

RED SEAL EXAM PREP

456A Welder

Free 49-Question Mock Exam

Practice for the Red Seal / Certificate of Qualification exam

Pass mark: 70% · Aligned to the published occupational standard topic weightings
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Mock Exam — answer all questions, then check the key

Q1. Which filler metal is used for GTAW of chrome-moly (Cr-Mo) steel such as P91?

- A) ER4043
- B) ER308L
- C) ER70S-2
- D) ER90S-B9

Q2. Which GMAW problem is indicated by a "stuttering" or irregular wire feed with a popping arc?

- A) Incorrect polarity
- B) Voltage set too high
- C) Shielding gas flow rate too low
- D) A wire feeding problem

Q3. Why is AC polarity used for GTAW of aluminum?

- A) AC reduces heat input for thin aluminum
- B) AC prevents tungsten contamination
- C) The EP half-cycle removes the aluminum oxide layer
- D) AC provides deeper penetration than DCEN

Q4. What is the main characteristic of an E6010 electrode?

- A) High cellulosic coating, deep penetration, DCEP only
- B) Iron powder coating, high deposition rate
- C) Low hydrogen, requires dry storage
- D) Rutile coating, easy slag removal, AC or DC

Q5. What does WHMIS stand for?

- A) Workplace Hazardous Materials Information System
- B) Welding Health and Material Inspection Standards
- C) Workshop Handling & Machinery Inspection Safety
- D) Workplace Hazard Management and Inspection Sheet

Q6. What is the difference between a groove weld and a fillet weld?

- A) Groove welds are used for lap joints; fillet welds are used for butt joints
- B) Groove welds require GTAW; fillet welds can use SMAW only
- C) Groove welds are partial penetration only; fillet welds are always full penetration
- D) Groove welds fill a prepared groove; fillet welds join surfaces at an angle

Q7. What is the function of anti-spatter spray in GMAW?

- A) To reduce oxidation of the weld pool
- B) To improve shielding gas coverage
- C) To keep spatter from sticking to the nozzle
- D) To lubricate the wire liner

Q8. Low-hydrogen electrodes (E7018) must be stored in:

- A) A freezer to prevent oxidation
- B) A heated rod oven at 120–150°C (250–300°F)
- C) A sealed plastic bag at room temperature
- D) Any dry location away from direct sunlight

Q9. Excessive spatter in FCAW-G is most likely caused by:

- A) Base metal temperature too high
- B) Wire stickout too short
- C) Arc voltage set too low
- D) Shielding gas flow rate too high

Q10. Which GMAW transfer mode requires the highest arc voltage to achieve?

- A) Short circuit transfer
- B) Spray transfer
- C) Pulsed spray transfer
- D) Globular transfer

Q11. What is the meaning of "T" and "1" in the E71T-1 classification?

- A) T = Tubular electrode, 1 = usable with CO₂ gas and DCEP
- B) T = Tubular electrode, 1 = single-pass only
- C) T = Titanium flux coating, 1 = one-inch wire diameter
- D) T = Travel direction, 1 = flat position only

Q12. A welder notices the electrode holder cable insulation is cracked. The correct action is:

- A) Reduce amperage to lower risk
- B) Wrap the crack with electrical tape and continue
- C) Replace the cable before continuing work
- D) Continue welding if the crack is small

Q13. What is the leg of a fillet weld?

- A) The total length of the fillet weld deposit
- B) The distance from the weld root to the toe
- C) The total depth of penetration into the base metal
- D) The height of the weld reinforcement above the base metal

Q14. In oxyfuel cutting (OFC), what initiates the cutting action?

- A) The acetylene flame melting the metal
- B) An electric arc combined with oxygen
- C) The heat from the preheat flames alone
- D) A high-pressure jet of pure oxygen

Q15. ER70S-6 wire has higher silicon and manganese content than ER70S-3. Why?

- A) To add deoxidizers for welding slightly rusty surfaces
- B) To enable AC power source compatibility
- C) To allow welding with 100% CO₂ shielding gas only
- D) To increase tensile strength above 80 ksi

Q16. What causes excessive drag lines (curved) on an OFC cut face?

