Sample Questions for AWS Certified Welding Engineer Examinations – Parts 1 and 2

Part 1 Basic Fundamentals of Science Examination

Mathematics

1. Determine the acute angle θ when tan 63° = cot θ.

a. 45°

b. 18°

c. 27°

d. 72°

2. Determine cos θ if sin θ = 0.6 and 0° ≤ θ ≤ 90°.

a. 0.8

b. 0.5

c. 0.2

d. 0.4

3. Factor the following expression:

$b2 - 3b - 4$

a. (b + 4)(b - 1)

b. (b + 1)(b - 4)

c. (b + 2)(b - 1)

d. (b + 1)(b - 2)

4. Calculate the area of a triangle with sides of 6, 8, and 10 cm.

a. 17 cm²

b. 48 cm²

c. 24 cm²

d. 34 cm²

5. A certain telephone pole is 80 feet high. A brace is run from a point ¾ of the way up the pole to a point 20 feet from the base of the pole. How long is this brace?

a. 63.2 ft

b. 72.4 ft

c. 68.2 ft

d. none of the above

6. What is the circumference of a circle that has a radius of 20 mm?

a. 52 mm

b. 63 mm

c. 126 mm

d. none of the above

7. If $x^2 + y^2 = 2$, and $xy = -1$, then $x^3 + y^3 = ?$

a. 2

b. 3

c. 0

d. 4

8. The mass, m, of a particular cast iron part is normally distributed with a mean of 66 kg and a standard deviation of 5 kg. What percent of the parts will have a mass more than 72 kg? Use the following formula for normal distribution.

$$\sigma - \mu = 0 \, xz$$
where μ = the mean and σ = standard deviation

a. 2.4%

b. 0.88%

c. 1.2%

d. 11.5%

Physics

9. A 1 inch by 1 inch by 1 inch copper cube was heated to 90° C. It was then placed into a beaker of water at the temperature of 10° C. After a steady state is reached, how much heat was released? (Assume that *copper C* = 0.386 kJ/kg°K)

a. 3.86 kJ/kg

b. 27.4 kJ/kg

c. 22.5 kJ/kg

d. 30.9 kJ/kg

10. Two blocks are connected to opposite ends of a light spring that exerts a force of 18N when the blocks are pulled apart. The mass ratio of the first block to the second block is 3:1. When the two blocks are released, and if the acceleration of the first block is 6 m/s, what is the acceleration of the second block?

a. 18 m/s²

b. 6 m/s²

c. 9 m/s²

d. 2 m/s²

Chemistry

11. Which of the following elements is most likely to form a compound with hydrogen?

a. He

b. Li

c. Cl

d. Na

12. When 30 grams of sodium hydroxide is neutralized by 36 grams of hydrochloric acid, how many moles of water will it yield? (Molecular weights: HCl = 18, NaOH = 20)

a. 3.0 mol

b. 2.0 mol

c. 2.5 mol

d. 1.5 mol

13. The periodic table of elements is not useful in predicting which of the following properties of an unknown element?

a. formula of its chloride

b. color

c. melting point

d. density

Strength of Materials

14. A square steel bar 50 mm on a side and 1 meter long is subject to an axial tensile force of 250 kN. Determine the decrease in the lateral dimension due to this load. (Assume E = 200 GPa and μ = 0.3.)

a. 5.0 X 10-4 mm

b. 7.5 X 10-3 mm

c. 2.0 X 10-5 mm

d. 1.5 X 10-4 mm

15. A 20 meter diameter spherical tank is to be used to store gas. The shell plating is 10 mm thick and the working stress of the material is 125 MPa. What is the maximum permissible gas pressure, p? Use the following equation,

$h\ pr\ c\ 2\ \sigma =$

where σc = circumferential tensile stress
r = radius, and
h = wall thickness

a. 0.50 MPa

b. 0.20 MPa

c. 0.10 MPa

d. 0.25 MPa

Sample Questions for AWS Certified Welding Engineer Examinations – Parts 1 and 2

Heat Transfer and Fluid Mechanics

16. Two ideal radiators in the form of parallel plates of equal areas are maintained at 530°R (290K) and 1000°R (550K), respectively. What is the approximate heat transfer between them on a unit area basis?

Use F 1-2 = 1.0.

Electricity

17. For an induction motor, an increase in rotor resistance leads to:

a. an increase in starting torque.

b. an increase in motor efficiency.

c. an increase in the starting current.

d. an increase in speed.

