundness.
- 6) How is a flattening test performed on pipe?
 - A sample piece of pipe not less than 2 1/2" (63.5 mm) in length is flattened cold between parallel plates.
- 7) What is looked for during the first step of a flattening test?
 - That no cracks or breaks occur in the sample prior to a specific dimension being reached between the parallel plates. The subject dimension is determined according to a standard formula.
- 8) Of what does the second step of a flattening test consist?
 - The flattening is continued until the sample break or the opposite walls of the tube meet.

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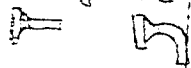
ANSWERS

PIPE AND FITTINGS

SECTION K
PAGE 2

- 9) What imperfections in the sample would cause the second step of the flattening test to be rejected?
 - Evidence of laminated or unsound material or incomplete weld.
- 10) Describe a reverse flattening test on a welded tube - what results would cause the test to be rejected?
 - A section of tubing is split longitudinally 90 degrees on each side of the weld and the sample opened and flattened with the weld at the point of maximum bend. There shall be no evidence of cracks, lack of penetration or overlaps resulting from flash removal in the weld.
- 11) Describe a flaring test and its requirements.
 - A section of tube shall stand being flared with a tool having a 60 degree included angle until the tube at the mouth of the flare has been expanded to a specified percentage without cracking or showing flaws.
- 12) What is a flange test and what results are required?
 - A section of tube shall be capable of having a flange turned over at a right angle to the body of the tube without cracking or showing flaws.
- 13) What information should be stamped on a butt weld fitting?
 - Manufacturer's name or trade mark, schedule number or nominal wall thickness, size and type of material.
- 14) At what depth does an imperfection become injurious to a butt weld fitting?
 - When it is in excess of 12 1/4 percent of the nominal wall thickness or when it encroaches on the minimum wall thickness.
- 15) What non-destructive examination would you expect to have been performed on a 36" diameter welded elbow?
 - Radiography of the weld.

Long neck flange



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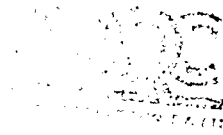
PIPE AND FITTINGS

ANSWER

SECTION K
PAGE 3

- 16) What dimensions should be checked when inspecting a raised face welding neck flange?
- Outside diameters; inside diameter; wall thickness; flange thickness; height of raised face; length through the hub; bolt circle diameter; bolt hole diameter.
- 17) What is the purpose of spot or back facing on flange bolt holes?
- Ensure a proper seating surface for the washer or nut.
- 18) How should a socket weld flange be set up for welding to a pipe?
- So as to maintain approximately a 1/16" gap between the face of the pipe and the inner lip of the flange (ANSI 31.3).
- 19) Can a seal weld be considered as adding a strength to a threaded joint? ✓
- No. (ANSI 31.3).
- 20) If threaded joints are seal welded, what percentage of the threads must be covered by the weld? ✓
- 100% (ANSI 31.3).
- 21) If you were inspecting slip on flanges which were to be used in hydrogen service, what special fabrication technique would you expect to check?
- Drilled hole (approximately 1/8") to vent space between I. D. of flange and O. D. of pipe.

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VALVES

Answers

operable (voir)

SECTION F
PAGE 3 of 3

- 19) Can a solid wedge gate be fabricated by welding? ✓
- Yes.
- 20) Can gate seats be made by depositing weld metal on the gate? ✓
- Yes. *Nonaise*
- 21) Is it permissible to supply gate valves with slots rather than holes in the packing gland? ✓
- No (holes only). *fente plutôt que*

EXAMINATIONS & RESPONSES

Answers

VALVESSECTION F
PAGE 1 OF 3SECTION F
PAGE 1 OF 3

- 1) Which API Specifications apply to the fabrication, inspection and testing of valves? ✓
- API 598, Valve Inspection and test.
 - API 599, Steel Plug Valves.
 - API 600, Steel Gate Valves.
 - API 604, Ductile Iron Gate Valves.
 - MSS SP-55 (Visual Inspection of Casting).
 - API 6D, Pipeline Valves.
- 2) Which API specification governs valve hydrostatic test pressures? ✓
- API 598.
- 3) What pressure tests are required on gate valves? ✓
- Shell or body, low pressure seat test and backseat test (high pressure closure test - only if specified in order).
- 4) For the low pressure seat test what test medium is used? ✓
- Air or inert gas.
- 5) Should the shell test be done after the valve is painted? ✓
- No.
- 6) What position is the gate in, during the shell test? ✓
- Partially closed.
- 7) What position is the gate in, during the backseat test? ✓
- Fully open.
- 8) Is the packing gland to be tight during the backseat test? ✓
- No, the packing gland is to be loose.
- 9) Is leakage permitted on the backseat test? ✓
- No.

