

- Ajmand*
1. When 'hydrogen control' is specified for a manual metal arc welding project the electrode would normally be:
 - a. Cellulosic
 - b. Iron oxide
 - c. Acid
 - d. Basic
 2. You would certainly recognise a hydrogen controlled flux covered electrode from its:
 - a. Colour
 - b. Length
 - c. Trade name
 - d. BS639/AWS code letter
 3. When manual metal arc welding is being carried out on an open construction site, which group of welders are most likely to require continuous monitoring?
 - a. Concrete shuttering welding teams
 - b. Pipe welding teams
 - c. Plater welders
 - d. Plant maintenance welders
 4. You notice manual metal arc electrodes, stripped of flux, are being used as filler wire for TIG welding. You would object because:
 - a. It is too expensive
 - b. The wire would be too thick
 - c. The metal composition may be wrong
 - d. The wire is too short
 5. When open site working, serious porosity in metal arc welds is brought to your attention. What would you investigate?
 - a. Electrode type
 - b. Power plant type
 - c. Electrode storage
 - d. Day temperature
 6. The steel composition in a structural contract is changed from 0.15% carbon 0.6% manganese, to 0.2% carbon 1.2% manganese. This might influence the incidence of:
 - a. Porosity
 - b. Cracking in the weld area
 - c. Undercut for fillet welds
 - d. Lack of fusion defects
 7. One of the following alloys is non-magnetic - which?
 - a. 4.0% chromium molybdenum
 - b. 12.0% chromium
 - c. Austenitic stainless steel
 - d. 9.0% nickel steel
 8. When TIG welding austenitic stainless steel pipe, argon gas backing is called for. This is to:
 - a. Prevent oxidation
 - b. Prevent underbead cracking
 - c. Prevent porosity
 - d. Control the penetration bead shape

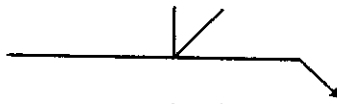
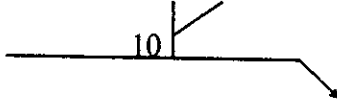
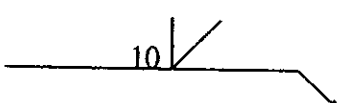
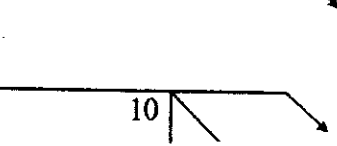
9. **Pre-heating a carbon steel manual metal arc welding is carried out to minimise the risk of:**
- Scattered porosity
 - Worm hole porosity
 - Parent metal cracking
 - Lack of penetration
10. **In UK practice, BS499 specifies that the drawing dimension quoted for a fillet weld is the:**
- Leg length
 - Throat thickness
 - Weld width
 - Actual throat thickness
11. **For open site manual metal welding the following equipment is available. Which would you choose for safe site working?**
- Single operator transformer
 - Multi operator transformers
 - AC/DC composite power unit
 - Diesel engine driven motor generator
12. **If submerged arc welding is used to make butt welds, which would you be most critical of?**
- The root gap tolerance
 - The angle of preparation
 - The root face width
 - The gas cut finish
13. **During CO₂ welding, the arc length is most likely to be affected by:**
- The wire diameter
 - The current return connections
 - The gas flow rate
 - The torch to work angle
14. **Preheating for arc welding applies to:**
- Assembly welding only
 - Assembly and tack welding
 - Joints over 25 mm thick only
 - Cruciform welds only
15. **Which one of the following statements is correct?**
- Preheating increases hardness
 - Preheating increases cooling
 - Preheating increases dilution
 - Preheating increases shrinkage stress
16. **You see a welder using an oxy-acetylene flame with a long feathered inner cone. What would be the effect of this on a carbon steel?**
- The weld would be hard and brittle
 - The weld could be too soft
 - There will be no effect on the weld
 - The weld will have undercut
17. **A welder qualification test is to verify:**
- The skill of the welder
 - The quality of the materials
 - The non-destructive test procedures
 - The manufacturing methods

18. **A fabricating procedure calls for fillet welds to be 'blended in' by grinding. This influences:**
- HAZ. cracking
 - Fatigue life
 - Residual stress
 - Yield strength
19. **Bend test specimens have been taken from a 25 mm thick carbon steel butt weld. Which would show lack of inter-run fusion?**
- Side bend
 - Root bend
 - Face bend
 - Guided bend
20. **Lamellar tearing has occurred in a steel fabrication. BEFORE welding could it have been found by:**
- X-ray examination
 - Dye penetrant
 - Ultrasonic examination
 - It would not have been found by any inspection method
21. **You are to oversee the arc welding of some machine fittings and find that they are cadmium plated. Would you:**
- Permit it to proceed
 - Permit it to proceed with fume extraction
 - Stop the operation at once
 - Advise the welder to drink milk and proceed
22. **One of the reasons for excluding hydrogen from the weld metal is to prevent the weld from:**
- Cracking
 - Cooling slowly
 - Cooling quickly
 - Expanding
23. **When a metal regains its original shape when a stress acting upon it is removed, the metal is said to have:**
- Ductility
 - Plasticity
 - Malleability
 - Elasticity
24. **Proof stress is used when non-ferrous metals are undergoing tensile tests to determine the equivalent:**
- Tenacity
 - Elasticity
 - Yield strength
 - Tensile strength

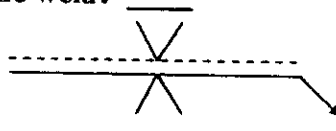
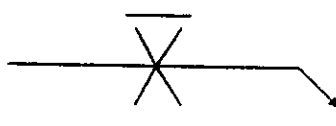
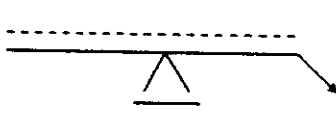
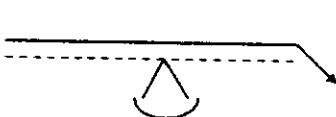
25. **To test a component for vibrational loading, a suitable mechanical test would be:**
- Impact
 - Tensile
 - Compressive
 - Fatigue
26. **The main reason for pre-heating medium and high carbon steels before cutting by oxy-fuel gas technique is to:**
- Improve the quality of the cut
 - Increase the cutting speed
 - Refine the grain structure
 - Prevent hardening and cracking
27. **One purpose of a microscopic examination of a weld is to establish the:**
- Strength of the weld
 - Number of alloying elements
 - Grain size
 - Number of runs used
28. **The predominant structure of an hyper-eutectoid steel that has been quenched at above its upper critical point will be:**
- Austenite
 - Martensite
 - Troostite
 - Sorbite
29. **When weld metal refinement takes place in a multi-run deposit, it is known by the term:**
- Weld annealing
 - Weld refining
 - Weld normalising
 - Weld recrystallisation
30. **One advantage of metal gas arc shielded welding is:**
- Can be used in draughty locations without protection
 - Produces a deposit low in hydrogen content
 - Any welding position can be welded with spray transfer
 - Fine spatter at nozzle restricting gas flow

MULTICHOICE PAPER TWO

1. **BS499 communicates by the use of symbols the type of joint preparation to be used. Which of the following symbols indicates the depth of weld penetration required on the joint?**

- a. 
- b. 
- c. 
- d. 

2. **Which of the following symbols would indicate that a weld has to be finished on the 'other' side of the weld?**

- a. 
- b. 
- c. 
- d. 

3. **The use of flux with gas shielded metal arc welding allows:**

- a. Sheet metal to be welded
- b. A stable arc when using high current densities
- c. Aluminium to be welded
- d. Less dilution of the weld by the parent metal

4. **In MMA welding what parameter is used for control of penetration into the base material?**

- a. Voltage
- b. Welding speed
- c. Iron powders in the coating
- d. Current

5. In the welding of a butt joint from one side, the profile of the root bead is controlled by:
- Root face
 - Bevel angle
 - Root gap
 - All of the above
6. What type of power characteristic is required for manual welding?
- Constant voltage
 - Flat characteristic
 - Drooping characteristic
 - DC generator
7. Which of the following tests would indicate the toughness of weld metal/parent metal - HAZ?
- Macro
 - Nick break
 - Hardness
 - Charpy vee notch
8. Degreasing components is essential for quality welding but some agents may:
- Cause corrosion problems
 - Give off phosgene gas
 - Leave residues
 - All the above
9. Which of the following elements has the greater effect on the hardenability of a steel plate?
- Molybdenum
 - Chromium
 - Titanium
 - Carbon
10. In MAG/CO₂ welding which parameter gives the greatest control of weld appearance during dip transfer or short-circuiting welding?
- Wire stick-out length
 - Amperage
 - Wire feed speed
 - Inductance
11. In MMA welding, the slags produced can be varied to suit the welding position. Which type of slag would be required for welding in the HV position?
- Fluid
 - Viscous
 - Semi fluid
 - None of the above
12. The weld metal deposit of MMA electrodes achieves its mechanical strength through:
- The core wire
 - The flux coating
 - Iron powders with the flux coating
 - None of the above

13. **What constituent is needed in the coating of an electrode to prevent the formation of porosity in the welding of a rimming steel?**
- Iron powders
 - Calcium fluoride
 - Silicon
 - Calcium carbonate
14. **Welds made with high heat inputs show a reduction in which of the following properties?**
- Ductility
 - Toughness
 - Fatigue strength
 - Mechanical strength
15. **In the welding of austenitic pipework the bore is usually purged with argon to:**
- Prevent formation of porosity in the weld
 - Prevent burn-through in the root run
 - Prevent oxidation of the root bead
 - Eliminate the formation of hydrogen
16. **In X-ray work the quality of the radiographic image is assessed by the:**
- Density of the film
 - IQI indicator
 - KVA available
 - Stand-off distance
17. **A steel described as QT will have improved tensile properties because it has:**
- Had control of chemical composition
 - Been heat-treated
 - Been quality tested
 - Been vacuum melted
18. **Which one of the following types of steel would give rise to the formation of porosity when autogenously welded with an arc process?**
- Fully killed steel
 - Semi killed steel
 - Rimming steel
 - Fine grained steel
19. **In submerged arc welding the use of excessively high voltage would result in:**
- Insufficient flux melting
 - Excessive flux melting
 - Slag removal difficulties
 - Spatter
20. **Cellulosic electrodes are often used when welding the root pass of pipes in the field because:**
- Hydrogen control is needed
 - There are iron powders in the electrode
 - Higher arc voltage can be obtained
 - Shorter arc length can be obtained

21. **In the welding of austenitic stainless steels, the electrode and plate material can be purchased with low carbon contents. The reason for this is to prevent:**
- Cracking in the heat affected zone
 - The formation of chromium carbides
 - Cracking in the weld metal
 - Distortion
22. **Submerged arc fluxes can be supplied in two forms. These are:**
- Sintered and agitated
 - Agitated and fused
 - Sintered and agglomerated
 - Fused and agglomerated
23. **In a steel that has improved creep properties at elevated temperatures, which one of the following elements helps in this improvement?**
- Tungsten
 - Manganese
 - Molybdenum
 - Carbon
24. **Welding a steel plate with a CE of 0.45 would require preheating to:**
- Prevent the formation of sulphides
 - Prevent hardening in the HAZ
 - Prevent the formation of carbides
 - To improve mechanical properties in the weld
25. **Which of the following processes uses the 'keyholing' system of fusion?**
- Friction welding
 - Diffusion bonding
 - Electron beam welding
 - Autogenous TIG welding
26. **In friction welding the metal at the interface is in the:**
- Liquid state
 - Solid state
 - Plastic state
 - Elastic state
27. **Welding procedures may require welds to be deposited at a controlled rate of heat input. High heat inputs would:**
- Have poor profile
 - Have larger grain size
 - Have high hardness in the HAZ
 - Have low elongation properties
28. **In a tensile test a brittle material would be indicated if the fracture surface:**
- Shows a reduction in size
 - Is flat and featureless
 - Breaks in the parent material
 - Breaks at 45° to the load