- A) Cutting speed too fast
- B) Oxygen pressure too high
- C) Tip size too small for metal thickness
- D) Preheat flames too large

Q17. What is globular transfer in GMAW and when does it occur?

- A) Transfer where the wire dips into the molten pool at low voltage
- B) Transfer of very fine droplets at high current — preferred for production welding
- C) Transfer of large droplets at intermediate voltage — high spatter
- D) Transfer mode unique to pulsed GMAW at low background current

Q18. What is dual-shield FCAW?

- A) Using two separate flux-cored wires simultaneously
- B) Using FCAW with a back-purge gas system
- C) FCAW using both inner and outer flux coatings
- D) FCAW using both core flux and external shielding gas

Q19. What is the effect of increasing arc length in SMAW beyond the optimal distance?

- A) Increases penetration
- B) Improves fusion at the weld toes
- C) Reduces heat input
- D) Causes porosity and spatter

Q20. What is the purpose of the high-frequency (HF) start in GTAW?

- A) To generate the shielding gas ionization
- B) To start the arc without touching the workpiece
- C) To provide the cleaning action for aluminum
- D) To increase amperage for thicker material

Q21. What is the minimum ventilation requirement for indoor welding of mild steel?

- A) A window must be open
- B) No ventilation needed below 100 A
- C) 2,000 cfm per welder
- D) 1,000 cfm per welder

Q22. What does "walking the cup" technique mean in GTAW?

- A) Bracing the nozzle cup against the base metal and rocking it to move the torch steadily
- B) Moving the torch in a circular pattern to spread heat evenly
- C) Using an oscillating motion of the filler rod during addition
- D) Moving the torch in a back-and-forth pattern to prevent burn-through

Q23. E6013 is preferred for welding thin sheet metal because:

- A) It produces a hard slag that prevents porosity
- B) It provides maximum penetration into thin material
- C) It has a soft arc, easy slag removal, and works on AC or DC
- D) It generates the highest amperage range

Q24. What does "stringer bead" mean in multi-pass welding?

- A) A wide weave bead deposited side to side
- B) A narrow bead deposited with no side-to-side motion
- C) A bead deposited in the vertical-up position
- D) The final cap pass over a multi-pass weld

Q25. What causes "sugaring" (oxidation/discolouration) on the back side of a stainless steel GTAW root pass?

- A) Using the wrong filler wire for the base metal
- B) Lack of back purge on the root side
- C) Insufficient post-flow gas time
- D) Excessive heat input from high amperage

Q26. What is the purpose of preheating steel before SMAW?

- A) To increase the deposition rate
- B) To slow the cooling rate of the joint
- C) To improve slag fluidity for easier removal
- D) To increase arc voltage

Q27. What is "burn-back" in GMAW?

- A) The wire burning back to the contact tip
- B) Undercutting at high wire feed speeds
- C) Porosity from shielding gas loss
- D) Excessive spatter on the base metal

Q28. What do AWS welding symbols indicate?

- A) The electrode classification and storage requirements
- B) The brand of welding machine to use
- C) The welding process and shielding gas to use
- D) The type, size, and location of a weld on a drawing

Q29. Carbon equivalent (CE) formula is used to determine:

- A) The hardenability and preheat requirement
- B) The carbon content of the weld metal
- C) The tensile strength of the completed weld
- D) The post-weld heat treatment temperature

Q30. What type of tungsten tip preparation is used for GTAW on steel with DCEN?

- A) A split (notched) tip
- B) A sharp tapered point
- C) A flat-ground tip
- D) A rounded ball tip

Q31. What is the purpose of the liner in a GMAW torch?

- A) To cool the contact tip
- B) To guide the wire to the contact tip
- C) To regulate shielding gas flow
- D) To insulate the torch from the work cable

Q32. What does "DCEP" mean in SMAW?

- A) Direct Current Electrode Positive — electrode is negative, work is positive
- B) Direct Current Electrode Polarity — applies only to AC welding
- C) Direct Current Electrode Positive — electrode is positive, work is negative
- D) Dual Current Electrode Positive — allows both AC and DC

Q33. What is the neutral flame setting in oxyfuel welding?

