STEEL QUIZ

STEEL QUIZ, A MONTHLY FEATURE IN *MODERN STEEL CONSTRUCTION*, allows you to test your knowledge of steel design and construction.Unless otherwise noted, all answers can be found in the *LRFD Manual of Steel Construction*. **To receive a free catalog of AISC publications, circle #10 on the reader service card in the back of this magazine.**

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QUESTIONS:

1. In laboratory testing of steel specimens, what is whitewash and what does it do?

2. What is the general distinction between a joist-girder and an open-web steel joist?

3. As stated in LRFD Specification Section M2.2, "Gouges greater than 3/16-in. deep and notches shall be removed by grinding or repaired by welding." What is the difference between a gouge and a notch?

4. A structural member has been properly designed to meet all applicable load and strength criteria. Can it be said that this member will never fail?

5. Sketch the pattern of members in a six-panel Pratt truss.

6. Can a W10x12 in ASTM A572 grade 50 material be cold-bent to any practical radius?

7. Why are beveled washers square or rectangular but not round?

8. In AWS D1.1-96 Section 5.3.2.1, low-hydrogen electrodes are required to be stored in ovens at a temperature that is at least equal to 250 degrees F. Why?

9. The ASTM A325 and A490 bolts used for shear connections with the threads excluded (X) have a shorter threaded length than those used for connections with the threads included (N), True or False?

10. Which of the following does not give an accurate measure of the unit weight of steel?
(a) 0.284 lbs. per $in.^3$
(b) 3.40 lbs. per $in.^2$ per foot of length
(c) 4.30 lbs. per $in.^2$ per foot of length
(d) 490 lbs. per $ft.^3$

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ANSWERS:

1. Whitewash is a mixture of lime and water – a paint with no binder – that is applied to a steel assembly that will be tested. In areas of yielding during testing, mill scale (tightly adherent surface rust) is released. When coated with whitewash, the mill scale flakes, taking the whitewash with it and visually distinct patterns of yielding result.

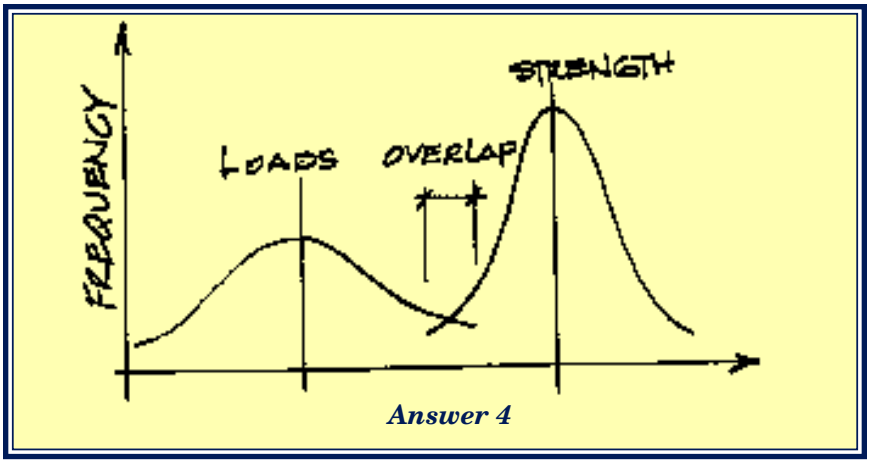
2. An open-web steel joist is typically a simple-span member that supports a uniformly distributed gravity load. A joist-girder typically supports a number of equally spaced concentrated loads, usually from open-web steel joists, at the panel points. Joist girders commonly frame between columns, have bottom-chord extensions, and can be either specified as simple-span members or designed to participate in the lateral-load-resisting system.

3. A notch is a sharp discontinuity that has a V- or similar shape. A gouge is a more gradual and structurally tolerable discontinuity that has a shape with a rounded bottom.

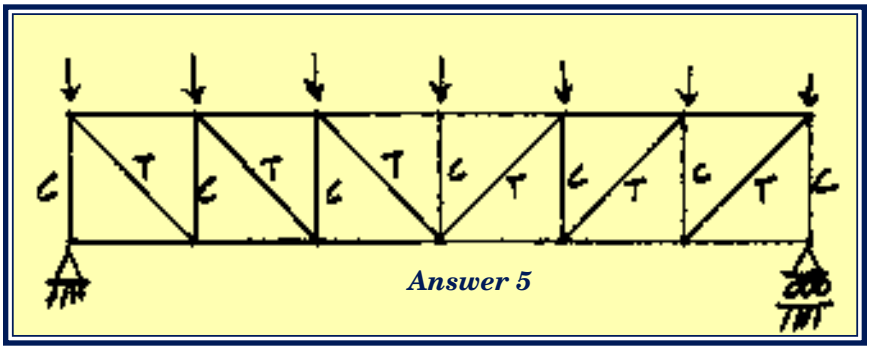
4. No, but it can be said that the risk of failure is acceptable by common standards. As illustrated at top right, the statistical distributions of load and strength will always overlap by some amount. Our design methods reduce this statistical overlap so that the risk of failure is below the level that is deemed to be acceptable.

5. As illustrated at right, a Pratt truss is one for which the long web members (diagonals) are normally in tension and the short web members (verticals) are normally in compression.

6. Practically any curvature can be induced, but the cross-section may be distorted early in bending by flange local buckling. For a W10x12 flange, b/t = 9.4, which exceeds the corresponding compact limit of 9.2 for 50 ksi steel ($65/\sqrt{50}$) from AISC LRFD Specification Table B5.1. In addition, the average F_y for ASTM A572 grade 50 material is higher (approximately 55 ksi), which increases the likelihood of local buckling. For a slight curvature, this non-compact flange can sustain some limited inelasticity prior to local buckling. However, as the curvature is increased, so are both the required inelasticity and the likelihood of local buckling. The selection of a heavier ("more than" compact) cross-section will greatly improve the ability to induce curvature by cold bending.



Answer 4



Answer 5

7. Beveled washers are used to compensate for a lack of parallelism between the outer faces of a bolted joint as is found in such cases as a joint involving the flange of an American standard beam (S-shape). To do so, the beveled washer must be properly oriented in the assembled joint. The square or rectangular shape simplifies proper orientation during installation.

8. Unprotected low-hydrogen electrodes absorb atmospheric moisture, which can increase the potential for underbead cracking due to the hydrogen that is released into the weld metal. By storing these electrodes in ovens at 250 degrees F, an acceptable level of moisture content is maintained.

9. False. The ASTM A325 and A490 bolts used for N and X connections (and SC connections, too) are physically identical for any given bolt length. It is the thickness of the connected plies that must be selected properly to exclude the threads.

10. Answer **c** is the incorrect one. Incidentally, answer **b** is most useful if you know the cross-sectional area of a shape (in square inches). Just multiply by 3.40 and you have the approximate weight per foot for that shape.