29. **What destructive test would be required to ascertain the likelihood of cracking in the heat affected zone of a weld?**
- a. Nick break
 - b. Side bend test
 - c. Charpy impact test
 - d. Macro test
30. **In submerged arc welding excessive arc voltage may cause:**
- a. Excessive penetration
 - b. Change in weld metal composition
 - c. Narrow weld width
 - d. Excessive bead profile

MULTICHOICE PAPER THREE

1. **The British code for visual inspection requirements is:**
 - a. BS 4872
 - b. BS 499
 - c. BS 4870
 - d. None of the above
2. **A code of practice for visual inspection should include the following:**
 - a. Before, during and after welding activities
 - b. Before welding activities only
 - c. After welding activities only
 - d. None of the above
3. **Incomplete root penetration in a butt joint could be caused by:**
 - a. Excessive root face width
 - b. Excessive root gap size
 - c. Low current setting
 - d. Both A and C
4. **Incomplete root fusion would certainly be caused by:**
 - a. Linear misalignment
 - b. Incorrect tilt angle
 - c. Differing root face widths
 - d. All of the above
5. **When visually inspecting a completed single vee butt weld cap, you would certainly assess:**
 - a. Cap height
 - b. Toe blend
 - c. Weld width
 - d. All the above
6. **You notice a very 'veed' ripple shape. This is most likely caused by: ←**
 - a. Poor consumable choice
 - b. Welding position
 - c. Excessive travel speed
 - d. All the above
7. **Toe blending is important as it may affect:**
 - a. Corrosion
 - b. Fatigue life
 - c. Overlap type defects
 - d. All the above
8. **Slag inclusions would occur with:**
 - a. Manual metal arc
 - b. Metal inert gas
 - c. Submerged arc welding
 - d. Both A and C
9. **Undercut is principally caused by:**
 - a. Excessive amps
 - b. Excessive volts
 - c. Excessive travel speed
 - d. All the above

10. **Undercut is normally assessed by:**
- Its depth
 - Its length
 - It's blending
 - All the above
11. **A welding procedure is useful to:**
- Give information to the welder
 - Give information to the inspector
 - Give confidence to a product
 - All the above
12. **An essential variable may:**
- Change the properties of a weld
 - Influence the visual acceptability
 - Require re-approval of a weld procedure
 - All the above
13. **A magnifying glass may be used during visual inspection, but BS 5289 states that its magnification should be:**
- Up to 5 Ø
 - 2 to 2.5 Ø
 - 5 to 10 Ø
 - None of the above
- 2 - 2.5 Ø
14. **When visually inspecting a fillet weld it would normally be sized by:**
- The leg lengths
 - The actual throat thickness
 - The design throat thickness
 - Both A and C
15. **A planar defect is:**
- Incomplete fusion defects
 - Slag inclusion
 - Incomplete penetration
 - Both A and C
16. **Penetrant inspection and magnetic particle inspection are mainly used**
- To aid visual inspection
 - Because the application says so
 - To confirm visual uncertainties
 - All the above
17. **Defects outside the limits specified in a standard should always be:**
- Repaired
 - Reported to 'a senior person'
 - Assessed along with other defects
 - All the above
18. **MIG welding tends to be susceptible to lack of fusion problems. This is because of:**
- Poor maintenance of equipment
 - Incorrect settings
 - Poor inter-run cleaning
 - All the above

19. **MMA electrodes can be grouped into three main types. These are:**
- Basic, cellulosic and rutile
 - Neutral, cellulosic and rutile
 - Basic, cellulosic and neutral
 - None of the above
20. **The main cause of porosity in welded joints is:**
- Poor access
 - Loss of gas shield
 - 'Dirty' materials
 - All the above
21. **Cracks in welds may be due to:**
- Solidification problems
 - Hydrogen problems
 - Excessive stresses
 - All the above
22. **A weave technique may give rise to:**
- Better profiles
 - Improved toe blending
 - Improved ripple shape
 - All the above
23. **With reference to a root penetration bead you would certainly assess:**
- Root fusion and penetration
 - Root concavity
 - Burnthrough
 - All the above
24. **In a fatigue failure the appearance of the fracture surface is characteristic. It would be:**
- Rough and torn
 - 'Chevron'-like
 - Smooth
 - None of the above
25. **Stray arcing may be regarded as a serious defect because:**
- It may reduce the thickness dimension of a component
 - It may cause loquation cracks
 - It may cause hard zones
 - All the above
26. **Overlap in welds could be influenced by:**
- Poor welding technique
 - Welding process
 - Welding position
 - All the above
27. **Flame cut preparations may, during welding, increase the likelihood of:**
- Cracking
 - Misalignment problems
 - Inclusions
 - All the above

28. **Macroscopic examination requires any specimen to be inspected:**

- a. Once, after etching
- b. Twice, before and after etching
- c. Using a microscope
- d. None of the above

29. **Which of the following may be classed as a more serious defect:**

- a. Slag inclusions
- b. Fusion defects (inter-run)
- c. Fusion defects (surface)
- d. Porosity

30. **A code of practice is:**

- a. A standard for workmanship only
- b. A set of rules for manufacturing a specific product
- c. Levels of acceptability of a weldment
- d. None of the above

MULTICHOICE PAPER FOUR

1. **Movement of the arc in MMA welding by magnetic forces is called:**
 - a. Arc deviation
 - b. Arc misalignment
 - c. Arc blow
 - d. Arc eye
2. **A metallurgical problem most associated with submerged arc welding is:**
 - a. Hydrogen cracking in the HAZ
 - b. Solidification cracking in the weld metal
 - c. Hydrogen cracking in the weld metal
 - d. Lamellar tearing in the weld metal
3. **Oxy pressure and nozzle size in flame cutting would influence:**
 - a. The temperature required for cut initiation
 - b. The ability to cut stainless steels
 - c. The depth of the cut obtainable
 - d. None of the above
4. **The main usage of arc cutting/gouging processes is:**
 - a. The cutting of single bevel preparations
 - b. The removal of deposited welds
 - c. The cutting of single U type preparations
 - f. The cutting/gouging of non-ferrous materials only
5. **Which of the following processes joins metals plastically?**
 - a. Friction welding
 - b. Resistance welding
 - c. Plasma welding
 - d. All the above
6. **Which electrode classification would be relevant to AWS A5.1-81?**
 - a. E 6013
 - b. E 5133
 - c. E 7018 - G
 - d. Fleetweld 5
7. **Which of the following coatings is associated with stove welding?**
 - a. Rutile
 - b. Cellulosic
 - c. Basic
 - d. Oxidising
8. **A common gas mixture used in MIG welding nickel alloys, to combine good levels of penetration with good arc stability would be:**
 - a. 100% CO₂
 - b. 100% argon
 - c. 80% argon and 20% CO₂
 - d. 98% argon and 2% oxygen

9. **Which type of SAW flux is more resistant to moisture absorption?**
- Fused
 - Agglomerated
 - Basic
 - All the above have the same resistance
10. **The flame temperature of oxy/acetylene mixture gas is given as:**
- 3200°C
 - 2300°C
 - 5000°C
 - None of the above
11. **A large grain structure in steels is said to produce:**
- Low ductility values
 - Low fracture toughness values
 - High fracture value values
 - High tensile strength
12. **The likelihood of brittle fracture in steels will increase with:**
- A large grain formation
 - A reduction of in-service temperature to sub zero temperatures
 - Ferritic rather than austenitic steels
 - All the above
13. **Repair welding is often more difficult than production welding due to:**
- The material being ingrained with in-service contaminants
 - Restricted access within the repair area
 - The possible position of the weld repair
 - All the above
14. **Hydrogen cracking in the weld metal is likely when welding:**
- Carbon manganese steels
 - Stainless steels
 - Micro alloyed steels (HSLA)
 - Low carbon steels
15. **EN 288 standard would refer to which of the following:**
- Welder approval testing
 - Welding equipment
 - Welding procedure approval
 - Consumables for welding
16. **Porosity is caused by:**
- Entrapped slag in the solidifying weld
 - Entrapped gas in the solidifying weld
 - Entrapped metallic inclusions in the solidifying weld
 - None of the above
17. **In a bend test the face of the specimen is in tension and the root is in compression. What type of test is being carried out?**
- A root bend test
 - A side bend test
 - A face bend test
 - None of the above

18. **Ultrasonic testing is more advantageous in detecting which of the following weld imperfections, over other NDT methods?**
- Lack of sidewall fusion
 - Surface undercut
 - Incompletely filled groove
 - Overlap
19. **Tempering is often carried out to regain toughness after which of the following processes?**
- Annealing
 - Normalising
 - Hardening
 - Stress relieving
20. **The presence of iron sulphide in the weld metal is most likely to produce which of the following upon contraction of the weld?**
- Solidification cracking
 - Hydrogen cracking
 - Intergranular corrosion
 - Stress corrosion cracking
21. **Austenitic stainless steel electrodes are generally smaller in length than mild steel electrodes because:**
- High amperage is used
 - Shelf life will be decreased
 - Their electrical conductivity is less than that of steel
 - They are more expensive
22. **The voltage necessary to maintain an arc during metal arc welding is termed:**
- Mains supply voltage
 - Arc current
 - Arc voltage
 - Open circuit voltage
23. **When MMA welding low carbon steel which electrode will give the greatest deposition rate?**
- Hydrogen controlled
 - Cellulosic
 - Rutile
 - Iron powder
24. **Inherent rectification of the electrical output is produced in the arc when TIG welding using:**
- AC with a suppressor
 - AC without a suppressor
 - DC with reverse polarity
 - DC with straight polarity
25. **Gamma rays and X-rays are part of a family of waves called:**
- Acoustic waves
 - Light waves
 - Electromagnetic waves
 - Transverse waves

26. **A measure of the accuracy of a radiograph as an NDT tool is given by its:**
- Intensity
 - Density
 - Sensitivity
 - Exposure
27. **A surface breaking crack will be detected during a magnetic particle inspection if it is:**
- At right angles to the lines of flux
 - Parallel to the lines of flux
 - At 25° to the lines of flux
 - All the above
28. **The advantage of ultrasonic non-destructive testing for the examination of weldments is:**
- It can be used to locate flaws
 - It can be used to size flaws
 - It has a high sensitivity to planar flaws
 - All the above
29. **Under normal contract conditions weld procedure approval tests for pipework are:**
- Mandatory
 - Dependant on site and weather conditions
 - Dependant upon the contractor's confidence in his procedures
 - Only required when MMA welding is used
30. **Hydrogen controlled electrodes were developed principally for:**
- The prevention of porosity
 - The prevention of cracking
 - The enhancement of arc voltage
 - Their ease of arc starting

MULTICHOICE PAPER FIVE

1. **Generally the most suitable method of detecting lack of sidewall fusion would be:**
 - a. Ultrasonics.
 - b. MPI.
 - c. Radiography.
 - d. Penetrant inspection.
2. **Hot shortness is a term used to indicate:**
 - a. Lamellar tearing.
 - b. Solidification cracking.
 - c. Hydrogen cracking.
 - d. None of the above.
3. **Cobalt as an isotope would generally be used on:**
 - a. Thin material.
 - b. Tee joints.
 - c. Plate thicknesses greater than 25 mm.
 - d. All the above.
4. **In welding procedure terms, a change in essential variable means:**
 - a. Re-qualification of the weld procedure.
 - b. Possible changes in the weld's microstructure.
 - c. Possible changes in the mechanical properties.
 - d. All the above.
5. **Weld symbols placed on a dotted line in accordance with ISO requirements means:**
 - a. Weld on 'arrow' side.
 - b. Weld on 'other' side.
 - c. Weld on site.
 - d. Full penetration required.
6. **A welding inspector's main attributes include:**
 - a. Knowledge and experience.
 - b. Literacy.
 - c. Honesty and integrity.
 - d. All the above.
7. **Technically, a code of practice is:**
 - a. A standard.
 - b. A 'set of rules' for the manufacture of a product.
 - c. Related to welder and weld procedure approval.
 - d. All the above.
8. **The correct term for 'cap height' is:**
 - a. Reinforcement.
 - b. Cap profile height.
 - c. Excess weld metal.
 - f. All the above.
9. **A tensile test will assess:**
 - a. Impact values.
 - b. Stress.
 - c. Strain.
 - d. Both b and c.

