ERRATA for

PE Metallurgical and Materials Practice Exam

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Errata posted 05/01/2023

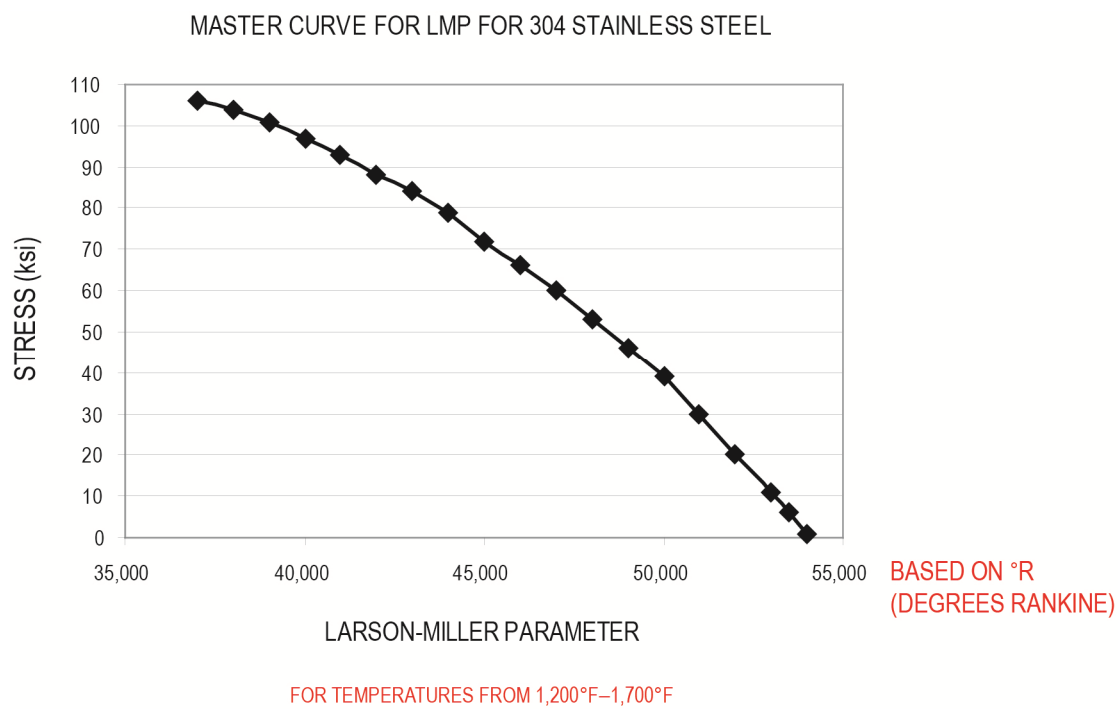
Revisions are shown in red.

Question 3, p. 9:
This item was replaced as follows.

At 1,000°C, the diffusivity of carbon in 1010 steel is 2.311×10^{-7} cm2/s. A carburizing process generates a constant surface concentration of 0.6 wt% C on a 1010 steel surface. Assume diffusivity is a constant. The concentration of carbon at a depth of 3 mm below the surface after 50 hours is most nearly:

- A. 0.1 wt% C
- B. 0.15 wt% C
- C. 0.25 wt% C
- D. 0.475 wt% C

Question 67, p. 44:
After 10 years, a continuously operated, ultra-high-pressure boiler suffers from a superheater tube failure. The tube is composed of ASME SA 304 stainless steel, and the tube was at a temperature of 1,600°F (871°C). Use the stress-LMP curve for 304 stainless steel shown, and assume the LMP constant related to the stainless steel is equal to 20. The stress (ksi) on the tube at failure is most nearly:



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Solution 3, p. 54:

C_0 = 0.1 wt% C
C_s = 0.6 wt% C
D = 2.311×10^{-7} cm^2/s
x = 3 mm = 0.3 cm
t = 50 hours = 180,000 s
C_x = ?

Governing equation:

$$\frac{C_x - C_0}{C_s - C_0} = 1 - \text{erf}\left(\frac{x}{2\sqrt{Dt}}\right)$$

$$\frac{C_x - 0.1}{0.6 - 0.1} = 1 - \text{erf}\left(\frac{0.3}{2\sqrt{2.311 \times 10^{-7}\ \text{cm}^2/\text{s} \times 180{,}000\,\text{s}}}\right) = 1 - \text{erf}\left(0.7355\right) \approx 1 - 0.7 = 0.3$$

$$C_x - 0.1 = 0.3 \times 0.5 = 0.15$$

$$C_x = 0.25\ \text{wt\% C}$$

THE CORRECT ANSWER IS: C

Solution 23, p. 60:

THE CORRECT ANSWER IS: C