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VALVES

Answers

SECTION F
PAGE 2 of 3

- 10) What is the purpose of the backseat test? ✓
- To facilitate replacement of the stem packing without removing the valve from service.
type de serrage
- 11) What test mediums can be used for the shall, backseat and high pressure closure tests? ✓
- Air, inert gas, kerosene or water (any liquids with a viscosity no higher than water can be used).
- 12) At what pressure is the low pressure test done? ✓
- 60 to 100 psig (4.1 to 6.9 bar).
operable (certain)
- 13) Describe the procedure for a low pressure seat test on a solid wedge gate valve. ✓
- Pressure shall be applied successively to each side of the closed valve with the other side open to atmosphere to check for leakage of the downstream side of the seat.
- 14) Is it permissible for a vendor to lubricate valve seats prior to testing? ✓
- Yes, but only with a film of oil not heavier than kerosene.
- 15) What does the term O, S and Y mean? ✓
- Outside, Screw and Yoke.
accès
- 16) What parts of a valve make up the "trim"? ✓
- Stem, body seat surface, gate seat surface, backseat bushing, stem hole guide.
tige, tige, serrage de tige (guide)
flange d'appui
- 17) What flange finish is standard on steel gate valves? ✓
- Serrated.
strie
- 18) Is it permissible to use a sealing compound for the installation of threaded seat rings? ✓
- No (light lubricant only).

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ALAMCO TEST PAPERS

QUESTIONS ET REPONSES

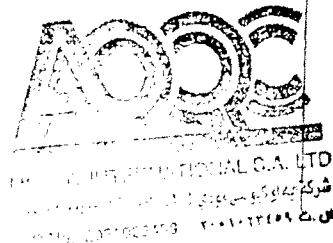
Answers

PIPE AND FITTINGS

SECTION K
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PIPEQK/08.12.87



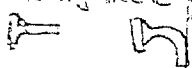
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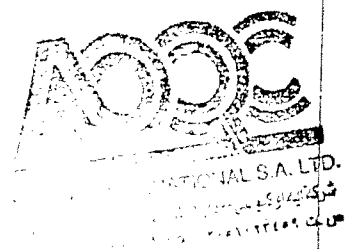
ANSWERS

PIPE AND FITTINGS

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Long neck flange




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ANSWERS TO TEST PAPERS

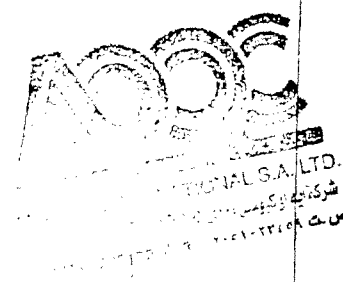
QUESTIONS & ANSWERS

ANSWERS

PIPE FABRICATION

SECTION L
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ARMED NET PAPER

QUESTIONS & RESPONSES

Answers

VALVES

SECTION F
PAGE 1 of 3

- 1) Which API Specifications apply to the fabrication, inspection and testing of valves? ✓
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 - API 600, Steel Gate Valves.
 - API 604, Ductile Iron Gate Valves.
 - MSS SP-55 (Visual Inspection of Casting).
 - API 6D, Pipelins Valves.

- 2) Which API specification governs valve hydrostatic test pressures? ✓
 - API 598.

- 3) What pressure tests are required on gate valves? ✓
 - Shell or body, low pressure seat test and backseat test (high pressure closure test - only if specified in order).

- 4) For the low pressure seat test what test medium is used? ✓
 - Air or inert gas.

- 5) Should the shell test be done after the valve is painted? ✓
 - No.

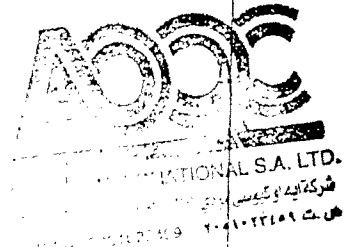
- 6) What position is the gate in, during the shell test? ✓
 - Partially closed.

- 7) What position is the gate in, during the backseat test? ✓
 - Fully open.

- 8) Is the packing gland to be tight during the backseat test? ✓
 - No. the packing gland is to be loose.

- 9) Is leakage permitted on the backseat test? ✓
 - No.

VALVESQF/26. 11. 87



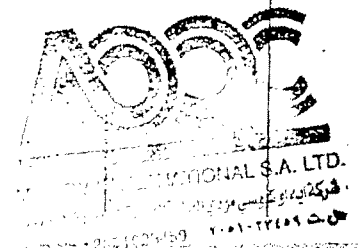
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Answers

VALVES

SECTION F
PAGE 2 of 3

- 10) What is the purpose of the backseat test? ✓
 - To facilitate replacement of the stem packing without removing the valve from service. *Tige de serrage*
- 11) What test mediums can be used for the shell, backseat and high pressure closure tests? ✓
 - Air, inert gas, kerosene or water (any liquids with a viscosity no higher than water can be used).
- 12) At what pressure is the low pressure test done? ✓
 - 60 to 100 psig (4.1 to 6.9 bar).
- 13) Describe the procedure for a low pressure seat test on a solid wedge gate valve. ✓
 - Pressure shall be applied successively to each side of the closed valve with the other side open to atmosphere to check for leakage of the downstream side of the seat. *opérale (coin)*
- 14) Is it permissible for a vendor to lubricate valve seats prior to testing? ✓
 - Yes, but only with a film of oil not heavier than kerosene.
- 15) What does the term O, S and Y mean? ✓
 - Outside, Screw and Yoke. *arcade*
- 16) What parts of a valve make up the "trim"? ✓
 - Stem, body seat surface, gate seat surface, backseat bushing, stem hole guide. *Tige Tige alésage de tige (guide) Bague d'arrêt*
- 17) What flange finish is standard on steel gate valves? ✓
 - Serrated. *strié*
- 18) Is it permissible to use a sealing compound for the installation of threaded seat rings? ✓
 - No (light lubricant only).