10. **The important point of high temperature steels is that:**
- They can withstand creep failure.
 - They may suffer re-heat cracking problems.
 - They may suffer loss of toughness.
 - All the above.
11. **An austenitic stainless steel may suffer:**
- Weld decay.
 - Sensitisation.
 - Solidification cracking.
 - All the above.
12. **Carbon equivalent values are useful to determine:**
- Weldability aspects.
 - Crack sensitivity aspects.
 - Typical mechanical properties.
 - All the above.
13. **A basic electrode would normally:**
- Have superior mechanical properties.
 - Require baking before use.
 - Not be used on low carbon steels.
 - Both a and b.
14. **When referring to TIG welding, the shielding gas could be:**
- Argon and hydrogen.
 - Argon and helium.
 - Argon and nitrogen.
 - All the above.
15. **When referring to MIG welding, the shielding gas would be:**
- Argon.
 - Argon + 1% oxygen.
 - Argon + 20% carbon dioxide.
 - None of the above.
16. **Submerged arc utilises:**
- Deep penetration characteristic.
 - High deposition rates on DC+.
 - Flat (PA) welding only.
 - None of the above.
17. **Ultrasonics would be preferred over radiography due to:**
- Ability to find most defects.
 - Lower skill requirement.
 - Ability to detect laminations.
 - Both a and c.
18. **The most serious defect types are:**
- Planar.
 - Cracks.
 - Lack of fusion.
 - All the above.

19. **MMA welding of low alloy steels is more likely to be performed with:**
- Rutile electrodes.
 - Cellulosic electrodes.
 - Iron powder electrodes.
 - Basic hydrogen controlled electrodes.
20. **Which of the following defects is more common to welds deposited by CO₂ welding than welds deposited by MMA?**
- Slag inclusions.
 - Excess penetration.
 - Lack of sidewall fusion.
 - Tungsten inclusions.
21. **Which defect would you expect to get in TIG welds in non-deoxidised steel?**
- Undercut.
 - Porosity.
 - Tungsten inclusions.
 - Linear misalignment.
22. **Which of the following can arise from copper inclusions in a ferritic steel weld?**
- Weld metal cracks.
 - HAZ cracks.
 - Lamellar tearing.
 - Porosity.
23. **Which of the following is likely to give the highest impact strength in ferritic weld metal?**
- Cellulosic electrodes.
 - Submerged arc with acid flux.
 - Spray transfer CO₂ welding.
 - Basic coated MMA electrodes.
24. **You suspect that ferritic steel plates contain cracks in the prepared edges. What NDT method would you use to check this?**
- Radiography.
 - Magnetic particle inspection.
 - Penetrant inspection.
 - Ultrasonic flaw detection.
25. **Which of the following defects would you not expect to find by visual inspection of welds?**
- Linear slag inclusions.
 - Undercut.
 - Overlap.
 - Linear misalignment.
26. **Stress relieving is not helpful in which of the following cases?**
- Improving resistance to stress corrosion cracking.
 - Improving dimensional stability after machining.
 - Lowering the peak residual stress.
 - Softening the steel.

27. **What is the maximum hardness usually recommended for the heat-affected zone of a medium strength ferritic steel weld?**
- a. 100 DP Hv.
 - b. 350 DP Hv.
 - c. 500 DP Hv.
 - d. 750 DP Hv.
28. **What effect does mid thickness laminations in steel plate normally have when they are located within a weld heat affected zone?**
- a. Cause lamellar tearing.
 - b. Fuse together to form a bond.
 - c. Affect the weld metal composition.
 - d. Cause internal tearing on a micro scale.
29. **The permanent backing material for MMA welding of low carbon steel should be made from:**
- a. Copper.
 - b. Low carbon steel.
 - c. QT steel.
 - d. Cast iron.
30. **The overall length of a pipeline can be affected by:**
- a. Transverse shrinkage.
 - b. Longitudinal shrinkage.
 - c. Angular shrinkage.
 - d. Circumferential shrinkage.

MULTICHOICE PAPER SIX

1. **The weld dimension used to indicate the minimum strength of a fillet weld is:**
 - a. Leg length.
 - b. Throat thickness.
 - c. Width of bead.
 - d. Length of weld element.
2. **An electroslag weld requires what heat treatment to improve the grain structure?**
 - a. Annealing.
 - b. Stress relieving.
 - c. Normalising.
 - d. Quench and tempering.
3. **The most common type of failure associated with sharp fillets, notches and undercut is:**
 - a. Crystallisation.
 - b. Fatigue.
 - c. Corrosion.
 - d. Brittle fracture.
4. **Weld decay in stainless steels can be avoided by:**
 - a. Stress relieving.
 - b. Slow cooling after welding.
 - c. Addition of more manganese to the steel.
 - d. Addition of titanium to the steel.
5. **An eutectoid mixture in steel is:**
 - a. A mixture of ferrite and austenite.
 - b. A mixture comprising a substitutional solid solution.
 - c. Called pearlite.
 - d. Called ledeburite.
6. **Low alloy steels having a high carbon equivalent before welding will require:**
 - a. A reduction in carbon content.
 - b. High pre-heat temperatures.
 - c. Low pre-heat temperatures.
 - d. No pre-heating.
7. **The electrodes for welding low alloy steels should be:**
 - a. Used with a low current value.
 - b. One size larger than for general purpose electrodes.
 - c. Used for welding in the flat position only.
 - d. Heated in a drying oven before use.
8. **The purpose of pre-heating low alloy steel pipes before electric arc welding is to:**
 - a. Refine grain structure.
 - b. Relieve internal stress.
 - c. Retard rapid cooling.
 - d. Regulate excessive expansion.
9. **Welder qualification tests are designed to:**
 - a. Test the correctness of the welding procedure.
 - b. Test the welder's skill.
 - c. Prove the weldability of the parent material.
 - d. All the above.

10. In positional MMA welding on pipework, welders are having difficulty in obtaining good capping profiles when welding in the overhead position. Would you:
- Advise them to increase the current.
 - Advise them to increase the voltage.
 - Ask for a new welding team.
 - Suggest the use of a smaller diameter electrode.
11. You have a macro section of a 'T' butt joint that shows a step-like defect lying outside the visible HAZ. What would this defect possibly signify?
- HAZ cracking.
 - Toe cracking.
 - Lamination.
 - Lamellar tearing.
12. Which electrode deposits weld metal with the greatest ductility and resistance to cracking?
- Rutile.
 - Cellulosic.
 - Basic.
 - Oxidising.
13. Which one of the following is not helpful in minimising angular distortion during welding?
- Use of double 'V' weld prep using balanced welding technique.
 - Pre-setting of work piece.
 - Applying post weld heat soak.
 - Changing from a single 'V' prep for thick material.
14. Argon purging on the root side is necessary in the TIG welding of stainless steel to:
- Obtain full penetration.
 - Obtain full fusion.
 - Avoid porosity in the root.
 - Obtain a satisfactory weld surface finish.
15. Which of the following can arise from copper inclusions in a mild steel weld?
- Weld metal cracks.
 - HAZ cracks.
 - Lack of fusion.
 - Porosity.
16. Stress relief is not helpful in which of the following cases?
- In improving resistance to stress corrosion.
 - In improving dimensional stability after machining.
 - In lowering the peak residual stresses.
 - In softening the metal.
17. Stray arc strikes are undesirable since they:
- Leave a poor surface finish.
 - Cause weld metal cracking.
 - Reduce corrosion resistance.
 - Cause local hardening and cracking in the parent material.

18. **Cold cracking is most likely to occur in a weldment if:**
- The rate of cooling is too fast.
 - The rate of cooling is too slow.
 - It lacks ductility at high temperatures.
 - Impurities are present at its grain boundaries.
19. **Chromium, when added to steel as an alloying element, has the effect of making the alloy more:**
- Ductile.
 - Plastic.
 - Hardenable.
 - Malleable.
20. **When depositing weld metal, fusion will take place at the sides of the joint resulting in an admixture between weld metal and parent metal. This alloying effect is known as:**
- Diffusion.
 - Absorption.
 - Dilution.
 - Migration.
21. **Percentage elongation of a metal undergoing a tensile test is a measure of:**
- Elasticity.
 - Plasticity.
 - Ductility.
 - Malleability.
22. **When a longitudinal load is put on a lap joint, the stress set up is normally:**
- Shear stress.
 - Tensile stress.
 - Compressive stress.
 - Residual stress.
23. **When a metal is subjected to a fluctuating load, a condition of cyclic stressing can be set up, which eventually can result in structural breakdown known as:**
- Tensile failure.
 - Fatigue failure.
 - Yield failure.
 - Shear failure.
24. **What happens to the mechanical properties of steel if the carbon content is increased to 0.5%?**
- The material becomes softer.
 - Malleability is increased.
 - The tensile strength is increased.
 - Ductility is increased.
25. **Columnar growth takes place when a metal is:**
- Cold.
 - Losing heat.
 - Being heated.
 - Being rolled.

26

If a low carbon steel pipe has to carry a liquid, care must be taken when making the butt welds to ensure penetration is not excessive because it:

- a. Reduces the flow rate of the liquid.
- b. May increase the rate of corrosion.
- c. Can contaminate the liquid.
- d. May cause excessive pipe wear.

27. When a steel suffers hot shortness, it is mostly due to the presence of:

- a. Sulphur.
- b. Phosphorous.
- c. Silicon.
- d. Manganese.

28. When a steel is heated to above its upper critical temperature, the structure produced is:

- a. Martensite.
- b. Austenite.
- c. Pearlite.
- d. Sorbite.

29. The type of crystal normally found in a single run arc weld in the as welded condition is:

- a. Equi-axed.
- b. Polycrystalline.
- c. Dendritic.
- d. Columnar.

30. The first sub-zone in the heat affected zone of the parent metal nearest the weld deposit will consist of:

- a. Large crystal grains.
- b. Small crystal grains.
- c. Elongated crystal grains.
- d. Distorted crystal grains.

MULTICHOICE PAPER SEVEN

1. **Pipe welding codes are set up by:**
 - a. Welding operators.
 - b. State governments.
 - c. Associations, societies, insurance companies, manufacturers and the military.
 - d. Construction unions.
2. **The different grain structure between the weld deposit and the base metal can be determined by:**
 - a. A face bend test.
 - b. A root bend test.
 - c. A hardness test.
 - d. An etching test.
3. **A root bend test is used to test the amount of weld:**
 - a. Ductility.
 - b. Elongation.
 - c. Hardness.
 - d. Penetration.
4. **What would be observed if a fillet weld were sectioned and macro-etched?**
 - a. The grain of the other beads is coarser than the final bead.
 - b. The penetration and fusion into the root is very deep.
 - c. Each bead appears to be distinctly separated from the adjoining beads.
 - d. The grain structure remains the same in all passes.
5. **What is the most common cause of failure in root bend tests?**
 - a. Too high a current setting.
 - b. Too long a pause in the down cycle of the weave.
 - c. Lack of fusion and penetration.
 - d. Too high a travel speed.
6. **The purpose of a nick break specimen is to provide a test for:**
 - a. Tensile strength and fracture appearance.
 - b. Ductility and fracture appearance.
 - c. Elongation and fracture appearance.
 - d. Soundness and fracture appearance.
7. **Which organisation publishes the most commonly used code for boiler and pressure vessel welding?**
 - a. American Welding Society.
 - b. American Society of Mechanical Engineers.
 - c. American Petroleum Institute.
 - d. American National Standards Institute.
8. **A low hydrogen electrode, according to BS 639, would contain:**
 - a. No hydrogen.
 - b. Less than 15 ml of hydrogen per 100 grams of deposited weld metal.
 - c. Between 15 ml and 25 ml of hydrogen per 100 grams of deposited weld metal.
 - d. Less than 25 ml of hydrogen per 100 grams of deposited weld metal.
9. **The second run in a three run butt weld using the stovepipe technique is known as the:**

- a. Filling run.
 - b. Hot pass.
 - c. Intermediate run.
 - d. Sealing run.
10. **You could determine that an electrode is cellulosic by its:**
- a. BS 639 coding.
 - b. Colour.
 - c. Trade name.
 - d. BS 499 coding.
11. **Which type of electrode coating gives the most voluminous gas shield?**
- a. Rutile.
 - b. Basic.
 - c. Oxidising.
 - d. Cellulosic.
12. **Which of the following steels is likely to be more susceptible to hydrogen cracking?**
- a. Carbon equivalent of less than 0.25 %.
 - b. Carbon equivalent of 0.35%.
 - c. Carbon equivalent of 0.38%.
 - d. Carbon equivalent of 0.43%.
13. **Preheating and interpass heating are used primarily for:**
- a. Aiding fusion.
 - b. Reducing hydrogen content of weld preparation prior to welding.
 - c. Ensure a fine grain size.
 - d. Slow down the cooling rate after welding.
14. **Submerged arc welds made with re-cycled flux are liable to:**
- a. Porosity.
 - b. Course grain size.
 - c. Undercut.
 - d. Incomplete penetration.
15. **Incomplete penetration in a single 'V' butt joint could be caused by:**
- a. Too large a root gap.
 - b. Too small a root gap.
 - c. Too high a heat input.
 - d. Too small a root face.
16. **In submerged arc welding, which of the following width to depth ratios would be likely to result in solidification cracking?**
- a. 1 : 3.
 - b. 3 : 1.
 - c. 2 : 1.
 - d. 1 : 1.
17. **You are responsible for controlling welding on site. A large incidence of porosity has been reported in recent welding. Would you investigate?**
- a. The electrode type.
 - b. Power source.
 - c. Electrode storage.
 - d. Day temperature.