- A) Oxygen valve fully open, acetylene barely open
- B) Excess oxygen, no feather
- C) Equal volumes of oxygen and acetylene
- D) Excess acetylene, large feather present

Q34. Welding cable size is selected based on:

- A) The type of electrode being used
- B) The amperage and duty cycle
- C) The length of the cable only
- D) The colour of the insulation

Q35. What is a flashback in oxyfuel equipment?

- A) Backfire from high acetylene flow
- B) Excess pressure causing the regulator to fail
- C) The flame burning back into the torch or hoses
- D) The flame going out due to low gas pressure

Q36. Which shielding gas mixture is most commonly used for GMAW of mild steel?

- A) 50% Argon / 50% Helium
- B) 100% carbon dioxide
- C) 75% Argon / 25% CO₂
- D) 100% Argon

Q37. What is hydrogen-induced cracking (HIC) and which electrode type is most susceptible?

- A) Cracking from dissolved hydrogen in the HAZ; high-cellulosic electrodes most susceptible
- B) Cracking from slag entrapment; iron powder electrodes most susceptible
- C) Cracking from high amperage; rutile electrodes most susceptible
- D) Cracking from fast cooling; low-hydrogen electrodes most susceptible

Q38. What is the gas lens in a GTAW torch?

- A) A mesh screen that produces smooth, laminar gas flow
- B) A lens that focuses the arc onto a smaller area for precision
- C) A glass lens that focuses the shielding gas into a beam
- D) A gas pressure regulator built into the torch body

Q39. What is the approximate spray transition current for ER70S-6 wire (0.9 mm / 0.035") with 98% argon / 2% oxygen shielding gas?

- A) Spray transfer is possible with any gas above 200 A
- B) Approximately 230–250 A
- C) Approximately 165 A
- D) Approximately 80–100 A

Q40. What polarity is typically used for FCAW-G?

- A) DCEN for indoor, DCEP for outdoor
- B) DCEP (electrode positive)
- C) AC
- D) DCEN (electrode negative)

Q41. What causes a "crater crack" at the end of a SMAW weld?

- A) Rapid contraction of the pool at arc break
- B) Using DCEN instead of DCEP
- C) Excessive amperage throughout the weld
- D) Moisture in the low-hydrogen electrode coating

Q42. What is the purpose of a Charpy V-notch impact test?

- A) To measure the tensile strength of the weld metal
- B) To measure the hardness of the HAZ
- C) To measure porosity in the weld cross-section
- D) To measure the toughness of the weld at a set temperature

Q43. Welding on a container that previously held flammable liquid is safe when:

- A) The liquid has been removed and the container rinsed with water
- B) The welder works quickly to minimize heat input
- C) The container has been aired out for 24 hours
- D) The container has been purged, tested, and certified flammable-gas free

Q44. What colour coding identifies a pure tungsten electrode (EWP)?

- A) Green
- B) Grey
- C) Red
- D) Gold (yellow)

Q45. What does CTWD stand for in GMAW?

- A) Circuit Travel Wire Direction
- B) Contact Tip to Work Distance
- C) Current to Wire Diameter ratio
- D) Contact Tip Wear Detection

Q46. What type of slag system does E71T-1 flux-cored wire use?

- A) Cellulosic slag — deep penetrating, used outdoors
- B) Iron powder — high deposition rate for flat/horizontal only
- C) Basic slag — used for positional welding with DCEN
- D) Rutile slag — fluid, easily removed, all-position

Q47. What is the Heat Affected Zone (HAZ) in welding?

- A) The weld metal itself (the fusion zone)
- B) The area preheated before welding
- C) Base metal altered by welding heat but not melted
- D) The area of the weld that is shielded by gas

Q48. During OFC, the tip-to-work distance is increased. What effect does this have?

- A) Reduces preheat effectiveness at the cut
- B) Narrows the kerf and improves cut quality
- C) Has no effect on cut quality
- D) Increases preheat and reduces cut quality

Q49. A welder is welding in a low-lying area and notices dizziness. The most likely hazard is:

- A) UV radiation causing nausea
- B) Oxygen displacement by argon or CO₂
- C) Carbon monoxide from the electrode coating
- D) Nitrogen narcosis from shielding gas

Answer Key & Explanations

Q1. Answer: D

P91 (9% Cr, 1% Mo) creep-resistant steel requires matching filler metal ER90S-B9 (or equivalent). Standard carbon steel or stainless filler would produce mismatched mechanical properties.