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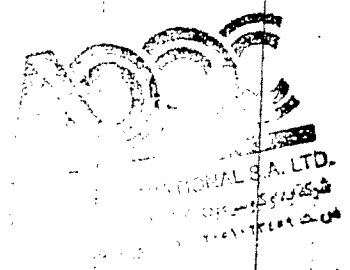
Answers

VALVES

operable (valve)

SECTION F
PAGE 3 of 3

- 19) Can a solid wedge gate be fabricated by welding? ✓
- Yes.
- 20) Can gate seats be made by depositing weld metal on the gate? ✓
- Yes. *Notwise*
- 21) Is it permissible to supply gate valves with slots rather than holes in the packing gland? ✓
- No (holes only). *forte plutôt que*



FINAL EXAM (CLOSED)

Instructions:

Choose only one answer, which you think is most appropriate.

Use the attached answer sheet in answering the following questions.

1. Post weld heat treatment of vessel welds generally results in:
 - a. Reduction in hardness
 - b. Increase of tensile strength
 - c. Increase of both strength and ductility
 - d. None of the above

2. A pressure vessel fabricated in 1960 was in service. It has been decided to remove the top head and extend the height and replace the dish head with a new one. The proposal is:
 - a. The proposal can be accepted for review by authorised inspector
 - b. No modification is allowed on this vessel
 - c. A pressure vessel engineer should be consulted for approval
 - d. None of the above

3. Vessels that are known to have a remaining life of over _____ years or that are protected against external corrosion need not have insulation removed for the periodic external inspection.
 - a. 10
 - b. 15
 - c. 5
 - d. 20

4. After an inspection interval is completed and if calculations indicate that an inaccurate rate of corrosion has been assumed initially, how do you determine the corrosion rate for the next inspection period?
 - a. Check the original calculations to find out what the error is in the original assumption.
 - b. Unless the corrosion rate is changed by Jurisdiction, the initial rates shall be used.
 - c. The corrosion rate shall be adjusted to agree with the actual rate found.
 - d. Call in a corrosion specialist

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5. If a vessel is made up of unknown materials and computations must be made to determine the MAWP what can the inspector or the vessel engineer do to establish the MAWP?
- The lowest grade material and highest joint efficiency in the applicable code may be assumed for calculations.
 - Assume MOC as SA 283 Gr. C and joint efficiency = 0.7
 - The vessel made of the unknown material must be removed from service and vessel of known material must be installed.
 - The vessel of unknown material shall be subjected to hydrostatic tests while having strain gages on it to determine its yield strength and thus allowable stress.
6. RBI assessment can be used to alter the inspection strategy provided:
- The degradation methods are identified and evaluated
 - The RBI is fully documented.
 - A third party conducts the RBI
 - Both A and B above
7. What climatic area may require a very active program for corrosion under insulation?
- Cooler dry locations.
 - Very cold locations with year round temperature less than 25°F
 - Warmer, wet locations
 - Warmer dry locations
8. Soil-to-air (S/A) interfaces for partially buried vessels are a location where localized corrosion may take place. If the buried part is excavated for inspection, how deep should the excavation be to determine if there is hidden damage?
- 12 to 18 inches
 - 6 to 12 inches
 - 12 to 24 inches
 - 6 to 18 inches
9. 2 Common way to minimize temper embrittlement is to limit
- 'J' factor for weld metal.
 - 'X' factor for base metal.
 - 'J' factor for base & 'X' factor for weld metal.

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- d. 'X' factor for base & 'J' factor for weld metal
10. The minimum hydro test temperature for in-service vessel of 2" thickness is:
- MDMT+10°F
 - MDMT+30°F
 - MDMT+ 0°C
 - MDMT+ 0°C
11. "Clam shell" type crack failure having concentric rings called "beach marks" showing "waves" of crack propagation is typically the description of
- Fatigue cracks.
 - Creep cracks.
 - Stress corrosion cracks.
 - Hydrogen induced cracks.
12. Minimum Design thickness for a vessel shell is 10 mm. Following four plates were received with actual thickness equal to: 10.2 mm, 9.7mm, 10.3mm, and 9.6 mm. As per ASME Sec. VIII Div.1, how many plates will you release for vessel fabrication?
- 1
 - 2
 - 3
 - All 4
13. What type of repairs and procedures may the inspector give prior general authorisation to continue (provided the inspector is satisfied with the competency of the repair organization)?
- Major repairs and minor procedures
 - Limited or routine repairs
 - Major alterations and re-ratings
 - Minor re-ratings and alterations
14. A vessel in service has different zones of corrosion. The next inspection frequency will be decided by:
- Zone with highest rate of corrosion
 - Zone with lowest remaining life
 - Average rate of corrosion shall be taken into consideration
 - Average remaining life of the vessel shall be considered

