1) The Concrete Reinforcing Steel Institute (CRSI) recommends that a reinforcing bar (rebar) inspection program be established for all construction projects where reinforcing bars are used. An appropriate checklist for rebar inspection is recommended that includes which of the following items, in addition to those listed below? a) Construction schedule, b) Certified mill test and/or bar coating report, c) Material shipment schedule, d) Potential concerns (possible discrepancies, drawing errors), e) Critical tolerances, f) Periodic meeting schedule

   1. Independent testing laboratory reports
   2. Approved placing drawings
   3. A. and B.
   4. None of the above

**Answer: C** - An appropriate checklist for rebar inspection is recommended that includes the listed items, independent testing laboratory reports, and approved placing drawings. CRSI recommends that a checklist procedure and the minimum requirements for rebar acceptance should be established during the pre-construction conference. These quality control measures will help to ensure that the rebar used will meet specific material standards and the project owner’s requirements.

2) Which of the following statements are true with regards to bits and bytes?

   1. A byte consists of a single numeric value; a bit is a sequence of bytes.
   2. A bit consists of a single numeric value; a byte is a sequence of bits.
   3. A bit consists of a single numeric value; a byte consists of an alphanumeric value.
   4. None of the above

**Answer: B** - A bit is a single numeric value; a byte consists of a sequence of bits. The terms *bits* and *bytes* refer to digital data that, when grouped together, form binary code. Bits are assigned a value of either “0” or “1.” There are usually eight bits in one byte.

3) Euler’s Formula is used to determine which of the following properties related to a simply-supported column?

   1. Maximum bending moment
   2. Critical buckling load
   3. Shear stress
   4. None of the above
**Answer: B** - Euler’s Formula is used to determine the critical buckling load of a simply-supported column. Euler’s Formula is expressed as follows:

\[ F_{cr} = \frac{EI\pi^2}{L^2} \]

Where
- \( E \) = Young’s modulus of the material used to construct the column
- \( I \) = cross-sectional area moment of inertia
- \( L \) = column length

4) What is the composite \( C \) value for the following drainage area for a 10-year storm recurrence interval? Drainage area: 0.25 acres of residential lots with 40% imperviousness (\( C = 0.49 \)) 0.25 acres of lawn with 0.95% slope with 0% imperviousness (\( C = 0.22 \)) 0.10 acres of impervious pavement (\( C = 0.95 \))

1. 0.20
2. 0.45
3. 0.55
4. Not enough information provided

**Answer: B** - The composite \( C \) value for the given drainage area for a 10-year storm recurrence interval is 0.45.

Solution: Calculate composite \( C \) by using the following equation:

\[ C = \frac{(C_1A_1 + C_2A_2 + C_3A_3)}{(A_1 + A_2 + A_3)} \]

\[ C = \frac{[(0.25 \text{ acres} \times 0.49) + (0.25 \text{ acres} \times 0.22) + (0.10 \text{ acres} \times 0.95)]}{(0.25+0.25+0.10)} \]

\[ C = 0.45 \]

5) When consuming drinking treated water, which of the following may be an indicator of water quality problems within a finished water storage facility?

1. Poor taste
2. Odor
3. Water temperature
4. All of the above
Answer: D - When drinking treating water, the presence of a poor taste or unpleasant odor, or the awareness of an ambient water temperature may indicate that there is a water quality problem within a finished water storage facility. Stale water within a storage facility promotes the growth of microorganisms that cause poor tastes or unpleasant odors and is often a result of water stored too long. Stagnant water will approach ambient temperatures, and may be a result of short-circuiting or accumulated sediment that impedes mixing within a storage unit.

6) What is the total volume of a grit chamber designed to handle an average daily flow of 3 million gallons with a peak flow ratio of 2.5, and a detention time of 3 minutes?

1. 540 ft$^3$
2. 1,350 ft$^3$
3. 2,079 ft$^3$
4. 6,250 ft$^3$

Answer: C - The total volume of the grit chamber is 2,079 ft$^3$ is required to handle an average flow of 3 million gallons per day (mgd), with a peak flow ratio of 2.5 with a detention time of 3 minutes.

Solution: Volume of grit chamber = Peak Flow x detention time

Where, peak flow = average flow x peak flow ratio

= 3 mgd x 2.5
= 7.5 mgd

Given, 1 mgd = 1.54 ft$^3$/seconds (sec)

Volume = 7.5 mgd x 1.54 ft$^3$/sec x 3 minutes x 60 sec/minute

= 2,079 ft$^3$
7) What is the passing sight distance for a section of 60 mile per hour (mph) 2-lane rural highway with a 1740-foot vertical sag curve where a bridge passes over at 16.8 feet? (Assume \( S > L \) and \( A = 3.15 \))

1. 870 feet
2. 2,210 feet
3. 2,273 feet
4. 3,389 feet

Answer: C - The passing sight distance for a section of 60 mph 2-lane rural highway with a 1,740-foot vertical sag curve where a bridge passes over at 16.8 feet is 2,273 feet.

Solution: Use sag vertical curve length at undercrossing equation (US Customary units)

\[ S = \frac{L}{2} + \frac{400(C-5.75)}{A} \]

Where, \( L = 1740 \) feet

\( C = 16.8 \)

\( A = 3.15 \)

\[ S = \frac{1740}{2} + \frac{400(16.8-5.75)}{3.15} \]

\[ = 2,273 \text{ feet} \]

8) In which of the following cases would an open-pit excavation to construct a spread footing not be permitted?

1. Not in or near open water
2. Soil material is adequately stable
3. Soil moisture content varies widely
4. There is no threat of compromising the stability of nearby structures

Answer: C - An open-pit excavation would not be permitted to construct a spread footing in cases where the soil moisture content is variable. Open-pit excavation is only recommended when soils can be maintained in a dry condition. Shoring and cribbing is needed in shallow foundation excavations where soil moisture content can vary widely due to the influence of groundwater or surface water runoff.
9) What is the amount of tension that should be applied to the spring balance of the end of a steel tape to yield the proper tension to the 75-ft increment? (Assume the final measurement in the line of tape is 75 ft and the normal 100-foot tape tension is 10 pounds (lbs.).)

1. 7.5 lbs
2. 10 lbs
3. 75 lbs
4. None of the above

**Answer: A** - 7.5 lbs. of tension should be applied to the 75-ft increment of tape.

**Solution:** Use the steel tape correction factor applied to the length of measurement

Tension = 10 lbs. /100 ft = 0.1 lb./ft

Correction = (0.1 lb./ft) (75 ft) = 7.5 lbs

10) Fill in the blank: C++, Java, Visual Basic, and FORTRAN are examples of _________.

1. Computer hardware
2. Programming languages
3. Graphical user interfaces
4. Coffee flavors

**Answer: B** - C++, Java, Visual Basic, and FORTRAN are examples of programming languages. Programming languages are designed to communicate instructions to machines. Instructions are given in the form of programs developed for specific functions and applications.

11) What is the sum of the exterior angles of an eight-sided traverse?

1. 180°
2. 1,440°
3. 1,800°
4. None of the above
Answer: C - Use the sum of exterior angles of a polygon equation: \( S = (n+2) \times 180^\circ \)

Where \( n = 8 \)

\[ S = (8+2) \times 180^\circ \]

\[ = 1,800^\circ \]