Q2. Answer: D

Irregular wire feed causes the arc to stutter and pop. Causes include a kinked liner, contaminated wire, worn or mis-grooved drive rolls, or wire drive tension issues.

Q3. Answer: C

Aluminum has a tenacious oxide layer (Al_2O_3 , melting point 2050°C) that prevents fusion. During the electrode positive (DCEP) half of AC, electrons flow from the work to the electrode, breaking up the oxide — this is cathodic cleaning.

Q4. Answer: A

E6010 has a high-cellulosic sodium coating that produces a forceful, deep-penetrating arc. It requires DCEP and is ideal for root passes on pipe and dirty/rusty steel.

Q5. Answer: A

WHMIS (Workplace Hazardous Materials Information System) is Canada's national hazard communication standard for hazardous products.

Q6. Answer: D

A groove weld occupies a groove or gap prepared in the base metal (butt joint). A fillet weld is a triangular cross-section weld joining surfaces at approximately 90° (T-joint, lap joint, corner joint).

Q7. Answer: C

Anti-spatter spray is applied to nozzles and workpiece surfaces to prevent spatter from adhering and bonding. It reduces nozzle cleaning frequency and cleanup time.

Q8. Answer: B

Low-hydrogen electrodes absorb moisture rapidly. Storage in a rod oven at $120\text{--}150^\circ\text{C}$ prevents moisture pickup and keeps hydrogen content low ($<5\text{ mL}/100\text{g}$).

Q9. Answer: C

Low arc voltage relative to wire feed speed causes an unstable arc and excessive spatter in FCAW-G. Proper voltage-WFS balance is critical. Also, 100% CO_2 produces more spatter than Ar/ CO_2 mixes.

Q10. Answer: B

Spray transfer requires voltage typically in the range of 26–40V combined with current above the spray transition threshold (which varies by wire diameter and shielding gas — for 0.9mm wire with Ar/CO₂ 75/25, roughly 200–250A). Below this transition, metal transfers in globular mode regardless of voltage. The spray transition is lowered (easier to achieve) with higher argon content in the shielding gas — which is why 100% CO₂ cannot achieve true spray transfer (CO₂ elevates the transition to beyond practical current levels). Wrong answers: low voltage (14–19V) produces short-circuit transfer, not spray; medium voltage (19–22V) is the globular range. For Red Seal: if a question shows 100% CO₂ + high voltage, the answer is globular — not spray.

Q11. Answer: A

E71T-1 classification: E=electrode; 7=70,000 psi (480 MPa) minimum tensile strength; 1=all-position (the '1' after the T confirms flat/horizontal/vertical-up/overhead capability); T=tubular wire (flux-cored); -1=usability designator specifying suitability for CO₂ or Ar/CO₂ shielding gas, DCEP polarity, and fluid fast-freezing slag. Common exam trap: E71T-11 (no external shielding gas — self-shielded FCAW) vs E71T-1 (requires external gas — FCAW-G). Self-shielded FCAW-S cannot be used for most structural work per CSA W59/AWS D1.1 without engineering approval. Wrong answers often confuse the '1' position digit with the flux type, or confuse T (tubular) with S (solid wire in GMAW nomenclature). Always check -G (gas-shielded) vs -S (self-shielded) designator on the wire classification.

Q12. Answer: C

Damaged insulation creates electrocution and fire hazard. Equipment must be repaired or replaced before use.

Q13. Answer: B

The leg of a fillet weld is the distance from the root of the joint to the toe of the weld, measured along the fusion face. For an equal-leg fillet, both legs are the same length.

Q14. Answer: D

OFC works by preheating steel to kindling temperature (~870°C/1600°F), then directing a high-pressure oxygen jet at the preheated metal to oxidize (burn) it rapidly.

Q15. Answer: A

Silicon (Si) and manganese (Mn) are deoxidizers. ER70S-6's higher Si/Mn content scavenges oxygen from the weld pool, improving weld quality on slightly rusty or dirty base metal and giving better wetting.