18. The main reason why all adhering scale should be removed when the pipe end preparation is made by oxy-gas cutting is?
- Oxidisation of the weld metal is minimised.
 - The speed of welding is increased.
 - Pipe bore alignment is made easier.
 - Reduction of the weld deposit is prevented.
19. When manual metal arc welding low carbon steel, which electrode covering will give the greatest degree of penetration?
- Iron powder.
 - Rutile.
 - Cellulosic.
 - Low hydrogen.
20. When tungsten arc gas shielded welding stainless steel, which one of the following should be used?
- Alternator.
 - A. C. transformer.
 - D. C. generator.
 - Constant potential rectifier.
21. Which gas shroud should be used when TIG arc gas shielded welding aluminium alloys?
- Nitrogen.
 - Carbon dioxide.
 - Argon/carbon dioxide mixture.
 - Argon.
22. The most common type of defect found in a structure when it is undergoing service is:
- Fatigue cracking.
 - Crystallisation.
 - Weld decay.
 - Stress fracture.
23. In the examination of a welded aluminium joint, macro etching may reveal:
- Lack of inter-run penetration.
 - Carbon pick-up.
 - Weld decay.
 - Micro cracks.
24. MMA welds made with damaged electrode coatings are subject to:
- Porosity.
 - Undercut.
 - Excessive penetration.
 - Excessive bead height.
25. Which physical test is more likely to reveal HAZ embrittlement?
- Transverse tensile.
 - All weld tensile.
 - Root bend.
 - Charpy impact.

26. Which of the following destructive tests is not normally required for welder approval?
- Bend tests.
 - Macro examination.
 - Impact tests.
 - Fracture tests.
27. Too large a diameter of filler rod should not be used to make a welded joint because:
- Excess reinforcement profile will be difficult to obtain.
 - The included bevel angle will have to be reduced.
 - Root fusion may be difficult to obtain.
 - The gap setting will have to be changed.
28. If pipe bores are not matched correctly it can result in:
- Lack of root penetration.
 - Incorrect gap setting.
 - Excessive root faces.
 - Overheating during welding.
29. A correctly made tack weld should slope from the middle to the ends in order to:
- Aid better penetration at the join-up.
 - Prevent porosity at the join-up.
 - Reduce the electrode size required.
 - Reduce the overall consumable consumption.
30. Two low carbon steel pipes, 150mm diameter and 6mm wall thickness, are to be butt welded using the TIG process. To ensure a full strength joint, which of the following preps is most suitable?
- Open single bevel.
 - Open single Vee.
 - Open square preparation.
 - Closed square preparation.

PROPERTIES OF MATERIALS

1. The ability of a material to withstand a load pulling it apart is called its _____.
2. The ability of a material to be stretched out without breaking is called _____.
3. An Izod impact machine is used to give indication of the _____ of a material.
4. The ability to withstand indentation is called Hardness.
5. Lack of ductility is called _____.
6. The property of a metal to return to its original shape is called _____.
7. Increase in carbon content causes an _____ in strength and hardness.
8. When carbon percentage increases, there is a decrease in _____.
9. Low carbon steel contains less than _____ carbon.
10. Low ductility in a weld metal could result in _____.
11. Alloying is used to _____ mechanical and physical properties of a steel.
12. Sulphur and phosphorus are not alloying elements; they are _____.
13. Alloying allows designers to use _____ sections and still have the same strength.
14. An alloy that contains a high percentage of chromium and nickel would have resistance to _____.
15. Quenching a carbon or low alloy steel will result in an _____ in hardness and a _____ in ductility.
16. The hard constituent that results when steel is quenched is called _____.
17. The tough laminated structure that is formed on slow cooling of ferrite and iron carbide (cementite) is called _____.
18. The amount of martensite formed depends on the speed of _____ and the percentage of _____.
19. After quenching, the structure may be improved by reheating to 200-300°C. This is called _____.
20. Small percentages of chromium will increase the strength and _____, while a small percentage of nickel will increase _____.

PROPERTIES OF MATERIALS

- | | | | |
|----------------------|----------------------------|--------------------------|-----------------|
| 1. Tensile Strength. | 2. Ductility. | 3. Toughness. | 4. Hardness. |
| 5. Brittleness. | 6. Elasticity. | 7. Increase. | 8. Ductility. |
| 9. 0.2% | 10. Cracking. | 11. Increase. | 12. Impurities. |
| 13. Smaller/Thinner. | 14. Corrosion. | 15. Increase....Decrease | |
| 16. Martensite. | 17. Pearlite. | 18. Cooling....Carbon. | |
| 19. Tempering. | 20. Hardness./..Toughness. | | |

ANSWERS

PAPER ONE

1. d	2. d	3. b	4. c	5. c	6. b	7. c
8. a	9. c	10. a	11. d	12. a	13. b	14. b
15. c	16. a	17. a	18. b	19. a	20. d	21. c
22. a	23. d	24. c	25. d	26. d	27. c	28. b
29. b	30. b					

PAPER TWO

1. b	2. a	3. b	4. d	5. c	6. c	7. d
8. d	9. d	10. d	11. b	12. b	13. c	14. b
15. c	16. b	17. b	18. c	19. b	20. c	21. b
22. d	23. c	24. b	25. c	26. c	27. b	28. b
29. d	30. b					

PAPER THREE

1. d	2. a	3. d	4. d	5. d	6. c	7. b
8. d	9. d	10. d	11. d	12. d	13. b	14. d
15. d	16. d	17. b	18. d	19. a	20. d	21. d
22. d	23. d	24. c	25. d	26. d	27. d	28. b
29. c	30. b					

PAPER FOUR

1. c	2. b	3. c	4. b	5. a	6. a	7. b
8. b	9. a	10. a	11. b	12. d	13. d	14. c
15. c	16. b	17. c	18. a	19. c	20. a	21. c
22. c	23. d	24. b	25. c	26. c	27. a	28. d
29. a	30. b					

PAPER FIVE

1. a	2. b	3. c	4. d	5. b	6. d	7. b
8. c	9. d	10. d	11. d	12. d	13. d	14. d
15. a	16. a	17. d	18. d	19. d	20. c	21. b
22. a	23. b	24. b	25. a	26. b	27. b	
28. a	29. b	30. b				

PAPER SIX

1. b	2. c	3. b	4. d	5. c	6. b	7. d
8. c	9. b	10. d	11. d	12. c	13. c	14. c
15. a	16. b	17. d	18. a	19. c	20. c	21. c
22. a	23. b	24. c	25. b	26. a	27. a	28. b
29. d	30. a					

PAPER SEVEN

1. c	2. d	3. a	4. c	5. c	6. d	7. b
8. b	9. b	10. a	11. d	12. d	13. b	14. a
15. b	16. a	17. c	18. a	19. c	20. c	21. d
22. a	23. a	24. a	25. d	26. c	27. c	28. a
29. a	30. b					

Please return this paper unmarked

1. Which mechanical test can be used to measure the toughness of weld metal, HAZ and parent material ?
A macro
B nick break
C hardness
D ✓ Charpy impact

2. Which is the best destructive test for showing lack of side-wall fusion in a 25mm thick butt weld ?
A nick break
B ✓ side bend
C Charpy impact
D a face bend test

3. The principle purpose of a welder qualification test is
A ✓ to test the skill of the welder
B to assess the weldability of the materials
C to decide which NDT methods to use
D to give the welder practice before doing production welding

4. A fabrication procedure calls for the toes of all welds to be “blended in” by grinding. The most likely reason for doing this is to
A make the weld suitable for liquid (dye) penetrant inspection
B ✓ improve the fatigue life
C reduce residual stresses
D improve the general appearance of the welds

5. For full penetration single-sided butt joints, root bead penetration and profile are mainly influenced by
A root face
B bevel angle
C ✓ root gap
D included angle

6. Undercut may need to be assessed according to
A depth
B length
C sharpness/profile/blend
D ✓ all of the above

7. When visually inspecting the root bead of a single-vee-butt weld it should be checked for
A ✓ lack of root penetration
B HAZ hardness
C tungsten inclusions
D all of the above

Please return this paper unmarked

8. The strength of a fillet weld is determined by
- A leg length
 - B weld profile
 - C weld width
 - D ✓ throat thickness
9. The European Standard for NDE of Fusion Welds by Visual Examination is
- A EN 288
 - B EN 499
 - C EN 287
 - D ✓ EN 970
10. Visual inspection of a fabricated item, for a high integrity application, should cover inspection activities
- A ✓ before, during and after welding
 - B before welding only
 - C after welding only
 - D during welding and after welding only
11. Incomplete root penetration in a single-vee-butt joint may be caused by
- A an excessive root face
 - B an excessive root gap
 - C the current setting being too low
 - D ✓ both A and C
12. Incomplete root fusion in a single-vee butt weld may be caused by
- A linear misalignment
 - B the root gap being too large
 - C root faces being too small
 - D ✓ all of the above
13. When visually inspecting the face of a finished weld it should be assessed for
- A maximum excess weld metal height
 - B toe blend
 - C inter-run blend
 - D ✓ all of the above
14. A burn-through may occur if
- A the current is too low
 - B the root face is too large
 - C ✓ the root gap is too large
 - D all of the above
15. A Code of Practice is
- A a standard for workmanship quality only
 - B ✓ a set of rules for manufacturing a specific product
 - C a specification for the finished product
 - D all of the above

Please return this paper unmarked

16. A solid inclusion in a weld may be
- A ✓ entrapped slag
 - B entrapped gas
 - C lack of inter-run fusion
 - D all of the above
17. Which of the following is a planar imperfection ?
- A ✓ a lack of sidewall fusion
 - B a slag inclusion
 - C linear porosity
 - D root concavity
18. For fillet welds, it is normal practice in the UK & USA to measure
- A throat thicknesses
 - B ✓ leg lengths
 - C penetration depths
 - D both A & C
19. In a bend test, when the face of the specimen is in tension and root is in compression, the test is called
- A a root bend
 - B a side bend
 - C ✓ a face bend
 - D a longitudinal bend
20. Heavy porosity on the surface of some MMA welds made on a construction site is most likely to be caused by
- A use of the wrong class of electrodes
 - B the use of excessive current
 - C ✓ moisture pick-up in the electrode covering
 - D a bad batch of electrodes
21. Slag inclusions may be present in
- A manual metal arc welds
 - B metal inert gas welds
 - C submerged arc welds
 - D ✓ both A and C
22. The main cause of undercut is
- A excessive amps
 - B excessive volts
 - C excessive travel speed
 - D ✓ all of the above
23. Which group of welders is most likely to require continuous monitoring by a welding inspector ?
- A concrete shuttering welders
 - B ✓ overland pipeline welders
 - C tack welders
 - D maintenance welders

*Dipe = Process
Pipeline = cross country
Pipeline.*

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24. Which of the following fillet welds is the strongest (assuming they are made using the same material, and WPS) ?

