Q: For this month’s column, I’d like to challenge the readers to have some fun testing their brazing knowledge.

Ten winners with the correct answers will win one of five Brazing Handbooks or one of five Jefferson’s Welding Encyclopedia.

Quiz respondents can e-mail their answers to quiz@aws.org and specify “quiz” in the subject line. Please only list numbers 1–20 with your letter choice next to it.

The deadline to submit answers is April 30. Winners will be drawn from all correct entries and will be announced in the May issue of the Welding Journal along with the answers.

2. Which one of the following is most important for optimal brazing results?
   A — Gravity  
   B — Capillary attraction  
   C — RMS surface roughness

3. BAg-1 can be safely used in a vacuum furnace if?
   A — Vacuum level is limited to about 10^-3 max.  
   B — A strong back-fill pressure of argon is used.  
   C — Should never be used in a vacuum furnace.

4. When Ni brazing, to prevent the formation of “continuous” nonductile centerline eutectics in the joint, the optimal joint clearance range should be?
   A — 0.000–0.003 in. (0.000 to 0.075 mm)  
   B — 0.004–0.007 in. (0.10 to 0.15 mm)  
   C — Tight clearance is not actually required, because a good diffusion cycle will eliminate any continuous centerline eutectics that may have formed.

5. The first practical nickel-based brazing filler metal (BFM) was developed shortly after WWII by evaluating which one of the following materials as a potential applicant for high-temperature brazing?
   A — A thermal-spray powder  
   B — Oak Ridge lab metallurgists evaluated “boronizing” a special Inconel® alloy.  
   C — It was discovered by accident when a nickel-based super-alloy began to sag due to eutectic-melting when in direct contact with a graphite plate during heat treating.

6. When did the practice of brazing first begin?
   A — It was first used by the Vikings to produce specialized multipointed weapons.  
   B — The process was developed by British shipbuilders during Napoleonic wars.  
   C — Brazing was known and used by the ancient Egyptians.

7. The in-service remelt temperature
of some nickel-based BFM s can be several hundred degrees higher than
the original brazing temperature because of which specific metallic ele-
ment that is part of the chemistry of the BFM?
A — Silicon
B — Chromium
C — Boron

8. When properly made, which is stronger — a welded joint or a brazed
joint?
A — A welded joint should always be stronger than a brazed joint.
B — The strengths should be equal, because a properly made weldment or
braze ment should always fall in the base metal, outside the joint.
C — Since brazing does not melt the base metal, a brazed joint should al-
ways be stronger than a weldment made on the same base metal.

9. Brazing fluxes help to prevent oxida-
tion of the base metals on which it is coated. Which flux can handle high-
er temperatures, and for a longer time, and also be potentially more ef-
effective on refractory metals?
A — White flux (which meets AMS 3410 requirements)
B — Black flux (which meets AMS 3411 requirements)

10. When brazing pure copper to pure copper using the BCuP family of BFM s,
is a brazing flux usually required?
A — Yes
B — No

11. Brazing aluminum base metals to-
together using the BAI SI class of BFM s can be easily done in a standard high-
temperature vacuum furnace used by many companies for nickel brazing
aerospace components, as long as the level of vacuum is maintained at \(10^{-5}\) or harder (i.e., at \(10^{-6}, 0.1\), etc.).
A — True
B — False

12. Because many people feel that a braze fillet contributes significantly to
the overall strength of a brazed joint, it is therefore wise to specify a mini-
mum fillet size on engineering draw-

ed procedures, so that brazing personnel
and engineers will know how big a
braze fillet they should produce.
A — True
B — False

13. In a similar vein, it is usually a good
recommendation to build up a large
braze fillet in the corner of two parts
being brazed together at right angles
(in which there is a 90-deg corner at
that joint edge), because the large fillet
is an excellent way to help spread
the stress that would otherwise try to con-
centrate in that sharp corner.
A — True
B — False

14. When vacuum brazing, which is
more important?
A — Level of vacuum in the furnace
B — The leak-up rate of the vacuum chamber

15. When brazing with a torch, the adjustment of the torch flame is important. For most applications, it is recommended to adjust the flame so that it is:

A — Slightly oxidizing  
B — Neutral  
C — Slightly carburizing

16. When vacuum brazing a 304-type base metal, it is recommended that only 304L be used rather than standard 304 material, because the 304L has far less carbon in it. This is important because:

A — With less carbon, there is much less chance of carburizing the brazed joint.  
B — Carbon wants to react with the chromium in the stainless steel at elevated temps to form chrome-carbides that migrate to grain boundaries, thereby reducing the amount of chromium-oxide on the surface of the stainless steel to keep it corrosion resistant.  
C — BFMs react adversely with carbon-containing materials, thereby preventing adequate “wetting” of the joint faying surfaces, thus causing excessive voids in the joint, and sometimes “leakers.”

17. When furnace brazing, it is often necessary to have one or more built-in “holds” at various temperatures on the way up to brazing temperature to allow for thermal equilibrium to occur in the furnace chamber. These “holds” are necessary because:

A — The heating rates used are too rapid, thus causing thinner parts to heat up faster than heavier parts in the load.  
B — The intermediate holds are timed so that the total brazing cycle meets minimum cycle times for the base metals being joined.  
C — At each intermediate “hold” point, metallurgical reactions are allowed to occur that cannot efficiently be completed at other temperatures.

18. When vacuum brazing, one of the terms used to describe the level of vacuum is the word “torr.” Where does this word come from?

A — In honor of Jonathan Torr, a man who claimed to invent the first practical vacuum furnace back in 1679.  
B — An abbreviation for “torr,” a term describing the extreme temperatures used in a vacuum furnace when brazing.  
C — Named after Evangelista Torricelli, an Italian scientist in the early 1600s.

19. When induction brazing a round steel bar assembly that is placed inside a circular induction coil, the “coupling distance” of the induction coil is very important. Coupling distance is:

A — The distance between the electrical junctions in the power head of the inductor where it is connected inside the power unit, always inversely proportional to the coil diameter.  
B — The distance between the ID of the induction coil and the OD of the part being heated inside the coil.  
C — The distance between the outside edge of the induction coil to the nearest piece of conductive metal in the immediate vicinity of the induction brazing unit.

20. When brazing a tube into a fitting where the tube and fitting are made from two different kinds of metals with different coefficients of thermal expansion, it would usually be best (from a brazed-joint integrity perspective) to select those base metals so that the higher-expanding metal is:

A — The outer member (the fitting)  
B — The inner member (the tube)