

PRACTICE EXAM 13: PE MECHANICAL—MACHINE DESIGN AND MATERIALS (100 QUESTIONS)

This practice exam contains 100 questions. Select the single best answer for each question. The official NCEES examination contains 80 questions and provides 8 hours of testing time within a 9-hour appointment. Use both SI and U.S. Customary units as indicated.

1. A proposed fixture has a fixed fabrication cost of \$83100 and a variable cost of \$1032000 spread over 4160 units. What is the average cost per unit?

- A. 41674.04 \$/unit
- B. 91682.88 \$/unit
- C. 83348.08 \$/unit
- D. 166696.15 \$/unit

2. A component is expected to experience 2081 MPa maximum stress, while its allowable design stress is 528.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.44
- C. 7.88
- D. 3.94

3. A drawing dimension is 1029.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 26136.6 mm
- B. 13068.3 mm
- C. 39204.9 mm
- D. 26162 mm

4. A machine saves 22230 labor-hours annually at \$4171/h. Ignoring interest, its \$216300 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 7708752.5 \$/year
- B. 15417505 \$/year
- C. 15489605 \$/year
- D. 30835010 \$/year

5. A proposed fixture has a fixed fabrication cost of \$83260 and a variable cost of \$1034000 spread over 4168 units. What is the average cost per unit?

- A. 83508.08 \$/unit
- B. 41754.04 \$/unit
- C. 91858.89 \$/unit
- D. 167016.16 \$/unit

6. A component is expected to experience 2085 MPa maximum stress, while its allowable design stress is 529.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.44
- C. 3.94
- D. 7.88

7. A drawing dimension is 1031.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 13093.7 mm
- B. 26187.4 mm
- C. 39281.1 mm
- D. 26212.8 mm

8. A machine saves 22270 labor-hours annually at \$4179/h. Ignoring interest, its \$216700 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 6632116.43 \$/year
- B. 13326147.14 \$/year
- C. 26528465.71 \$/year
- D. 13264232.86 \$/year

9. A proposed fixture has a fixed fabrication cost of \$83420 and a variable cost of \$1036000 spread over 4176 units. What is the average cost per unit?

- A. 41834.04 \$/unit
- B. 92034.89 \$/unit
- C. 83668.08 \$/unit
- D. 167336.17 \$/unit

10. A component is expected to experience 2089 MPa maximum stress, while its allowable design stress is 530.25 MPa. What design factor is implied?

- A. 1.97
- B. 3.94
- C. 4.44
- D. 7.88

11. A drawing dimension is 1033.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 26238.2 mm
- B. 13119.1 mm
- C. 39357.3 mm
- D. 26263.6 mm

12. A machine saves 22310 labor-hours annually at \$4187/h. Ignoring interest, its \$217100 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 5824679.38 \$/year
- B. 11703633.75 \$/year
- C. 23298717.5 \$/year
- D. 11649358.75 \$/year

13. A proposed fixture has a fixed fabrication cost of \$83580 and a variable cost of \$1038000 spread over 4184 units. What is the average cost per unit?

- A. 41914.04 \$/unit
- B. 92210.9 \$/unit
- C. 83828.09 \$/unit
- D. 167656.18 \$/unit

14. A component is expected to experience 2093 MPa maximum stress, while its allowable design stress is 531.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.44
- C. 7.88
- D. 3.94

15. A drawing dimension is 1035.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 13144.5 mm
- B. 26289 mm
- C. 39433.5 mm
- D. 26314.4 mm

16. A machine saves 22350 labor-hours annually at \$4195/h. Ignoring interest, its \$217500 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 15590125 \$/year
- B. 7795062.5 \$/year
- C. 15662625 \$/year
- D. 31180250 \$/year