Q16. Answer: A

When travel speed is too fast, the oxygen jet cannot cut through the full thickness vertically, causing the cut to lag behind and produce curved drag lines.

Q17. Answer: C

Globular transfer occurs at intermediate voltages between short circuit and spray thresholds. Large irregular droplets — bigger than the wire diameter — form and fall into the pool, causing significant spatter. Generally avoided in production.

Q18. Answer: D

Dual-shield FCAW (FCAW-G) uses flux inside the wire core AND external shielding gas for superior weld quality. This produces high-quality, low-hydrogen welds with excellent mechanical properties — common in structural and offshore applications.

Q19. Answer: D

Longer arc length increases arc voltage and heat, but also exposes the molten weld pool to atmospheric contamination, causing porosity and spatter. Proper arc length equals electrode diameter.

Q20. Answer: B

HF start initiates the arc via a high-frequency spark across the gap between the electrode and workpiece — no contact required. This prevents tungsten contamination and electrode tip damage.

Q21. Answer: C

ANSI Z49.1 (Safety in Welding and Cutting) and OSHA 1910.252(c)(2) specify a minimum of 2,000 cfm (approximately 57 m³/min) of fresh air per welder for mild steel welding to dilute and remove welding fumes. This mechanical ventilation requirement applies when the space is less than 10,000 cubic feet per welder, the ceiling height is less than 16 feet, or the area is partitioned so cross-ventilation is obstructed. This is a general ventilation threshold — local exhaust ventilation (LEV/fume extraction gun) is preferred as it captures fumes at source and requires less total airflow. Wrong answers: 500 cfm is far too low for safe dilution; 10,000 cfm is appropriate for confined spaces or heavy-fume processes, not typical workshop SMAW. When welding coated, galvanized, or stainless steel, local exhaust is mandatory regardless of general ventilation levels because toxic fumes (zinc oxide, hexavalent chromium) exceed threshold limit values even with 2,000 cfm dilution.

Q22. Answer: A

"Walking the cup" means bracing the ceramic nozzle against the pipe and using a rocking or rolling motion to move the torch. This provides a stable torch angle and consistent arc length for pipe welding.

Q23. Answer: C

E6013 (rutile-coated) produces a soft arc, light spatter, easy slag removal, and shallow penetration — making it ideal for thin sheet metal where burn-through is the primary risk. Wrong answers: E6010 and E6011 have deep penetration and forceful arc (designed for root passes and pipe), which would easily burn through thin material. E7018 (low-hydrogen) is excellent for structural work but requires an oven and produces a broader bead; it is not the preferred choice for light gauge sheet. E6013's easy restriking and smooth bead also make it a good learning electrode, but its low penetration means it's NOT suitable for code-quality root passes or high-strength joints where full fusion is required.

Q24. Answer: B

A stringer bead is a narrow, straight pass with no side-to-side weaving motion. It provides better mechanical properties (especially toughness) than a wide weave bead.

Q25. Answer: B

"Sugaring" is a rough, oxidized surface on the weld root caused by atmospheric oxygen reacting with chromium in the hot metal, forming chromium oxides (Cr_2O_3) and depleting the corrosion-resistant chromium from the surface.

Q26. Answer: B

Preheat slows the cooling rate of the HAZ, reducing hardness and the risk of hydrogen-induced cracking, especially in high-carbon or low-alloy steels.

Q27. Answer: A

Burn-back occurs when the wire electrode burns back and fuses to the contact tip, stopping the weld. Caused by low wire feed speed relative to voltage.

Q28. Answer: D

AWS A2.4 welding symbols communicate weld type, size, length, location, and finishing requirements on engineering drawings without written notes. Key elements: the reference line is horizontal — symbol below the line = arrow side weld; symbol above = other side weld; both sides = weld both sides. The tail contains welding process or specification reference. Common Red Seal exam traps: a flag on the reference line = field weld; a filled circle at the arrow-reference line junction = weld all around; finish symbols (G=grind flush, C=chipping, M=machining) follow the weld size. Wrong answers confuse 'arrow side' with 'front of the part' — arrow side means the side the arrow touches, regardless of orientation. Symbols are read left-to-right along the reference line; length and pitch follow size.