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15. Resistance to sulphidation is generally achieved by
- Upgrading to higher nickel alloys
 - Upgrading to higher chromium alloys
 - Upgrading to higher copper based alloys
 - All of the above.
16. Characteristic SCC in Austenitic S.S. generally will be
- Transgranular, branching and aggravated by increasing temperature
 - Intergranular and unidirectional (straight) and aggravated at low temperature
 - Independent of chloride content
 - None of the above
17. In planning for an internal inspection of a vertical vessel that has acidic corrodents, what type of corrosion would you expect to find on the vessel shell from inside?
- Hydrogen blistering near liquid level
 - Hydrogen blistering on top dished head
 - Hydrogen blistering near the bottom of vessel
 - None of above
18. H₂S in sour crude is more harmful in presence of:
- Oxygen
 - Water (*i.e.*, Wet H₂S)
 - Sulphur
 - a and c above
19. The leak tightness of the relief valves is tested on the test block at a pressure equal to:
- Same as set pressure
 - 90% of the set pressure
 - Same as reseal pressure
 - None of the above
20. The principal reason for inspecting a pressure relief device is to determine:

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- a. Condition of pressure relief device and if it is functioning properly
 - b. The remaining life of pressure relief device.
 - c. The spring coil diameter.
 - d. The body thickness.
21. Which of the following tests must be conducted on a valve as soon as it has been received in the shop for inspection?
- a. Visual inspection
 - b. Hydrotesting of valve body
 - c. Radiographic testing
 - d. Check set-pressure
22. API 576 does not address:
- a. Valve testing on test benches in shop
 - b. Application of rupture discs
 - c. Training requirements for mechanics involved in inspection and repair of pressure relieving devices
 - d. All of the above
23. For vessels which are supported on concrete saddles and working in an area where the humidity is high which areas on them are typically susceptible to external corrosion?
- a. At the anchor bolts in the foundation
 - b. At the Points of contact of the metal surface with the concrete
 - c. All of the above
 - d. None of the above
24. Inspection records contain the following information for a TML on a dished head. (Thk. in inches) On the basis of this information, the long-term corrosion rate for the location is:

<i>Thickness</i>	<i>Year</i>
0.500	0
0.425	5
0.400	10

- a. 1 ½ mils per year
- b. 5 mils per year

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- c. 10 mils per year
 - d. 100 mils per year
25. A certain C. S. vessel which required impact testing was required to have PWHT initially according to code requirement. After 10 years when repaired by welding PWHT is to be carried out. Performing PWHT is found to be impracticable. Which of the following is relevant (as per API-510)?
- a. PWHT may be exempted, if proper NDE is carried out.
 - b. Carry out temper-bead welding as alternative to PWHT.
 - c. Carry out both hydro-testing and pneumatic testing in lieu of the PWHT.
 - d. Carry out preheating to minimum 200°F
26. A cylindrical shell with thickness = 4.0", ID=96", S=17100 and E=0.85 and C. A. = 1/8" showed metal loss of 1/4" within the areas lying 8" on either side of the longitudinal welds. Your analysis of situation is:
- a. Recalculate shell thickness t'_{minimum} considering E=1.0
 - b. The thinned area is on or within weld area hence (a) above can not be adopted
 - c. Prepare repair procedure and restore the metal loss as per API -510
 - d. b and c above
27. Materials used for making repair by welding in carbon steel vessels shall have the following limitations?
- a. They shall meet the requirements stipulated in NACE Standard.
 - b. The carbon content shall not be over 0.35%
 - c. Welding repair shall be done by using only the GTAW process
 - d. All of the above
28. For non-continuous corrosive service with remaining life 25 years, external inspection shall be performed not later than:
- a. 10 years
 - b. 12.5 years
 - c. 5 years
 - d. None of above

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29. An ellipsoidal head has an internal diameter of 76 inches and depth of 21 inches (including a straight face dimension of 2 inches). What should its spherical (crown) radius be?
- 76.9 inches
 - 15.6 inches
 - 68.4 inches
 - All of the above
30. For carrying out temper – bead welding technique in lieu of PWHT, apart from other requirements, which of the following is acceptable?
- The root and final pass of weld shall be radiographed.
 - Weld metal shall be deposited for second pass while the first pass below the second pass is still not cooled down and its cooling rate is retarded due to the heat of second pass.
 - After depositing each layers of the weld, the weld shall be PT checked.
 - Both b and c
31. Calculate the remaining life and external insp. interval of a vessel given the following data:
- | | |
|--|--------------|
| Actual thickness | = 0.955 inch |
| Minimum thickness required | = 0.759 inch |
| Thickness at previous inspection 5 years prior to present inspection | = 1.025 inch |
- 20 years, 10 years
 - 14 years, 5years
 - 28 years, 10 years
 - None of the above
32. As per API 510, the organization who carry out PRV repair, testing has to be:
- Needs to be a certified company to perform all repair work in accordance to ASME.
 - Needs to have have documented quality control procedure
 - Needs to have qualified personnel to carry out the job within scope of repair
 - Only b and c above