- A 8 mm actual throat
- B 7 mm leg + 2 mm excess weld metal
- C mitre fillet with 10mm leg
- D✓ concave fillet with 11mm leg 7.7

25. A typical included angle for MMA welding of a full penetration pipe butt joint is

- A 35°
- B✓ 70°
- C 90°
- D dependent on the pipe diameter

26. A fillet weld has an actual throat thickness of 8mm and a leg length of 7mm. What is the excess weld metal ?

- A 2.1mm
 - B 1.8mm
 - C✓ 3.1mm
 - D 1.4mm
- 86 422 $7 \times 0.7 = 4.9$*

27. The fusion boundary of a fillet weld is

- A✓ the boundary between the weld metal and HAZ
- B the boundary between individual weld runs
- C the depth of root penetration
- D the boundary between the HAZ and parent material

28. If a Welding Inspector detects a type of imperfection not allowed by the Application Standard he must always... ..

- A✓ request further NDE
- B reject the weld
- C✓ prepare a concession request
- D only reject the weld if he considers it to be harmful

29. BS EN 970 allows the use of a magnifying glass for visual inspection but recommends that the magnification is

- A x2
- B✓ x2 to x5
- C x5 to x10
- D not greater than x20

30. The majority of welder qualification tests are carried out using an unbacked joint. This is because

- A it is quicker, and cheaper, if back-gouging is not required
- B if the welding process is not TIG, back purging is not required
- C all welder qualification tests are done on small diameter pipe
- D✓ it requires more skill and increases the welder's qualification range

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1. Deflection of the arc by magnetic forces, that can make welding difficult to control, is commonly known as
A arc initiation
B arc misalignment
C✓ arc blow
D arc constriction

2. Which of the following electrodes is classified to BS EN 499 ?
A E 38 3 R
B✓ E 6013
C E 7018 - G
D E 51 33 B

3. Which of type of electrode is used for "stove-pipe welding" for overland pipelines construction ?
A rutile
B✓ cellulosic
C high recovery rutile
D all of the above

4. The three main types of MMA electrodes used for welding C & C-Mn steels are
A✓ basic, cellulosic and rutile
B neutral, cellulosic and rutile
C basic, cellulosic and neutral
D rutile, low hydrogen and basic

5. A WPS may specify a maximum width for individual weld beads (the 'weave' width) when welding C-Mn steels because if this is exceeded it will cause
A lack of inter-run fusion
B✓ a reduction in HAZ toughness
C lack of sidewall fusion
D all of the above

6. You notice that MMA electrodes, with the flux covering removed, are being used as filler rods for TIG welding. This should not be allowed because
A it is wasteful
B the rod diameter be too large
C✓ the weld metal composition may be wrong
D the rod is too short

7. For TIG welding, what benefit does a current slope-out device have ?
A✓ it reduces Tungsten spatter
B it reduces the risk of crater cracking
C it reduces the risk of arc strikes
D it reduces the interpass temperature

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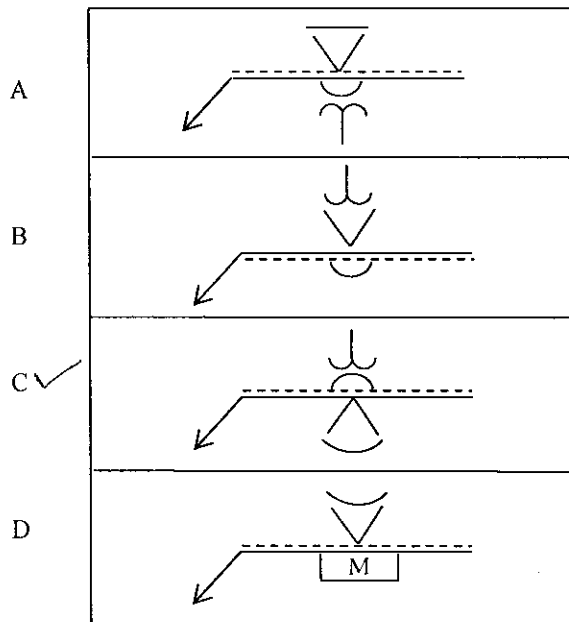
8. Which type of power source characteristic is normally used for manual welding ?
- A constant voltage
 - B flat characteristic
 - C ✓ constant current
 - D a motor generator
9. In MMA welding, penetration is principally controlled by
- A arc voltage
 - B welding speed
 - C ferro-silicon in the electrode coating
 - D ✓ current
10. Pipe bores of some materials must be purged with Argon before and during TIG welding in order to
- A prevent linear porosity
 - B prevent burn-through
 - C ✓ prevent oxidation of the root bead
 - D eliminate moisture pick-up in the root bead
11. The chemical composition of the weld metal deposited by a C-Mn steel electrode is usually controlled by
- A ~~the~~ the core wire composition
 - B ✓ additions in the flux coating
 - C iron powder in the flux coating
 - D dilution from the base material
12. Silicon is added to steel, and the covering of MMA electrodes, in order to give
- A ✓ deoxidation
 - B improve strength
 - C improve toughness
 - D more resistance to hydrogen cracking
- Si = Primary
Mn = Secondary
Al = Tertiary*
13. A fusible insert for TIG welding helps to
- A reduce porosity
 - B give controlled root penetration
 - C avoids the need for a back purge
 - D ✓ all of the above
14. According to AWS 2.4 a weld symbol for the 'other' side is placed
- A above the dashed line
 - B below the dashed line
 - C ✓ above the solid line
 - D below the solid line
15. When low hydrogen MMA electrodes are specified for what type of covering will they have ?
- A cellulosic
 - B rutile
 - C acid
 - D ✓ basic

Please return this paper unmarked

16. A hydrogen controlled MMA electrode can always be recognised by the

- A ✓ EN code letter (or AWS code number)
- B electrode length
- C Trade Name
- D colour of the covering

17. According to BS EN 22553 which of the following symbols means that the weld toes must be smoothly blended on the 'other side' ?



18. Which of the following units is used to express Heat Input ?

- A Joules
- B N/mm^2
- C J/mm^2
- D ✓ kJ/mm

19. Which one of the following elements is added to steel to give resistance to creep at elevated service temperatures ?

- A Nickel
- B Manganese
- C ✓ Molybdenum
- D Aluminium

20. Nick break and fillet fracture tests are used for

- A ✓ assessing weld quality
- B assessing weld metal ductility
- C assessing weld metal toughness
- D all of the above

Please return this paper unmarked

21. Which of the following steels is non-magnetic ?

- A ✓ 18% Cr, 8% Ni
- B 13% Cr
- C 9%Cr, 1 Mo
- D 9% Ni

22. Weld spatter during MMA welding is most likely to be caused by

- A excessive current
- B incorrect baking and storage of electrodes
- C a bad batch of electrodes
- D ✓ all of the above

23. A qualified Welding Procedure Specification is used to

- A give instruction to the welder
- B give information to the welding inspector
- C give confidence that welds will have the specified properties
- D ✓ all of the above

24. An arc strike (stray flash) on a steel component is regarded by some codes as unacceptable because

- A it will cause copper contamination
- B it may cause hard spots
- C it may give cracking
- D ✓ of both B & C

25. In a transverse tensile test, brittleness would be indicated if

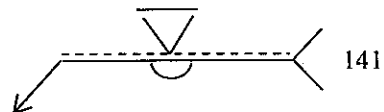
- A there is a reduction in cross-section at the position of fracture
- B ✓ the fracture surface is flat and featureless but has a rough surface
- C fracture occurred in the weld metal
- D the fracture face shows beach marks

26. The surface of a fatigue fracture will

- A be rough and torn
- B have sharp chevron markings
- C ✓ be smooth
- D have shear lips

27. What does the number 141 refer to on this drawing symbol ?

- A the WPS Number
- B ✓ the welding process
- C a filler material
- D the acceptance standard



28. The polarity used for TIG welding of all materials, except aluminium and magnesium, is

- A ✓ DC negative
- B DC positive
- C AC
- D any polarity can be used

Please return this paper unmarked

29. A typical temperature range for baking low hydrogen electrodes is

- A 150 to 200°C
- B 200 to 250°C
- C ✓ 300 to 350°C
- D 400 to 450°C

30. If welding travel speed is doubled, but the current and voltage remain the same, the heat input will

- A ✓ be reduced by 50%
- B be increased by a factor of two
- C be about the same
- D be reduced by approximately 25%

$$HI = \frac{V \times A}{T.S}$$

$$HI \propto \frac{1}{2} \times 0.5$$

Please return this paper unmarked

1. Which type of submerged arc welding flux is susceptible to moisture pick-up?
 - A neutral
 - B agglomerated
 - C fused
 - D they are all about the same

2. A large grain size, in the HAZ of a C-Mn steel weld joint, may have
 - A low ductility
 - B low toughness
 - C high toughness
 - D high tensile strength

3. A STRA test is used to measure
 - A the tensile strength of the welded joint
 - B the level of residual stress in butt joints
 - C the fracture toughness of the HAZ
 - D the through thickness ductility of a steel plate (the 'Z' direction)

4. The risk of hydrogen cracking is higher when MMA welding of
 - A C-Mn steels
 - B austenitic stainless steels
 - C low alloy steels for elevated temp. service
 - D low carbon steels for cryogenic service

5. The property of a material that has the greatest influence on welding distortion is the.....
 - A yield strength
 - B co-efficient of thermal expansion
 - C elastic modulus
 - D co-efficient of electrical conductivity

6. Which of the following is a suitable shielding gas for FCAW of stainless steels?
 - A 100% Argon
 - B 70% Argon + 30% He
 - C Argon + 5% Hydrogen
 - D Argon + 20% CO₂

7. The presence of iron sulphides in a weld bead may cause
 - A solidification cracking
 - B hydrogen cracking
 - C lamellar tearing
 - D weld decay

8. A macro section is particularly good for showing
 - A the HAZ microstructure
 - B overlap
 - C the weld metal microstructure
 - D all of the above

Please return this paper unmarked

9. Which of the following procedures would be expected to produce the least distortion in 15mm straight butt weld ?
- | | | |
|-----|----------|--------------------------|
| A | TIG weld | single sided, multi-pass |
| B | MMA weld | single sided, multi-pass |
| C | MMA weld | double sided, multi-pass |
| D ✓ | SAW weld | 1 pass per side |
10. A suitable gas /gas mixture, for GMAW of aluminium is
- | | |
|-----|---------------------------------|
| A | 100% CO ₂ |
| B ✓ | 100% Argon |
| C | 80% Argon + 20% CO ₂ |
| D | 98% Argon + 2% O ₂ |
11. Which of the following is associated with SAW more often than it is with MMA welds is ?
- | | |
|-----|---|
| A ✓ | hydrogen cracking in the HAZ |
| B | solidification cracking in the weld metal |
| C | re-heat cracking during PWHT |
| D | lamellar tearing |
12. EN ISO 5817 (Level C) specifies that the limit for the diameter (D) of a single pore in a weld is: -
 $D \leq 0.3s$, but max.4mm where s = material thickness.
For which of the following situations is the pore acceptable ?
- | | | |
|----|-----|--|
| A | ← | $s = 20\text{mm}$, measured pore diameter = 5.0mm |
| B | 4.5 | $s = 15\text{mm}$, measured pore diameter = 4.5mm |
| ✓C | 3 | $s = 10\text{mm}$, measured pore diameter = 3.0mm |
| D | 3 | $s = 10\text{mm}$, measured pore diameter = 3.5mm |
13. To measure arc voltage accurately it is recommended that the voltmeter should be connected
- | | |
|-----|--|
| A ✓ | as near as practical to the arc |
| B | across the power source terminals prior to arc initiation |
| C ✗ | across the power source terminals during the welding operation |
| D | all of the above are suitable |
14. Lamellar tearing has occurred in a steel fabrication. What technique could have been used to find it before the weld was made ?
- | | |
|-----|--|
| A | X-ray examination |
| B | liquid penetrant examination |
| C | ultrasonic examination |
| D ✓ | it could not have been found by any inspection method. |
15. Pre-heating a low alloy steel prior to welding is done to minimise the risk of
- | | |
|-----|----------------------|
| A | porosity |
| B ✓ | excessive distortion |
| C | HAZ cracking |
| D | lack of fusion |