17. A prismatic bar carries 4120 kN axial tension over a net area of 10550 mm². What is the average normal stress?

- A. 195.26 MPa
- B. 195.67 MPa
- C. 390.52 MPa
- D. 585.78 MPa

18. A solid circular shaft of diameter 52 mm transmits 41720 N·m torque. What is its maximum torsional shear stress?

- A. 755.57 MPa
- B. 3022.28 MPa
- C. 3022.83 MPa
- D. 1511.14 MPa

19. A rectangular beam 4164 mm wide and 4224 mm deep carries a maximum bending moment of 1033.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.04 MPa
- B. 0.08 MPa
- C. 0.45 MPa

D. 0.59 MPa

20. A steel tie, length 42060 mm and area 10715 mm², carries 4136 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 40.59 mm
- B. 162.35 mm
- C. 41.14 mm
- D. 81.18 mm

21. A ductile member has yield strength 10470 MPa and calculated von Mises stress 4183 MPa. What factor of safety against yielding results?

- A. 2.5
- B. 1.25
- C. 1.5
- D. 3.5

22. A pin-ended column has $E = 200,000$ MPa, $I = 212500000$ mm⁴, and length 53325 mm. What is its Euler critical load?

- A. 590.05 kN
- B. 36.88 kN
- C. 147.51 kN
- D. 46.95 kN

23. At a point, $\sigma_x = 4172$ MPa, $\sigma_y = 2076$ MPa, and $\tau_{xy} = 1048.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 4043.41 MPa
- B. 4659.97 MPa

- C. 2096 MPa
- D. 2021.71 MPa

24. A part has alternating stress 4204 MPa and mean stress 2117 MPa. With $S_e = 6341$ MPa and $S_{ut} = 10735$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 1.16
- C. 5.07
- D. 1.38

25. A prismatic bar carries 4136 kN axial tension over a net area of 10590 mm². What is the average normal stress?

- A. 195.28 MPa
- B. 390.56 MPa
- C. 195.69 MPa
- D. 585.84 MPa

26. A solid circular shaft of diameter 58 mm transmits 41880 N·m torque. What is its maximum torsional shear stress?

- A. 546.59 MPa
- B. 2186.37 MPa
- C. 1093.18 MPa
- D. 2186.92 MPa

27. A rectangular beam 4180 mm wide and 4240 mm deep carries a maximum bending moment of 1037.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.08 MPa

- B. 0.04 MPa
- C. 0.45 MPa
- D. 0.59 MPa

28. A steel tie, length 42220 mm and area 10755 mm², carries 4152 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 40.75 mm
- B. 162.99 mm
- C. 41.3 mm
- D. 81.5 mm

29. A ductile member has yield strength 10510 MPa and calculated von Mises stress 4199 MPa. What factor of safety against yielding results?

- A. 1.25
- B. 1.5
- C. 2.5
- D. 3.5

30. A pin-ended column has $E = 200,000$ MPa, $I = 213300000$ mm⁴, and length 53525 mm. What is its Euler critical load?

- A. 146.96 kN
- B. 587.85 kN
- C. 36.74 kN
- D. 46.78 kN

31. At a point, $\sigma_x = 4188$ MPa, $\sigma_y = 2084$ MPa, and $\tau_{xy} = 1052.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 4677.86 MPa
- B. 2104 MPa
- C. 2029.45 MPa
- D. 4058.91 MPa

32. A part has alternating stress 4220 MPa and mean stress 2125 MPa. With $S_e = 6365$ MPa and $S_{ut} = 10775$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 1.16
- C. 5.07
- D. 1.38

33. A prismatic bar carries 4152 kN axial tension over a net area of 10630 mm². What is the average normal stress?

- A. 195.3 MPa
- B. 195.71 MPa
- C. 390.59 MPa
- D. 585.89 MPa

34. A solid circular shaft of diameter 54 mm transmits 42040 N·m torque. What is its maximum torsional shear stress?

- A. 1359.73 MPa
- B. 679.86 MPa
- C. 2719.45 MPa
- D. 2720 MPa

35. A rectangular beam 4196 mm wide and 4256 mm deep carries a maximum bending moment of 1041.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.04 MPa
- B. 0.08 MPa
- C. 0.45 MPa
- D. 0.59 MPa

36. A steel tie, length 42380 mm and area 10795 mm², carries 4168 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 40.91 mm
- B. 163.63 mm
- C. 41.46 mm
- D. 81.82 mm

37. A ductile member has yield strength 10550 MPa and calculated von Mises stress 4215 MPa. What factor of safety against yielding results?