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33. A vessel which was inspected six years ago and had shell thickness = 0.870". As on today the thickness as reported by filed inspection is 0.786. What was the corrosion rate over last six years?
- a. 10 mpy
 - b. 12 mpy
 - c. 14 mpy
 - d. none of above
34. If the vessel in above question has minimum permissible thickness = 0.618" for the present design conditions. What will be estimated remaining life of the vessel if corrosion rate remains same?
- a. 10 years
 - b. 12 years
 - c. 14 years
 - d. None of above
35. For a vessel, remaining life is estimated as 22 years from now, next planned internal and external inspection shall not be later than:
- a. 11 Years, 5 Years
 - b. 10 Years, 5 Years
 - c. 5 Years, 5 Years
 - d. None of the above
36. What is the maximum defect permitted on the convex surface of a welder qualification bend test after bending?
- a. ¼ inch
 - b. 1/8 inch
 - c. 1/16 inch
 - d. 3/16 inch
37. Certification of contaminants shall be obtained for all PT materials used on:
- a. Carbon steels
 - b. Ferritic stainless steels
 - c. Austenitic stainless steels
 - d. None of the above

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38. The scope of the ASME Boiler and Pressure Vessel, Code, Section V includes:
- NDE acceptance criteria
 - How to perform NDE to achieve a desired result
 - Where to do NDE (i.e. what welds to examine)
 - All of above.
39. For Ammeter calibration for magnetizing equipment, the allowable tolerance is:
- $\pm 5\%$
 - $\pm 10\%$
 - $\pm 15\%$
 - $\pm 20\%$
40. Which of the following are commonly preferred to know the process side degradation of pressure vessels?
- On -stream inspection.
 - Internal inspection
 - External inspection as alternative to internal inspection
 - Any of above is OK
41. For MT examination by Prod technique the magnetizing current required depends on:
- Prod Spacing
 - Thickness of item under Inspection
 - a & b above
 - None of above
42. While deciding the governing thickness for crown portion for corroded 2:1 ellipsoidal head, API 510 stipulates that & crown thickness shall be calculated:
- According to relevant ellipsoidal dished head formula
 - According to code formula for spherical heads with head radius equal to 0.9 D, where D is shell dia meter.
 - Thickness of crown shall be same as knuckle thickness.
 - None of the above
43. For a vertical column, Int. dia. = 48" and height (T-T) = 80ft, The vessel MAWP is 60 psi. Minimum vessel part MAWP for bottom dished head (2:1 Ellip type) shall be:

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- a. 94.6 psi
 - b. 82.8 psi
 - c. 95.5 psi
 - d. None of above
44. How is hammer testing utilized?
- a. As a preliminary survey for thinned areas
 - b. As a independent test method for which ASNT Certification in NDT is available
 - c. As a important tool in the hands of the Authorized inspection only
 - d. To carry out Carpy impact test
45. Which of the following represent grouping of weld-metals in ASME IX?
- a. P – Nos.
 - b. F – Nos.
 - c. S – Nos.
 - d. A – Nos.
46. Which is/are advantage of magnetic particle testing over penetrant testing?
- a. It can detect surface discontinuities with foreign material imbedded in them.
 - b. It is faster on individual parts.
 - c. It can detect near-surface discontinuities.
 - d. All of the above
47. Double wall Double image technique is used for the radiography of:
- a. Plate welds
 - b. Tubular products with outer diameter less than 3.5 inch
 - c. Large pipes with outer diameter 200 mm and above
 - d. Heavy castings
48. As per ASME Sec. VIII Div. 1, if permanent deformation is observed due to over pressure during hydrotesting:
- a. The inspector should ask for re-test using proper test pressure and new pressure gauges.

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- b. Follow-up the hydro-testing by a pneumatic test at proper pressure, taking suitable precautions as given in code
 - c. The inspector may ask for providing additional stiffening rings around vessel and carry out re-hydro test at proper test pressure.
 - d. The inspector may reject the vessel.
49. The size of a properly deposited equal fillet weld is shown as 10 mm. The throat dimension for this weld will be approximately:
- a. 10 mm
 - b. 8 mm
 - c. 7 mm
 - d. 9 mm
50. If any setting is noticed on a vessel, which of the following should be done:
- a. Conduct RT after 48 hours of observing the defective condition
 - b. Nozzles and adjacent shell areas should be inspected for distortion and cracking
 - c. Use acoustic emission monitoring
 - d. All of the above
51. Identify the correct statement (s)
- a. SSC is aggravated due to wet H₂S
 - b. Hydrogen blistering may occur on I.D, O.D, or any where within wall thickness of the pressure vessel.
 - c. High hardness & High strength steels are more likely to undergo damage due to SCC compared to low strength/ low hardness steels
 - d. All of the above are correct statements
52. Cracks and laminations look similar from surface however, generally:
- a. Cracks run normal to vessels surfaces
 - b. Lamination runs slant or parallel to surface
 - c. a and b above
 - d. None of above
53. High temperature hydrogen attack is typically due to
- a. Methane gas formation
 - b. Wet H₂S formation