Please return this paper unmarked

16. Typical temperatures used for normalising a C-Mn steel plate are

- A 600 to 650°C
- B 1000 to 1100°C
- C 700 to 800°C
- D ✓ 880 to 920°C

17. For GMAW the burn-off rate of the wire is directly related to

- A ✓ the stick-out length
- B wire feed speed
- C the arc voltage
- D the travel speed

18. For MMA welding of a 60mm wall nozzle to a 100mm wall vessel shell, pre-heat temperature should be checked .

- A ✓ before welding starts/re-starts
- B on the shell and the nozzle
- C at points at least 75mm from the joint edge
- D all of the above

19. A crack running along the centreline of a weld bead could be caused by

- A use of damp flux
- B lack of preheat
- C arc voltage being too high
- D ✓ weld bead being too deep and very narrow

20. In order to improve resistance to service failure caused by cyclic loading , it is good practice to

- A use low heat input welding
- B use steel with a low CEV
- C ensure there are no features that give high stress concentration
- D ✓ all of the above

21. The use of low carbon austenitic stainless steels and stabilised stainless steels will minimise the risk of

- A HAZ cracking
- B weld decay
- C weld metal cracking
- D distortion

22. Which type of SAW flux is susceptible to breaking down into fine particles during circulation ?

- A ✓ fused
- B neutral
- C alloyed
- D agglomerated

23. The maximum hardness in the HAZ of a steel will increase if the

- A heat input is increased
- B ✓ CEV is increased
- C joint thickness is decreased
- D all of the above

Please return this paper unmarked

24. BS EN ISO 5817 (Level B) specifies the limit for Excess Weld Metal (h) on a butt weld as: -
 $h \leq 1\text{mm} + 0.1b$, but max. 5mm, b = weld width.

In which of the following situations is the measured Excess Weld Metal acceptable.

- A b = 10 measured excess weld metal = 2.5mm 2
- B b = 20 measured excess weld metal = 3.5mm 3
- C ✓ b = 35 measured excess weld metal = 4.5mm 4.5
- D b = 45 measured excess weld metal = 5.5mm

Handwritten calculations:

$$\frac{0.1 \times 20}{10} = 2$$

$$\frac{0.1 \times 35}{10} = 3.5$$

$$\frac{0.1 \times 45}{10} = 4.5$$

25. A carbon manganese steel is being welded by MMA and the electrode run-out-lengths that have been used are much shorter than specified by the WPS. This deviation may give

- A an increased risk of hydrogen cracking
- B an increased risk of solidification cracking
- C ✓ lower values of HAZ toughness
- D higher values of HAZ hardness

26. The first procedure that is prepared for a Weld Procedure Qualification test weld is a

- A ✓ pWPS
- B WPS
- C WPQR
- D WPAR

27. Transfer of material identification by hard stamping is sometimes not allowed for high integrity applications because

- A it is too slow
- B it can be a safety hazard
- C ✓ it may be damaging to the material
- D all of the above

28. When welding thin plate, distortion can be minimised by

- A using back-step welding
- B minimising weld volume
- C using bridge tacks
- D ✓ all of the above

29. Which of the following would be considered to be high Heat Input welding ?

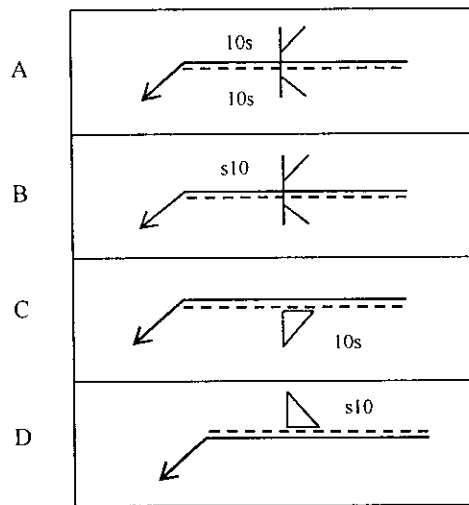
- A 550 J/mm
- B 55 J/mm
- C 5.5 J/mm
- D ✓ 5.0 kJ/mm

30. Initiation of a TIG arc by using a High Frequency spark may not be allowed because

- A ✓ it often causes tungsten inclusions
- B it can damage electronic equipment
- C it is an electrical safety hazard
- D it often causes stop/start porosity

Please return this paper unmarked

1. Which of these drawing symbols shows weld penetration depth in accordance with BS EN 22553 ?



2. BS EN 288 is a specification for.....

- A welder approval testing
- B welding equipment calibration
- C welding procedure approval
- D consumables for submerged arc welding

3. What determines the penetrating power of Gamma rays ?

- A time
- B type of isotope
- C source-to-film distance
- D source strength

4. Which element has the greatest effect on the HAZ hardness of a carbon-manganese steel ?

- A Molybdenum
- B Chromium
- C Titanium
- D Carbon

5. Pre-heating a steel plate with a carbon equivalent value (CEV) of 0.48 may be required in order to

- A drive out moisture from the plate
- B prevent excessive hardening in the HAZ
- C prevent the formation of carbides
- D improve the mechanical properties of the weld metal

6. A welder approval certificate should be withdrawn if

- A he has not done any welding for a period of 4 months
- B he has been absent from work for a period of 7 months
- C the repair rate for his welds exceeds 1%
- D all of the above

Please return this paper unmarked

7. In friction welding, the metal at the interface when the joining occurs is described as being in the

- A liquid state
- B inter-critical state
- C ✓ plastic state
- D elastic state

8. A penetrameter is used to measure

- A the size of a discontinuity in a weld joint
- B the density of a radiographic film
- C the degree of film contrast
- D the quality of the radiographic technique

9. Which of the following cutting methods is suitable for cutting stainless steel ?

- A ✓ plasma
- B oxy-acetylene
- C oxy-propane
- D all of the above

10. Which of the following would be classed as the most serious type of defect ?

- A a buried linear slag inclusion
- B buried lack of inter-run fusion
- C ✓ surface breaking lack of sidewall fusion
- D surface porosity

11. Ultrasonic testing has an advantage over other NDT methods for the detection of

- A ✓ lack of side wall fusion
- B root undercut
- C incompletely filled groove
- D root concavity

12. Exceeding the maximum inter-pass temperature specified for a C-Mn steel weld joint, may give

- A excessive porosity
- B burn through
- C ✓ lower toughness
- D all of the above

13. MIG/MAG welding has a tendency to give lack of sidewall fusion when

- A spray transfer conditions are used
- B 100%CO₂ shielding gas is used
- C pulsed current is used
- D ✓ dip transfer conditions are used

14. The temperature range over which a steel goes from having high toughness to low toughness is called ...

- A the critical transformation temperature
- B the ductility dip temperature
- C the bi-modal temperature
- D ✓ the transition temperature

Please return this paper unmarked

15. For SAW, what is the effect of raising arc voltage but keeping with all other parameters the same ?

- A the weld bead width will increase
 B ✓ the depth of penetration will increase
 C the weld bead width will decrease
 D the depth of penetration will decrease

H.T.αV

16. Changing an essential variable (beyond the allowed limits) for a qualified welding procedure

- A may change the mechanical properties of the joint
 B may adversely affect the quality of the weld
 C will require a new welding procedure to be approved
 D ✓ all of the above

17. With reference to the various grades of stainless steels, which of the following statements is true ?

- A they are all non-magnetic
 B they all require 100% Ar for GMAW
 C they all have very high thermal conductivity
 D ✓ only certain grades can be used for service at very low temperatures

18. Which of the following AWS A5.1 electrodes has a rutile covering

- A E 6010
 B E 7016
 C E 7018
 D ✓ E 6013 ✓

12, 13 → Rutile 2, 3
 10, 11 → Cellulosic, 0, 1
 15, 16 → Basic, 5, 6

19. Welds made with very high heat input will show a reduction in

- A tensile ductility
 B ✓ notch toughness
 C fatigue strength
 D creep resistance

20. During PWHT of a complex fabrication, it is heated to the soak temperature at a much higher rate than specified by the procedure. This may

- A cause excessive oxidation
 B not allow sufficient time to relieve stresses
 C introduce excessive compressive stresses
 D cause distortion

21. When MAG welding in dip transfer mode (short-circuiting mode) spatter can be reduced by

- A ✓ using inductance
 B using 100% CO₂
 C using Ar + 30%He
 D increasing the stick-out length

22. Repair welding of in-service plant and equipment may be more difficult than making repairs during initial fabrication because

- A the material may be contaminated
 B of restricted access to repair area
 C positional welding may be needed
 D ✓ of any of the above

Please return this paper unmarked

23. For gamma radiography of a steel weld at 40mm thick, the recommended isotope is
- A Thulium 170 = 7mm
 - B Ytterbium 169 = 12mm
 - C ✓ Iridium 192 = 10-75mm
 - D ~~60~~ Cobalt 60 = 40-150mm
24. The sensitivity of a radiograph is assessed
- A by using a densitometer
 - B ✓ by using an image quality indicator (IQI)
 - C from the kVA used
 - D from stand-off used
25. A transverse tensile test, from a Weld Procedure Approval Record (WPAR) test plate, is used to measure
- A the tensile strength of the weld
 - B the tensile strength of the joint
 - C ✓ the stress/strain characteristics of the weld
 - D the stress/strain characteristics of the joint
26. The highest and lowest heat input positions are considered to be
- A PB highest; PA lowest
 - B PE highest; PC lowest
 - C PD highest; PB lowest
 - D ✓ PF highest; PG lowest
27. What type of covering will an electrode have that is suitable for welding 60mm C-Mn steel and can give good weld metal toughness at -50°C ?
- A rutile
 - B basic
 - C cellulosic
 - D choice will depend on the welding position
28. The dip transfer mode (or short-circuiting mode) of metal transfer used for MIG/MAG welding is characterised by
- A giving deep penetration
 - B ✓ being suitable for positional welding
 - C giving low spatter
 - D all of the above
29. Carbon equivalent values (CEV) are used to determine the how to avoid the risk of
- A hydrogen cracking
 - B lamellar tearing
 - C ✓ solidification cracking
 - D weld decay
30. When 2 different material types are welded together, the joint is referred to as
- A ✓ a composite joint
 - B a transition joint
 - C an autogenous weld
 - D all of the above

**WELDING INSPECTION
TRAINING ONLY**

MULTI CHOICE PAPER 1

Name: _____ **Date:** _____

Answer all questions. (ONLY ONE ANSWER PER QUESTION)

1. When "hydrogen control" is specified for a manual metal arc welding project the electrode would normally be:
- (a) Cellulosic _____
 - (b) Iron oxide _____
 - (c) Acid _____
 - (d) Basic _____
2. You would with certainty recognise a hydrogen controlled flux covered electrode from its :
- (a) Colour _____
 - (b) Length _____
 - (c) Trade Name _____
 - (d) AWS/BS639 Code Letter _____
3. When manual metal arc welding is being carried out on an open construction site, which group of welders are the most likely to require continuous monitoring?
- (a) Concrete shuttering welding teams _____
 - (b) Pipe welding team _____
 - (c) Plater welders _____
 - (d) Plant maintenance welders _____