- A. 1.25
- B. 2.5
- C. 1.5
- D. 3.5

38. A pin-ended column has $E = 200,000$ MPa, $I = 214100000$ mm⁴, and length 53725 mm. What is its Euler critical load?

- A. 585.67 kN
- B. 36.6 kN
- C. 146.42 kN
- D. 46.61 kN

39. At a point, $\sigma_x = 4204$ MPa, $\sigma_y = 2092$ MPa, and $\tau_{xy} = 1056.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 4695.75 MPa
- B. 2112 MPa
- C. 2037.2 MPa
- D. 4074.4 MPa

40. A part has alternating stress 4236 MPa and mean stress 2133 MPa. With $S_e = 6389$ MPa and $S_{ut} = 10815$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.16
- B. 1.51
- C. 5.07
- D. 1.38

41. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 4125 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 36473.01 MPa
- B. 9118.25 MPa
- C. 4559.13 MPa
- D. 18236.5 MPa

42. A bolt transfers 4142 kN through a plate 11 mm thick with an effective bearing diameter of 20 mm. What is the average bearing stress in the plate?

- A. 5992.91 MPa
- B. 9413.64 MPa
- C. 37654.55 MPa
- D. 18827.27 MPa

43. Using the relation $T = KFd$, estimate bolt preload when installation torque is 20700 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 5750.27 kN
- B. 8625 kN
- C. 5750 kN
- D. 11500 kN

44. Two parallel fillet welds, each 4166 mm long with 6 mm leg size, carry 2063 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 58.37 MPa
- B. 82.53 MPa
- C. 41.27 MPa
- D. 116.74 MPa

45. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 4133 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 6712.12 MPa
- B. 26848.46 MPa
- C. 3356.06 MPa
- D. 13424.23 MPa

46. A bolt transfers 4150 kN through a plate 12 mm thick with an effective bearing diameter of 20 mm. What is the average bearing stress in the plate?

- A. 5504.11 MPa
- B. 8645.83 MPa
- C. 34583.33 MPa
- D. 17291.67 MPa

47. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 20740 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 6481.52 kN
- B. 9721.88 kN
- C. 6481.25 kN
- D. 1296.25 kN

48. Two parallel fillet welds, each 4174 mm long with 7 mm leg size, carry 2067 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 70.74 MPa
- B. 50.03 MPa
- C. 35.37 MPa
- D. 100.06 MPa

49. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 4141 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 20595.64 MPa
- B. 2574.46 MPa
- C. 10297.82 MPa
- D. 5148.91 MPa

50. A bolt transfers 4158 kN through a plate 10 mm thick with an effective bearing diameter of 20 mm. What is the average bearing stress in the plate?

- A. 20790 MPa
- B. 6617.66 MPa
- C. 10395 MPa
- D. 41580 MPa

51. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 20780 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 6112.03 kN
- B. 6111.76 kN
- C. 9167.65 kN
- D. 1222.35 kN

52. Two parallel fillet welds, each 4182 mm long with 8 mm leg size, carry 2071 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 61.9 MPa
- B. 30.95 MPa
- C. 43.78 MPa
- D. 87.56 MPa

53. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 4149 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 36685.21 MPa
- B. 4585.65 MPa
- C. 9171.3 MPa
- D. 18342.61 MPa

54. A 18-tooth pinion rotating at 22150 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 3691.67 rpm
- B. 14766.67 rpm
- C. 22150 rpm
- D. 7383.33 rpm

55. A shaft transmits 2056 hp at 42020 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 3083.76 in·lbf
- B. 1541.88 in·lbf
- C. 4625.63 in·lbf
- D. 6167.51 in·lbf

56. An open belt connects a 130-mm driver at 21320 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 4330.62 rpm
- B. 8661.25 rpm
- C. 12658.75 rpm
- D. 21320 rpm

57. A collar bearing supports 1029.5 kN at mean friction radius 0.020 m with friction coefficient 0.080. What friction torque must be overcome?