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- c. Temper embrittlement
 - d. Presence of molybdenum in alloy steels.
54. The nonmetallic coating disbonding in a vessel can be better detected by:
- a. Eddy current testing
 - b. Holiday detection
 - c. Ultrasonic testing
 - d. Acoustic emission testing
55. External inspection of a pressure vessel starts with:
- a. Ladder, stairs, walkway and platforms of the vessel
 - b. Insulation, skirt and foundation
 - c. The external surfaces, of vessel
 - d. Dimensional check of the vessel
56. Before carrying out an inter service inspection on a vessel put in-service for quite some time what the inspector should do first?
- a. Check the material in which it is constructed.
 - b. Check the permanent file of the vessel.
 - c. Check the progressive history file of the vessel.
 - d. Check the original thickness report.

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Q.	ANS.	REFERENCE	Q.	ANS.	REFERENCE
1	A	General Knowledge	29	C	API 510, 5.7 (e)
2	C	API 510, 7.1.1	30	B	API 510, 3.19
3	A	API 510, 6.3	31	B	API 510, 6.3, 6.4
4	C	API 510, 6.4	32	D	API-510 6.6
5	B	API 510, 6.7	33	C	API 510, 6.4
6	D	API 510, 6.2	34	B	API 510, 6.4
7	C	API 572, 8.2.1	35	B	API 510, 6.3, 6.4
8	B	API 572, 8.2.9	36	B	ASME IX, QW - 163
9	D	API 571, 4.2.3	37	C	ASME V, Art. 6, App. II
10	A	API 510, 6.5	38	B	ASME V, Art. 1, Scope
11	A	API 571 4.2.16.5(a)	39	B	ASME V, Art. 7, T-761
12	C	ASME VIII, UG - 16 (c)	40	B	API 510, 6.1
13	B	API 510, 7.11	41	C	ASME V, Art. 7, T-752.2
14	B	API 510, 6.4	42	B	API 510, 5.7 (e)
15	B	API 571 4.4.2.6.a	43	C	BOK, 80 + 82 x 0.433
16	A	API 571 4.5.1.3(b) and 4.5.1.5.c,d	44	A	API 572, 10.8.1
17	A	API 572, Page 29	45	D	ASME IX, Table QW - 442
18	B	API 572, Page 28	46	D	ASME V, Art. 7, Scope & Gen. Knowledge
19	B	API 576, 6.2.15	47	B	ASME V, Art. 2, T-271 (b)
20	A	API 576, 6.1	48	D	ASME VIII, UG - 99
21	D	API 576, 6.28	49	C	BOK, 10 x 0.7 = 7 mm
22	C	API 576, Scope	50	B	API 572, 10.38
23	B	API 572, 10.3.5	51	D	API 571, 5.12.3.1 a, d and 5.1.2.3.4(d)
24	C	API 510, 6.4	52	C	API 572, Page 31
25	B	API 510, 7.2.3.2	53	A	API 571, 5.1.3.1.1 (a)
26	D	API 570, 5.7 (d)	54	B	API 572, 10.4.6
27	B	API 510, 7.2.8	55	A	API 572, 10.3.2
28	C	API 510, 6.3	56	C	API 572, 10.4.3

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Instructions:

Choose only one answer, which you think is most appropriate.

Use the attached answer sheet in answering the following questions.

1. For UT examination using Pulse- Echo Technique, thickness calibration was performed at 80°F. An on-stream UT reading at a TML on a pressure vessel (operating at 680°F) was indicated as 50 mm. Its actual thickness will be approximately:
 - a. 44 mm
 - b. 47 mm
 - c. 48.5 mm
 - d. 50 mm

2. What will be the size of nozzle to shell weld for nozzle weld configuration? Conforming to Fig.-'j' of UW-16. (Nom. Shell thickness = 28 mm., Nom. Nozzle thickness = 16mm., weld size $t_2= 12\text{mm}$)
 - a. 8 mm
 - b. 10 mm
 - c. 12mm
 - d. 14 mm

3. During the recent planned internal inspection showed two pits of following description. (Min. vessel thickness required = 5/8" including C.A = 1/8"). Pits are separated by 12 inch distance (edge to edge).
 - Pit A: Available thickness at bottom of pit = 0.4 inch.
Pit dia. = 1.5"
 - Pit B: Available thickness at bottom of pit = 0.34 inch.
Pit dia. = 0.75"

Your assessment is:

- a. Pitting is not harmful hence acceptable
 - b. Pit A may be ignored but not Pit B
 - c. Pit B may be ignored but not Pit A
 - d. Both pits can not be ignored
4. Following combination of Base metal and welding electrode was qualified by a certain PQR. Impact testing is not required.