Q29. Answer: A

$\text{CE} = \text{C} + \text{Mn}/6 + (\text{Cr} + \text{Mo} + \text{V})/5 + (\text{Ni} + \text{Cu})/15$. Higher CE means greater hardenability of the base metal, requiring preheat to slow cooling and reduce HIC risk.

Q30. Answer: B

For DCEN GTAW (steel, stainless, titanium), the tungsten is ground to a tapered point. For AC GTAW (aluminum), a rounded ball forms naturally at the tip.

Q31. Answer: B

The liner (conduit liner) guides the wire electrode from the drive rolls through the torch body to the contact tip, preventing kinking and ensuring smooth wire feed.

Q32. Answer: C

DCEP (reverse polarity): electrode is connected to the positive terminal, work to negative. Produces deeper penetration and is used with E6010, E7018.

Q33. Answer: C

A neutral flame has a 1:1 oxygen-to-acetylene ratio, producing a sharp bright inner cone with no feather — suitable for most welding.

Q34. Answer: B

Cable must handle the amperage and duty cycle of the welding process without overheating. Undersized cable creates excessive resistance, heat, and fire hazard.

Q35. Answer: C

Flashback occurs when the flame burns back into the hoses or torch body, causing a hissing/squealing sound. It can cause hose fires or cylinder explosions.

Q36. Answer: C

C25 (75% Ar / 25% CO₂) is the most widely used mixture for mild steel GMAW. It provides a stable arc, good penetration, and lower spatter than 100% CO₂.

Q37. Answer: A

HIC (cold cracking) occurs when hydrogen from the electrode diffuses into the HAZ and combines with residual stress and microstructure to cause delayed cracking. Cellulosic (E6010/E6011) electrodes produce the most hydrogen.

Q38. Answer: A

A gas lens replaces the standard collet body. Its porous metal mesh screen produces a smooth, laminar (non-turbulent) flow of shielding gas, extending coverage and enabling longer electrode stickout.

Q39. Answer: C

Spray transfer requires an argon-rich gas (at least ~80% Ar). With 98Ar/2O₂, 0.9 mm ER70S-6 transitions from globular to spray at roughly 165 A; with 90Ar/10CO₂ the transition rises to about 200 A. With C25 (75/25) true axial spray cannot be achieved — the high CO₂ content disrupts the arc column.

Q40. Answer: B

FCAW-G typically uses DCEP (electrode positive), similar to GMAW solid wire. Some FCAW-S wires use DCEN — always check the manufacturer's specification.

Q41. Answer: A

When the arc is suddenly extinguished, the weld pool shrinks rapidly. If the crater is not filled, tensile stresses from contraction cause a star-shaped crater crack.

Q42. Answer: D

The Charpy test strikes a notched specimen with a pendulum and measures the energy absorbed before fracture (in joules). It evaluates toughness at specified temperatures, critical for pressure vessels and low-temperature service.

Q43. Answer: D

Containers must be thoroughly purged, cleaned, and gas-tested to below 10% LEL before any hot work — explosive residues can remain after airing.

Q44. Answer: A

AWS A5.12 colour coding: Pure tungsten (EWP) = Green. Used with AC for aluminum and magnesium welding.

Q45. Answer: B

CTWD (Contact Tip to Work Distance) is the distance from the contact tip to the workpiece. It affects electrical stickout and therefore current/deposition rate.

Q46. Answer: D

E71T-1 is a rutile-type flux-cored wire used with CO₂ or Ar/CO₂ shielding gas. It produces a fluid, easily removed slag and is suitable for all-position welding.

Q47. Answer: C

The HAZ is the region of base metal adjacent to the fusion zone that has not melted but experienced temperatures high enough to alter its microstructure and properties (grain growth, hardening).

Q48. Answer: A

Increasing tip-to-work distance reduces heat intensity at the workpiece, potentially insufficient for proper preheat and causing poor cutting or failure to cut.

Q49. Answer: B

Argon and CO₂ are heavier than air and can accumulate at floor level in low-lying areas, displacing oxygen and causing asphyxiation.

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