- A. 1647.2 N·m
- B. 3294.4 N·m
- C. 2470.8 N·m
- D. 3294.95 N·m

58. A power screw has lead 7 mm, input torque 4133 N·m, and raising efficiency 0.32. What axial load can it raise?

- A. 593.56 kN
- B. 1780.69 kN
- C. 1187.13 kN
- D. 2374.25 kN

59. A 19-tooth pinion rotating at 22200 rpm drives a 56-tooth gear. Neglecting slip, what is the gear speed?

- A. 3766.07 rpm
- B. 14667.86 rpm
- C. 22200 rpm
- D. 7532.14 rpm

60. A shaft transmits 2061 hp at 42120 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1541.96 in·lbf
- B. 3083.92 in·lbf
- C. 4625.87 in·lbf
- D. 6167.83 in·lbf

61. An open belt connects a 125-mm driver at 21370 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 4308.47 rpm
- B. 12753.06 rpm
- C. 21370 rpm
- D. 8616.94 rpm

62. A collar bearing supports 1032.0 kN at mean friction radius 0.022 m with friction coefficient 0.090. What friction torque must be overcome?

- A. 2043.36 N·m
- B. 4086.72 N·m
- C. 3065.04 N·m
- D. 4087.27 N·m

63. A power screw has lead 6 mm, input torque 4143 N·m, and raising efficiency 0.33. What axial load can it raise?

- A. 715.86 kN
- B. 2147.58 kN
- C. 1431.72 kN
- D. 2863.44 kN

64. A 20-tooth pinion rotating at 22250 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 3836.21 rpm
- B. 7672.41 rpm
- C. 14577.59 rpm
- D. 22250 rpm

65. A shaft transmits 2066 hp at 42220 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1542.04 in·lbf
- B. 3084.08 in·lbf
- C. 4626.11 in·lbf
- D. 6168.15 in·lbf

66. An open belt connects a 120-mm driver at 21420 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 8568 rpm
- B. 4284 rpm
- C. 12852 rpm
- D. 21420 rpm

67. A hydraulic cylinder must produce 1032.0 kN using a piston area of 21300 mm². Neglecting losses, what gauge pressure is required?

- A. 24.23 MPa
- B. 24.64 MPa
- C. 48.45 MPa
- D. 96.9 MPa

68. A simply supported beam of span 2.5 m carries a central point load of 2059 kN. What is the maximum bending moment?

- A. 2573.75 kN·m
- B. 643.44 kN·m
- C. 823.6 kN·m
- D. 1286.88 kN·m

69. A lever has an effort arm of 6246 mm and a load arm of 4124 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 1.51
- D. 3.03

70. A 606-V DC source is applied across a 9- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 67.33 A
- B. 33.67 A
- C. 101 A
- D. 134.67 A

71. A thin-walled cylindrical vessel has internal pressure 207.4 MPa, inside diameter 10620 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 42357.46 MPa
- B. 169429.85 MPa
- C. 42358.01 MPa
- D. 84714.92 MPa

72. A linear spring has stiffness 2070 kN/m and is compressed 42 mm. What force does it exert?

- A. 43470 N
- B. 86940 N
- C. 130410 N
- D. 43470.55 N

73. An undamped single-degree system has mass 2064 kg and stiffness 1047000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.38 Hz
- D. 7.17 Hz

74. A hydraulic cylinder must produce 1035.5 kN using a piston area of 21370 mm². Neglecting losses, what gauge pressure is required?