Base Metal = SA 285 Gr C Plates, 3/4" thk
Welding electrode = AWS E 7015,

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This PQR will qualify which of the following combinations of Base Metal – Welding electrodes.

- a. 1" thk SA 515gr 60 plates, E 6013 electrodes
 - b. 1¾ " thk SA 285 grc plates, E 6013 electrodes
 - c. 1¼ thk plates plates SA516gr70, E 7018 electrodes
 - d. None of above
5. The recommended minimum development time in minutes allowed for a material made of high temperature alloy is:
- a. 5 min
 - b. 15 min
 - c. 10 min
 - d. 6 min
6. A weld procedure is qualified in 1G position. This procedure can be used for welding in positions:
- a. 1G
 - b. 2G
 - c. 4G
 - d. All of the positions
7. A 1" thickness C.S. weld with 1/8" thk acceptable reinforcement was to be radiographed. The applicable hole type penetrameter on (source side) and essential hole shall be:
- a. ASME 30 - 2T
 - b. ASME 25 - 2T
 - c. ASME 20 - 2T
 - d. ASME 30 - 4T
8. A radiograph for a long seam in new pressure vessel (UW 51) of 25mm thick plate shows 3mm crack, and 6 mm long isolated slag. Your decision for acceptance of the radiograph will be:
- a. Repair crack, repair slag
 - b. Repair slag, accept crack
 - c. Repair crack, accept slag
 - d. Accept crack, accept slag
9. For a vessel which is planned for internal inspection after 8 years what should be the minimum remaining corrosion allowance in the vessel if corrosion rate is 150 microns per year.

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- a. 2.0 mm
 - b. 2.4 mm
 - c. 1.2 mm
 - d. None of above
10. For vessel 2.5 inch thick, MDMT specified was 60°F and material of construction used was SA 515 gr 60, without impact testing. The vessel failed later due to brittle failure. Maintenance Department says SA 516 GR 60 should have been used. What is your assessment?
- a. SA 515 GR 60 failed but 516 gr 60 would not have failed
 - b. 516gr 60 would not have made any difference
 - c. Impact strength was not apparent reason for failure
 - d. b and c above
11. A pressure vessel constructed according to ASME Sec. VIII, Div. 1 with shell thickness 7/8" (Material of Construction P No. 4, group no. 1) is to be repaired by using insert plates. The requirement of radiography to be incorporated in repair procedure shall be:
- a. Full radiography
 - b. Spot radiography
 - c. May be a, or b depending on joint efficiency
 - d. Data is not adequate
12. After completion of alterations a pressure test is:
- a. Normally required
 - b. Subject to approval of the jurisdiction , appropriate NDE shall be required where pressure test is not performed
 - c. Substituting NDE for a pressure test after an alteration ay be done only after consulting a pressure vessel engineer experienced in pressure vessel design
 - d. All of the above
13. A procedure qualification test was carried out for a groove weld on a plate with weld metal thickness of 16 mm thickness by SMAW process. The test was found satisfactory. This procedure can be used with SMAW for weld thickness of:
- a. 5 to 32 mm
 - b. 0 to 16 mm
 - c. Any thickness

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- d. 0 to 32 mm
14. In liquid penetrant testing, a procedure is qualified to a temperature of 15 degree C. Pick up a correct statement.
- a. The same procedure is qualified from 10⁰C to 52⁰C
 - b. The same procedure is restricted to maximum of 15⁰C only
 - c. The same procedure shall be applied to 5 ⁰C to 10⁰C
 - d. The same procedure shall be applied to temperature more than 15⁰C
15. An in-service vessel with seamless 2:1 Ellipsoidal head 60 inch ID, 400 psi design pressure, (corrosion allowance = 0) and (S = 20000 psig) was inspected. Available thickness of only 5/8" was observed on the crown portion. The knuckle thickness was found to be adequate. Your assessment is:
- a. Head thickness in crown portion is still ok for operation.
 - b. Thickness is inadequate.
 - c. Depends on the opinion of third party inspector
 - d. Depends on the opinion of API 510 inspector
16. Choose correct hydrostatic test pressure from given options for a vessel with following data:
- | | | |
|-----------------------------------|---|--------------------|
| Design pressure | = | 200 psi |
| Design temperature | = | 675 ^o F |
| M.O.C | = | SA 537 Cl.1 |
| Allow stress (Ambient) | = | 18,000 psi |
| Allow stress (675 ^o F) | = | 15,000 psi |
- a. 350 psig
 - b. 260 psig
 - c. 312 psig
 - d. None of above
17. The temperature measured at a weld layer for a magnetic material is around 45⁰C, but weld is in vertical position. It is decided to carryout a surface NDT method. Choose a suitable NDT method.
- a. Penetrant testing wet developer
 - b. Magnetic particle testing with dry particles-prod type
 - c. Magnetic particle testing with dry particles-yoke type
 - d. None of above

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18. A weld procedure is qualified on pipe OD = 2", in 1G position. This procedure can be used for welding:
- a. 6" OD pipe in 1G only
 - b. 2" OD pipe in 1G only
 - c. Any diameter pipe in any position
 - d. Pipes smaller than 2" OD in 1G only

19. During the External inspection, observed resistance of electrical grounding connections for Pressure vessels was 42 ohms. Your advice is:
- a. Accept
 - b. Resistance must be reduced to 25 Ohms Maximum
 - c. Resistance must be increased to 25 Ohms minimum
 - d. Depends on opinion of electrical engineer.