4. You notice manual metal arc electrodes, stripped of flux, are being used as filler wire, for TIG welding. You would object because :
- (a) It is too expensive _____
 - (b) The wire would be too thick _____
 - (c) The weld metal composition may be wrong ✓
 - (d) The wire is too short _____
5. When open site working, serious porosity in metal arc welds is brought to your attention. What would you investigate ?
- (a) Electrode type _____
 - (b) Power plant type _____
 - (c) Electrode storage ✓
 - (d) Day temperature _____
6. The steel composition in a structural contract is changed from 0.15% carbon, 0.6% manganese, to 0.2% carbon, 1.2% manganese. Might this influence the incidence of :
- (a) Porosity _____
 - (b) Cracking in the weld area ✓
 - (c) Undercut for fillet welds _____
 - (d) Lack of root fusion defects _____
7. One of the following alloys is non-magnetic. Which ?
- (a) 4.0% Chromium molybdenum _____
 - (b) 12.0% Chromium _____
 - (c) Austenitic Stainless Steel ✓
 - (d) 9.0% Nickel Steel _____

8. When TIG welding Austenitic stainless steel pipe, Argon gas backing is called for. This is to :
- (a) Prevent oxidation
 - (b) Prevent underbead cracking
 - (c) Prevent porosity
 - (d) Control the penetration bead shape
9. Pre-heating a Carbon steel manual metal arc welding is carried out to **minimise** the risk of :
- (a) Scattered porosity
 - (b) Worm hole porosity
 - (c) Parent metal cracking
 - (d) Lack of penetration
10. In UK practice, BS499 Part 2 specifies that the minimum drawing dimension quoted for a fillet weld is the :
- (a) Leg length
 - (b) Actual throat thickness
 - (c) Weld width
 - (d) Depth of penetration
11. For open site manual metal welding the following equipment is available. Which would you choose for safe working?
- (a) Single operator transformer
 - (b) Multi operator transformers
 - (c) AC/DC composite power unit
 - (d) Diesel engine driven motor generator

12. The flux being used for a SAW application has been described as sharp or flaky. What type of flux would you expect this to be:
- (a) Basic _____
 - (b) Acid _____
 - (c) Fused _____
 - (d) Alkaline _____
13. During CO₂ welding, the arc length is most likely to be affected by:
- (a) The wire diameter _____
 - (b) The current return connections _____
 - (c) The gas flow rate _____
 - (d) The torch to work angle _____
14. Preheating for arc welding applies to:
- (a) Assembly welding only _____
 - (b) Assembly and tack welding _____
 - (c) Joints over 25mm thick only _____
 - (d) Cruciform welds only _____
15. You see a welder using an Oxy-acetylene flame with a long feathered inner cone. What would be the effect of this on a carbon steel.
- (a) The weld could be hard and brittle _____
 - (b) The weld metal could be too soft _____
 - (c) There will be no effect on the weld _____
 - (d) The weld will have undercut _____

16. A welder qualification test is to verify:
- (a) The skill of the welder
 - (b) The quality of the materials
 - (c) The non-destructive test procedures
 - (d) The manufacturing methods
17. A fabricating procedure calls for fillet welds to be "blended in" by grinding. This is to:
- (a) Remove Hydrogen cracking
 - (b) Improve fatigue life
 - (c) Remove undercut
 - (d) Improve yield strength
18. Bend test specimens have been taken from a 25mm thick, carbon steel butt weld. Which would show lack of inter-run fusion:
- (a) Side bend
 - (b) Root bend
 - (c) Face bend
 - (d) Guided bend
19. Lamellar tearing has occurred in a steel fabrication. Before welding could it have been detected by:
- (a) X-ray examination
 - (b) Dye penetrant
 - (c) Ultrasonic inspection
 - (d) It would not have been found by any inspection method

20. You are to oversee the arc welding of some machined fittings and find they are cadmium plated. Would you:
- (a) Permit it to proceed _____
- (b) Permit it to proceed with fume extraction _____
- (c) Stop the operation at once ✓
- (d) Advise the welder to drink milk and proceed _____
21. What is the leg length of a fillet weld?
- (a) The distance from the weld face to the penetration _____
- (b) The distance between the two toes _____
- (c) The distance from the original root to the toe ✓
- (d) The distance from penetration to the weld toe _____
22. The term duty cycle normally refers to:
- (a) The shift pattern of inspection staff _____
- (b) A monthly occurrence involving outage time _____
- (c) Output capability of a welding plant ✓
- (d) Component life expectancy _____
23. The throat dimension, measurable from the surface, of a mitre fillet weld having equal 20mm leg lengths will be:
- (a) 25mm $20 + 0.707 \times 20$ _____
- (b) 17mm _____
- (c) 14mm ✓
- (d) It cannot be determined form the information provided _____

24. Which of the following abbreviations is "the odd one out"?
- (a) GTAW ✓
 - (b) MMA *stick*
 - (c) SMAW
 - (d) GMAW
25. A typical included angle for MMA welding 15mm carbon steel, single V butt joints would be:
- (a) 35°
 - (b) 30°
 - (c) 70° ✓
 - (d) 120°
26. A pipeline girth weld has been made in the 5G position. In which region would you expect to find the highest heat input?
- (a) PA
 - (b) Flat
 - (c) PB
 - (d) PF ✓
27. What is the main reason for grinding flush single V butt welds, when specified?
- (a) To reduce component weight
 - (b) To remove all defects in the cap region
 - (c) To reduce the risk of Hydrogen cracking
 - (d) To reduce the likelihood of fatigue failure ✓

28. Plug welds are normally used to weld plates that:

- (a) Overlap
- (b) Have holes through both plates
- (c) Are to be 100% watertight
- (d) Have "P" shaped lifting lugs attached

29. Which of the following is a non planar defect:

- (a) Spheroidal graphite
- (b) Lack of penetration
- (c) Lamination
- (d) Slag inclusion

30. What is a typical diameter range for basic electrodes for all positional MMA Welding

- (a) 2.5 – 8mm
- (b) 0.8 – 1.2mm
- (c) 3.25 – 4mm
- (d) Size really does not matter

**WELDING INSPECTION
TRAINING ONLY****MULTI CHOICE PAPER 2****Name:** _____**Date:** _____**Answer all questions.**

1. Movement of the arc by magnetic forces in MMA welding is termed:
 - (a) Arc deviation _____
 - (b) Arc misalignment _____
 - (c) Arc blow _____
 - (d) Arc eye _____

2. A metallurgical problem most associated with submerged arc welding is:
 - (a) Hydrogen cracking in the HAZ _____
 - (b) Solidification cracking in the weld metal _____
 - (c) Hydrogen cracking in the weld metal _____
 - (d) Lamellar tearing in the weld metal _____

3. Oxy pressure and nozzle size would influence what in flame cutting:
 - (a) The temperature required for cut initiation _____
 - (b) The ability to cut stainless steels _____
 - (c) The depth of cut obtainable _____
 - (d) None of the above _____

- 4. The main usage of arc cutting/gouging processes is in:
 - (a) The cutting of single bevel preparations _____
 - (b) The removal of deposited welds _____
 - (c) The cutting of single U-type preparations _____
 - (d) The cutting/gouging of non-ferrous materials only _____

- 5. Which of the following processes is not a fusion welding process:
 - (a) Friction welding _____
 - (b) Resistance welding _____
 - (c) Plasma welding _____
 - (d) All of the above _____

- 6. Which electrode classification would be relevant to AWS A5.1-81:
 - (a) E 6013 _____
 - (b) E 5133 _____
 - (c) E 433N₁R _____
 - (d) E22553 _____

- 7. Which of the following MMA electrode coatings is associated with "Stove " welding:
 - (a) Rutile _____
 - (b) Cellulosic _____
 - (c) Fused _____
 - (d) Pipelex _____

8. A common gas/mixture used in MIG welding nickel alloys to combine good levels of penetration with good arc stability would be:
- (a) 100% CO₂ _____
 - (b) 100% argon _____
 - (c) 80% argon 20% CO₂ _____
 - (d) 98% argon 2% oxygen _____
9. The type of SAW flux is more resistant to moisture absorption is:
- (a) Fused _____
 - (b) Agglomerated _____
 - (c) Basic _____
 - (d) All of about the same resistance _____
10. The flame temperature of oxygen/acetylene gas mixture is given as:
- (a) 3200°C _____
 - (b) 2300°C _____
 - (c) 5000° _____
 - (d) None of the above _____
11. A large grain structure in steels is said to produce:
- (a) Low ductility values _____
 - (b) Low fracture toughness values _____
 - (c) High fracture toughness values _____
 - (d) High tensile strength _____

12. The likelihood of brittle fracture in steels will increase with:
- (a) A large grain formation _____
 - (b) A reduction of in-service temperature to sub zero levels _____
 - (c) Ferritic rather than austenitic steels _____
 - (d) All of the above _____
13. Repair welding is often more difficult than production due to:
- (a) The material being ingrained with in-service contaminates _____
 - (b) Restricted access within the repair area _____
 - (c) The possible position of the weld repair _____
 - (d) Any of the above _____
14. Hydrogen cracking is most likely when welding:
- (a) Carbon manganese steels _____
 - (b) Stainless steels _____
 - (c) Micro alloyed steels (HSLA) _____
 - (d) Low carbon steels _____
15. EN standard 288 would refer to which of the following:
- (a) Welder approval testing _____
 - (b) Welding equipment _____
 - (c) Welding procedure approval _____
 - (d) Weld symbols on drawings _____

16. Porosity is caused by:
- (a) Entrapped slag in the solidifying weld _____
 - (b) Entrapped gas in the solidifying weld _____
 - (c) Entrapped metallic inclusions in the solidifying weld _____
 - (d) None of the above _____
17. In a bend test, the face of the specimen is in tension and root is in compression; the type of test being carried out would be:
- (a) A root bend test _____
 - (b) A side bend test _____
 - (c) A face bend test _____
 - (d) None of the above _____
18. Ultrasonic testing is of advantage in detecting which of the following weld imperfections over other NDT methods:
- (a) Lack of side wall fusion _____
 - (b) Surface undercut _____
 - (c) Incompletely filled groove _____
 - (d) Overlap _____
19. The process of tempering is often carried out to regain toughness after which of the following processes:
- (a) Annealing _____
 - (b) Normalising _____
 - (c) Hardening _____
 - (d) Stress relieving _____

20. The presence of iron sulphide in the weld metal is most likely to produce which of the following upon contraction of the weld:
- (a) Solidification cracking _____
 - (b) Hydrogen cracking _____
 - (c) Intergranular corrosion _____
 - (d) Stress corrosion cracking _____
21. A welding procedure that has yet to undergo testing is referred to as:
- (a) WPS _____
 - (b) WPRT _____
 - (c) WPSut . _____
 - (d) None of the above _____
22. SMAW welding equipment is said to have an output characteristic that is:
- (a) Flat _____
 - (b) Constant current _____
 - (c) Constant voltage _____
 - (d) Either b or c _____
23. Which of the following materials is most likely to require the highest levels of cleaning immediately prior to welding:
- (a) Low carbon steel _____
 - (b) Carbon manganese steel _____
 - (c) Austenitic stainless steel _____
 - (d) All about the same _____

24. What is the maximum allowable HI/LO for 8mm material if the code states the following-

“Linear misalignment is permissible if the maximum dimension does not exceed 10% of t up to a maximum of 2mm”

- (a) 2mm _____
- (b) 8.8mm _____
- (c) 0.8mm _____
- (d) I could not sentence this defect as an incorrect term has been used _____

25. When visually inspecting the root of a pipe weld, in a single V butt, with the cap ground flush. You have identified root concavity, which has a depth of 0.5 mm .The application standard you are using contains the following statement:

“Root concavity shall be acceptable provided the density of the radiographic image does not exceed that of the parent material”

Which of the following is correct:

- (a) You must have the pipe radiographed _____
- (b) Sentencing may only be performed by a qualified radiographic interpreter _____
- (c) It should be rejected _____
- (d) You should accept, as there is no radiograph to view _____

26. Which of the following statements is correct regarding gas welding low carbon steel:

- (a) It will give a low heat input _____
- (b) Acetylene or propane are normally used as fuel gasses _____
- (c) A low skill level is required to produce sound welds _____
- (d) It may be used for autogenous welding _____

27. The code you are using gives the following formula for the maximum penetration allowance:

$$h \leq 1\text{mm} + 0.6 b \text{ up to a maximum of } 4\text{mm}$$

(Where "h" is the penetration height and "b" is the penetration width)

Which of the following root heights is acceptable?