NOTE: Samples questions only for Parts 3 and 4. No answers provided.
Sample Questions (no answers provided) for Part 3 Welding
Related Disciplines Examination

NDE/Weld Discontinuities

18. Prepare a shop procedure for the ultrasonic (UT) inspection of a full penetration electron beam butt weld produced in the flat position in a one inch thick Inconel 718 casting. Design the procedure for testing of the weld by angle-beam ultrasonic transducers of 45 and 60 degrees.
Provide precise distances for transducer placement and movement and describe how the calibration for the distance measurements will be performed.

19. A large stainless steel component in a corrosive service environment failed in the HAZ of a weld. Your recommendation is to examine the fracture surface of the failed weld, but it is not possible to cut out a section due to its bulk.

a. What procedure would you use to examine the surface?

b. Speculate of the fracture mechanism.

20. A large low alloy steel casting is found to contain a surface crack.

The crack has to be removed by gouging and grinding before any repair welding is to be done.

a. What NDE method would you use to determine the extent of the cracking?

b. What method would you use to make sure that all of the crack has been removed after the gouging and grinding?

c. What test do you recommend to make sure that there is no cracking occurring during each pass of the build-up of the repair weld?

Welding Heat Sources and Arc Physics

21. Sketch plots for each of the following relationships and describe the characteristics of a typical welding arc.

a) Arc voltage versus current for at least three different arc lengths.

b) Arc voltage versus arc length for three different current levels.

c) Arc voltage versus position across the arc from the anode to the cathode.

d) Discuss how the voltage drops near the electrodes appears in each of the three above plots. Relate the electrode voltage drops to the distribution of heat in the arc and to the overall efficiency of the arc as a heat source for welding.

22. When is magnetic arc blow most likely to occur in the arc welding of steel? Give three examples and briefly explain the cause.

Welding Processes and Controls

23. Name the appropriate welding materials and welding conditions for the following welding processes when notch toughness is the most important characteristic of the weld metal.

a) SMAW.

b) SAW

c) GMAW

24. In GMAW, a larger droplet is observed in globular metal transfer when CO_2 is used as the shielding gas than when argon is used. Explain the reason(s).

Sample Questions for AWS Certified Welding Engineer Examinations – Parts 1 and 2

25. Describe two arc welding processes which involve slag/metal reactions. Explain the mode of transfer of metal from the electrode to the weldment in each case. What are the functions of slag during welding for each of the processes? Approximate the melting temperature of the slag relative to the weld metal.

Welding and Joining Metallurgy

26. Briefly explain the advantages and disadvantages of continuous welding and intermittent welding of a lap joint by comparing them in terms of strength and weld deformation.

27. Austenitic-ferritic stainless steel weldments are commonly used in marine (sea water) applications. Why? Discuss the weldability of these steels.

28. Answer the following regarding hot cracking in the weld metal of austenitic stainless steel.

a. Give five factors that could cause these cracks.

b. Name two impurities that accelerate hot cracking.

c. Describe precautions that must be taken when selecting filler metals in order to prevent hot cracking in weld metal.

29. Name four items of caution when reusing the flux for submerged arc welding.

30. Small additions of elements (microalloying) are added to low carbon steel to increase tensile strength and fracture toughness. Explain what elements give these properties and how the steel processing routes are affected by microalloying.

Weld Design

31. List five implications that residual stress and weld deformation place upon the design of welded connections.

32. Explain the significance of selecting filler metal to deliberately undermatch the tensile properties of the weldments in a single bevel butt joint between a heavily restrained flange on a beam to a heavy column connection.

Sample Questions for AWS Certified Welding Engineer Examinations – Parts 1 and 2

Safety

33. What is the toxic metal most identified with exposure to welding galvanized steel (breathing it can cause metal fume fever)?

a. chromium

b. tin

c. zinc

d. none of the above

34. OSHA (an American government safety agency) issues standards regulating how high concentrations of air contaminants can be in the workplace. These standards are called:

a. Recommended Exposure Limits (REL)

b. Permissible Exposure Limits (PEL)

c. Threshold Limit Values (TLV)

d. Material Safety Data Sheets (MSDS)

35. Your welding shop uses metals containing chromium and nickel. You have been assigned to assess the effects of welding fumes containing these metals.

a. Describe the immediate effects of overexposure.

b. Describe the long term (chronic) effects of exposure.

c. Discuss how to protect against overexposure.

d. Identify information sources that you can use in solving problems that you may uncover in your work.