20. For a certain nozzle to shell joint (No corrosion allowance is required.) following data is presented.

Shell thickness provided	=	0.42 inch.
Nozzle I.D.	=	3.2 in.
Pad size	=	6.4 in. O. D.
Thickness of pad	=	0.42.

Your assessment is:

- a. Nozzle is adequately reinforced.
 - b. Reinforcement is inadequate.
 - c. Data is inadequate: nozzle thickness must be given.
 - d. Data is inadequate: design shell thickness must be given.
21. For procedure qualifications with the GTAW process _____ is Non-essential variable.
- a. Change of P No.
 - b. Change of A No.
 - c. Change of F No.
 - d. Groove design
22. The crown portion for torispherical head (ID=40 inches) may be considered as the portion lying entirely within a circle whose centre will be same as head centre and diameter will be:
- a. 36"

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- b. 40"
 - c. 32"
 - d. 200"
23. For 2:1 Ellip. Head (ID=75 inches), the crown portion would lie within similar circle of diameter:
- a. 60"
 - b. 30"
 - c. 54"
 - d. 48"
24. In liquid penetrant examination the maximum permitted rounded indication size for circumferential welds with plate thickness up to 1 inch will be:
- a. 1/8"
 - b. 1/16
 - c. 3/16"
 - d. 1/4"
25. For a vertical process column with column ID. = 48" and height (tan-tan) =98 ft., the hydrostatic head for bottom dished head (2:1 Ellip. type) will be:
- a. 40.6 psi
 - b. 42.4 psi
 - c. 43.3 psi
 - d. None of above
26. Leak tightness of the relief valves is tested by conducting:
- a. Water Bubble test with water head = 0.5" at the set pressure
 - b. Water Bubble test with water head = 1.0" at set pressure
 - c. Water Bubble test with water head = 0.5" at 90% of the set pressure
 - d. None of above
27. Estimated rate of Sulphidation corrosion for a crude handling equipment due to sulphur content of 0.5% (by weight) at 600°F is 10 mpy. What will be the corrosion rate if sulphur content is 1.0% by weight?
- a. 10 mpy approximately

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- b. 12 mpy approximately
 - c. 15 mpy approximately
 - d. 20 mpy approximately
28. Suggest suitable construction materials for caustic service having 40% NaOH concentration (by weight) operating at 240°F
- a. Carbon steel with PWHT
 - b. Carbon Steel, but PWHT is not required
 - c. Carbon steels with quenched and tempering treatment
 - d. Consider Use of Nickel alloys.
29. To avoid HTHA, suggest suitable materials of construction for hydrogen service with partial pressure of hydrogen = 1500psi, and temperature = 800°F
- a. Carbon steel
 - b. 1.25 Cr – 0.5 Mo
 - c. 2.25 Cr – 1 Mo
 - d. 1 Cr – 0.5 Mo
30. In typical refinery service, PWHT of 2.25 Cr – 1 Mo steel is generally required if hardness values in base metal and HAZ is
- a. Higher than 241 Brinell
 - b. Lower than 241 Brinell
 - c. Higher than 225 Brinell
 - d. Lower than 225 Brinell

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Q. NO.	ANSWER	REFERENCE
1	A	ASME V, SE 797, 8.5
2	C	ASME VIII, UW - 16 (j) Notes
3	A	API 510, 5.7 (b)
4	C	ASME IX, Tables QW - 451, QW - 422 & QW - 423
5	C	ASME V, Table T-672
6	D	ASME IX, QW - 203
7	A	ASME V, Table T - 276
8	C	ASME VIII, UW - 51
9	B	API 510, 6.4
10	A	ASME VIII, Fig. UCS - 66
11	A	API 510 and ASME VIII, Table UCS - 57
12	D	API 510, 7.2.10
13	D	ASME IX, Table QW - 451.1
14	A	ASME V, T-652
15	A	API 510, 57 (e) and ASME VIII, UG-32 (f)
16	C	ASME VIII, UG - 99
17	A	General Knowledge
18	C	ASME IX, QW - 452.3
19	B	API 572, 10.3.9
20	A	Pad OD = 2d and pad thickness - shell thk is always ok
21	D	ASME IX, Table QW - 256 and QW 402.1
22	C	API 510, 5.7 (e)
23	A	API 510, 5.7 (e)
24	C	ASME VIII, Appendix 8, 8.4
25	C	$h = 100 \text{ ft.}; \text{ head} = 100 \times 0.433 = 43.3 \text{ psi (BOK)}$
26	C	API 576, 6.2.15 & Fig. 40
27	B	API 571 Fig. 4 - 66
28	D	API 571 Fig. 4 - 85
29	C	API 571 Fig. 5 - 35
30	A	API 577 Table 11