- A. 24.23 MPa
- B. 24.64 MPa
- C. 96.91 MPa
- D. 48.46 MPa

75. A simply supported beam of span 2.4 m carries a central point load of 2066 kN. What is the maximum bending moment?

- A. 1239.6 kN·m
- B. 2479.2 kN·m
- C. 619.8 kN·m
- D. 860.83 kN·m

76. A lever has an effort arm of 6267 mm and a load arm of 4138 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 1.51
- D. 3.03

77. A 608-V DC source is applied across a 6- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 50.67 A
- B. 152 A
- C. 101.33 A
- D. 202.67 A

78. A thin-walled cylindrical vessel has internal pressure 208.1 MPa, inside diameter 10655 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 39594.74 MPa
- B. 158378.96 MPa
- C. 39595.29 MPa
- D. 79189.48 MPa

79. A linear spring has stiffness 2077 kN/m and is compressed 40 mm. What force does it exert?

- A. 83080 N
- B. 41540 N
- C. 124620 N
- D. 41540.55 N

80. An undamped single-degree system has mass 2071 kg and stiffness 1050500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.38 Hz
- D. 7.17 Hz

81. A hydraulic cylinder must produce 1039.0 kN using a piston area of 21440 mm². Neglecting losses, what gauge pressure is required?

- A. 48.46 MPa
- B. 24.23 MPa
- C. 24.64 MPa
- D. 96.92 MPa

82. A simply supported beam of span 2.7 m carries a central point load of 2073 kN. What is the maximum bending moment?

- A. 2798.55 kN·m
- B. 699.64 kN·m
- C. 1399.28 kN·m
- D. 767.78 kN·m

83. A lever has an effort arm of 6288 mm and a load arm of 4152 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.03

84. A 610-V DC source is applied across a 8- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 38.12 A
- B. 114.38 A
- C. 152.5 A
- D. 76.25 A

85. A thin-walled cylindrical vessel has internal pressure 208.8 MPa, inside diameter 10690 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 46501.5 MPa
- B. 186006 MPa
- C. 93003 MPa
- D. 46502.05 MPa

86. A linear spring has stiffness 2084 kN/m and is compressed 46 mm. What force does it exert?

- A. 95864 N
- B. 47932 N
- C. 143796 N
- D. 47932.55 N

87. An undamped single-degree system has mass 2078 kg and stiffness 1054000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.38 Hz
- C. 7.17 Hz
- D. 3.58 Hz

88. A hydraulic cylinder must produce 1042.5 kN using a piston area of 21510 mm². Neglecting losses, what gauge pressure is required?