- (a) $h = 0.5\text{mm}$ $b = 5.0\text{mm}$ _____
- (b) $h = 4.6\text{mm}$ $b = 6.0\text{mm}$ _____
- (c) $h = 3.8\text{mm}$ $b = 4.0\text{mm}$ _____
- (d) None of the above _____

28. Which of the following statements is correct:

- (a) Copper inclusions are usually grouped with slag and other Solid inclusions for sentencing purposes _____
- (b) Undercut lengths at both weld toes in the same longitudinal Location are added together for sentencing purposes _____
- (c) A measurement for maximum penetration height is always specified in Application standards _____
- (d) None of the above _____

29. According to BS 499 a weld on the "other side" is shown by a symbol:

- (a) On the dotted line _____
- (b) Below the reference line _____
- (c) On the solid line _____
- (d) Above the reference line _____

30. What defect would appear as "bright white specks" on a radiograph?

- (a) Gas pores _____
- (b) Slag inclusions _____
- (c) Tungsten inclusions _____
- (d) Undercut _____

**WELDING INSPECTION
TRAINING ONLY****MULTI CHOICE PAPER 3**

Name: _____

Date: _____

Answer all questions.

1. The BS EN code for welder approvals is:
- (a) BS EN 4872 _____
 - (b) BS EN 499 _____
 - (c) BS EN 287 _____
 - (d) None of the above _____
2. A Code of Practice for Visual Inspection should cover the following:
- (a) Before, during and after welding activities _____
 - (b) Before welding activities only _____
 - (c) After welding activities only _____
 - (d) None of the above _____
3. Incomplete root penetration in a butt joint could be caused by:
- (a) Excessive root face width _____
 - (b) Excessive root gap size _____
 - (c) Low current setting _____
 - (d) Both A & C _____

- 4. Incomplete root fusion would certainly be caused by:
 - (a) Linear misalignment _____
 - (b) Incorrect tilt angle _____
 - (c) Differing root face widths _____
 - (d) All of the above _____

- 5. Which of the following tests would you normally expect a test house to use for the assessment of HAZ hardness, for procedure approval in the UK:
 - (a) Rockwell _____
 - (b) CTOD _____
 - (c) Brinell _____
 - (d) Vickers _____

- 6. You notice a very "veed" ripple shape. This may indicate:
 - (a) Poor consumable choice _____
 - (b) The use of a fully automated welding process _____
 - (c) Excessive travel speed _____
 - (d) Both b and c _____

- 7. "Toe Blending" is important as it may affect:
 - (a) Toughness _____
 - (b) Fatigue life _____
 - (c) Penetration _____
 - (d) All of the above _____

- 8. Slag inclusions may occur with:
 - (a) Manual Metal arc _____
 - (b) Metal Inert gas _____
 - (c) Submerged arc welding _____
 - (d) Both A & C _____

- 9. Undercut may be caused by:
 - (a) Excessive amps _____
 - (b) Excessive volts _____
 - (c) poor weaving technique in vertical position with MMA _____
 - (d) All of the above _____

- 10. Which of the following materials would be considered to represent the greatest problem from a weldability aspect when using SMAW:
 - (a) Carbon Manganese with CE of 0.28 _____
 - (b) Free machining steel _____
 - (c) Carbon Manganese with CE of 0.45 _____
 - (d) Low carbon steel _____

- 11. The abbreviation PQR is otherwise known as:
 - (a) Provisional Qualification Record _____
 - (b) WPAR _____
 - (c) Personnel Qualification Record _____
 - (d) WQT _____

12. An alteration of an essential variable may:
- (a) Change the properties of the weld _____
 - (b) Influence the visual acceptability _____
 - (c) Require re-approval of a weld procedure _____
 - (d) All of the above _____
13. Weld samples prepared for micro examination would typically require a finish to which of the following levels:
- (a) 1200 grit _____
 - (b) 500 grit _____
 - (c) 3000 grit _____
 - (d) 3 micron _____
14. When visually inspecting a fillet weld, it would normally be "sized" by:
- (a) The leg lengths _____
 - (b) The actual throat thickness _____
 - (c) The design throat thickness _____
 - (d) Both A & C _____
15. Which of the following relate to the term "planar defect":
- (a) A lamination _____
 - (b) A serious defect likely to lead to failure of the product _____
 - (c) Slag inclusion _____
 - (d) Both a and b _____

16. Penetrant inspection and magnetic particle inspection are mainly used to:
- (a) Aid visual inspection _____
 - (b) Because the application standard says so _____
 - (c) To confirm "visual uncertainties" _____
 - (d) All of the above _____
17. Defects outside of the limits specified in a standard should always be:
- (a) Repaired _____
 - (b) Reported to "a senior person" _____
 - (c) Radiographed _____
 - (d) All of the above _____
18. When MIG welding aluminium alloy in the overhead position which current type would normally be expected to be used:
- (a) AC _____
 - (b) DC negative _____
 - (c) Drooping _____
 - (d) DC positive _____
19. Manual metal arc electrodes can be grouped into three main types. These are:
- (a) Basic, cellulosic and rutile _____
 - (b) Neutral, cellulosic and rutile _____
 - (c) Basic, cellulosic and neutral _____
 - (d) Fused, agglomerated and basic _____

20. Which of the following defects would normally be considered to be not detectable by Radiography:
- (a) 2 mm deep/4mm long centreline cracking in weld root _____
 - (b) 200 mm long Lamination _____
 - (c) 10 mm deep lack of sidewall fusion on a single U butt _____
 - (d) Gas poor 1.5mm \varnothing _____
21. Cracks in welds may be due to:
- (a) Solidification problems _____
 - (b) Hydrogen problems _____
 - (c) Excessive stresses _____
 - (d) All of the above _____
22. Welding a single V butt with laminations showing on the sidewall may give rise to:
- (a) Lamellar tearing _____
 - (b) Solidification cracking _____
 - (c) Martensite _____
 - (d) Undercut _____
23. With reference to a root penetration bead, you could certainly assess:
- (a) Root fusion and penetration _____
 - (b) Toe blend _____
 - (c) Overlap _____
 - (d) All of the above _____

24. A welded product has failed in service. This has been confirmed as being caused by material overload due to a design fault. What would you expect the appearance of the fracture surface to be?
- (a) Rough and torn _____
 - (b) Flat and crystalline _____
 - (c) Flat and very smooth _____
 - (d) Showing beach marks _____
25. "Stray arcing" may be regarded as a serious defect. This is because:
- (a) It may reduce the thickness dimension of a component _____
 - (b) It may cause liquation cracks _____
 - (c) It may cause hard zones _____
 - (d) All of the above _____
26. Overlap in welds is :
- (a) A non planar defect _____
 - (b) Where the 2 plates to be joined are overlapping _____
 - (c) Lack of fusion defect found in the root or cap region _____
 - (d) Another name for linear misalignment _____
27. Flame cut edges would normally be required to be ground back to a distance specified in a procedure because:
- (a) If the HAZ is left on the prep it may result in weld decay In service _____
 - (b) The HAZ would have become sensitised _____
 - (c) There is a strong potential for hardening in this region _____
 - (d) To reduce weight loading on the completed structure _____

- 28. Macroscopic examination requires any specimen to be inspected:
 - (a) Once, after etching _____
 - (b) During preparation and after etching _____
 - (c) Using a microscope _____
 - (d) By penetrant inspection _____

- 29. Which of the following may be classed as a "more serious defect":
 - (a) Slag inclusions _____
 - (b) Fusion defects (interun) _____
 - (c) Fusion defects (surface) _____
 - (d) Porosity _____

- 30. A code of practice is:
 - (a) A standard for workmanship only _____
 - (b) A set of rules for manufacturing a specific product _____
 - (c) Levels of acceptability of a weldment _____
 - (d) None of the above _____

**WELDING INSPECTION
TRAINING ONLY**

MULTI CHOICE PAPER 4

20 questions total

Name: _____

Date: _____

Answer all questions.

1. Which of the following would be a typical MAG, individual pass, heat input

(a) 1.2 j/mm	_____
(b) 65 kj/mm	_____
(c) 6.5 kj/mm	_____
(d) 1.2 kj/mm	_____

2. The term "Skip" refers to what in welding/fabrication terms ?

(a) A production scheduling term	_____
(b) A secure location for quarantined goods	_____
(c) An Australian marsupial	_____
(d) A run sequence	_____

3. A prod may be used for which NDT process

(a) Eddy current	_____
(b) Radiography	_____
(c) Ultrasonic testing.	_____
(d) Magnetic particle inspection	_____

4. Which of the following is a typical electrode classified as E7016 according to AWS 5.1

(a) Iron powder electrodes	_____
(b) Rutile electrode	_____
(c) Cellulosic electrode	_____
(d) Basic electrode	_____

5. During TIG welding the arc voltage is controlled by:
- a. The welder _____
 - b. The voltage control on the power source _____
 - c. The power source giving out a constant voltage _____
 - d. The electrode polarity _____
6. Which one of the following statements is correct:
- (a) SMAW may use either AC or DC _____
 - (b) GTAW may use either AC or DC _____
 - (c) SAW may use both AC and DC _____
 - (d) All of the above _____
7. Suckback is a commonly slang term used to describe:
- (a) Lack of penetration _____
 - (b) Root concavity _____
 - (c) Underfill _____
 - (d) Incomplete root penetration _____
8. A typical temperature specifically for hydrogen removal for a carbon – manganese weldment is:
- (a) 150⁰C _____
 - (b) 600⁰C _____
 - (c) 350⁰C _____
 - (d) 900⁰C _____
9. A typical angle of bevel used for MAG welding 12mm carbon steel could be:
- (a) 120° _____
 - (b) 35° _____
 - (c) 70° _____
 - (d) 90° _____
10. In arc welding processes, excess weld metal profile is mostly affected by:
- (a). Arc length _____
 - (b). Open circuit voltage _____
 - (c). Amperage _____
 - (d). Root gap _____

11. "Autogenous welding" basically means:

- (a) Fully automated process _____
- (b) Fusion welding _____
- (c) Fully mechanised process _____
- (d) Welding without filler wire _____

12. According to ISO 2553 which of the following symbols represents a permanent backing strip:-

(a)

MR

 a. _____

(b)

M

 b. _____

(c)

PB

 c. _____

(d) None of the above d. _____

13. Which of the following radioactive terms do we not normally associate with NDT

- (a) Gamma _____
- (b) Cobalt 60 _____
- (c) Thorium _____
- (d) Iridium 192 _____

14. Which submerged arc flux may be described as "powdery" or "ball like"?

- (a) Basic _____
- (b) Fused _____
- (c) Agglomerated _____
- (d) Acid _____

15. During visual inspection of a fillet weld with even leg lengths of 15mm and a throat measurement of 9mm . A cross section is not available. The weld profile is:
- (a) Concave _____
 - (b) Convex _____
 - (c) Mitre _____
 - (d) Not able to be determined _____
16. Which of these statements relating to carbon steels is false :
- (a) High heat input results in high hardness _____
 - (b) High heat input may result in large grains _____
 - (c) Loss of toughness may result from weaving _____
 - (d) Toughness may be restored by normalising _____
17. Which of the following parameters presents the welding inspector with the greatest difficulty to monitor during fully manual welding operations?
- (a) Current _____
 - (b) Travel speed _____
 - (c) Arc length _____
 - (d) Interpass temperature _____
18. You are the only welding inspector overseeing 4 welding stations, producing circumferential single V butt welds on a pipeline. For which of the following stages would you consider your closest scrutiny to be required?
- (a) Completion of capping run _____
 - (b) Cleaning of completed weld _____
 - (c) Radiography _____
 - (d) Root pass deposition _____
19. Which of the following processes would be potentially most capable of producing weldments that are low in H₂
- (a) MMA using basic type electrodes _____
 - (b) SAW using correctly treated flux _____
 - (c) Electron Beam _____
 - (d) MIG _____
20. Which of the following tests would you normally not expect to be performed during a welder approval test?
- (a) Bend _____
 - (b) Nick break _____
 - (c) Macro _____
 - (d) Tensile _____