- A. 24.23 MPa
- B. 48.47 MPa
- C. 24.64 MPa
- D. 96.93 MPa

89. A simply supported beam of span 2.6 m carries a central point load of 2080 kN. What is the maximum bending moment?

- A. 2704 kN·m
- B. 676 kN·m
- C. 1352 kN·m
- D. 800 kN·m

90. A mating hole measures 2065.04 mm and its shaft measures 2064.98 mm. What diametral clearance exists?

- A. 0.06 mm
- B. 0.04 mm
- C. 0.02 mm
- D. 0.03 mm

91. Inspection accepts 10685 of 10705 manufactured parts. What is the observed percent yield?

- A. 49.91 %
- B. 99.81 %
- C. 149.72 %
- D. 100.19 %

92. A machining operation reduces a diameter from 2074 mm to 2070 mm. What percent reduction in diameter occurs?

- A. 0.46 %
- B. 0.29 %
- C. 0.39 %
- D. 0.19 %

93. Four repeated measurements are 70.45, 70.41, 70.44, and 70.42 mm. What is their arithmetic mean?

- A. 35.22 mm
- B. 281.72 mm
- C. 70.43 mm
- D. 70.45 mm

94. A mating hole measures 2069.05 mm and its shaft measures 2068.98 mm. What diametral clearance exists?

- A. 0.05 mm
- B. 0.02 mm
- C. 0.04 mm
- D. 0.07 mm

95. Inspection accepts 10705 of 10725 manufactured parts. What is the observed percent yield?

- A. 99.81 %

- B. 49.91 %
- C. 149.72 %
- D. 100.19 %

96. A machining operation reduces a diameter from 2078 mm to 2074 mm. What percent reduction in diameter occurs?

- A. 0.46 %
- B. 0.19 %
- C. 0.29 %
- D. 0.38 %

97. Four repeated measurements are 70.49, 70.45, 70.48, and 70.46 mm. What is their arithmetic mean?

- A. 70.47 mm
- B. 35.23 mm
- C. 281.88 mm
- D. 70.49 mm

98. A mating hole measures 2073.06 mm and its shaft measures 2072.98 mm. What diametral clearance exists?

- A. 0.06 mm
- B. 0.08 mm
- C. 0.02 mm
- D. 0.04 mm

99. Inspection accepts 10725 of 10745 manufactured parts. What is the observed percent yield?

- A. 49.91 %
- B. 149.72 %

- C. 100.19 %
- D. 99.81 %

100. A machining operation reduces a diameter from 2082 mm to 2078 mm. What percent reduction in diameter occurs?

- A. 0.46 %
- B. 0.29 %
- C. 0.19 %
- D. 0.38 %

Practice Exam 13: Answer Key and Explanations

1. C — C — Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 83348.08 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

2. D — D — The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

3. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 26136.6 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

4. B — B — Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 15417505 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

5. A — A — Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 83508.08 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

- 6. C — C —** The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 7. B — B —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 26187.4 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent
- 8. D — D —** Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 13264232.86 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 9. C — C —** Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 83668.08 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 10. B — B —** The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 11. A — A —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 26238.2 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent
- 12. D — D —** Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 11649358.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 13. C — C —** Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 83828.09 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 14. D — D —** The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.94 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

15. B — B — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 26289 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

16. A — A — Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 15590125 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

17. C — C — Average axial stress is force divided by net resisting area. Converting kilonewtons to newtons makes newtons per square millimeter, numerically equal to megapascals. Substitution gives 390.52 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

18. D — D — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1511.14 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

19. B — B — Using $\sigma = \frac{Mc}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.08 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

20. D — D — Elastic axial elongation follows $\Delta L = \frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 81.18 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

21. A — A — For a ductile material evaluated by von Mises stress, the yield factor of safety is yield strength divided by equivalent stress. Substitution gives 2.5. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign

22. C — C — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI$ divided by L^2 . Substitution gives 147.51 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

23. A — A — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4043.41 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

24. B — B — The modified Goodman relation divides alternating stress by endurance limit and mean stress by ultimate strength; their sum equals the reciprocal safety factor. Substitution gives 1.16 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

25. B — B — Average axial stress is force divided by net resisting area. Converting kilonewtons to newtons makes newtons per square millimeter, numerically equal to megapascals. Substitution gives 390.56 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

26. C — C — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1093.18 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

27. A — A — Using $\sigma = \frac{Mc}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.08 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

28. D — D — Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 81.5 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

29. C — C — For a ductile material evaluated by von Mises stress, the yield factor of safety is yield strength divided by equivalent stress. Substitution gives 2.5 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign

30. A — A — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\frac{\pi^2 EI}{L^2}$. Substitution gives 146.96 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

31. D — D — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4058.91 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

32. B — B — The modified Goodman relation divides alternating stress by endurance limit and mean stress by ultimate strength; their sum equals the reciprocal safety factor. Substitution gives 1.16 . Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

33. C — C — Average axial stress is force divided by net resisting area. Converting kilonewtons to newtons makes newtons per square millimeter, numerically equal to megapascals. Substitution gives 390.59 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

34. A — A — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1359.73 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

35. B — B — Using $\sigma = \frac{Mc}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.08 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

36. D — D — Elastic axial elongation follows $\Delta L = \frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 81.82 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

37. B — B — For a ductile material evaluated by von Mises stress, the yield factor of safety is yield strength divided by equivalent stress. Substitution gives 2.5. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign

38. C — C — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\frac{\pi^2 EI}{L^2}$. Substitution gives 146.42 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

39. D — D — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 4074.4 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

40. A — A — The modified Goodman relation divides alternating stress by endurance limit and mean stress by ultimate strength; their sum equals the reciprocal safety factor. Substitution gives 1.16. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

41. B — B — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 9118.25 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

42. D — D — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 18827.27 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

43. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 5750 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

44. A — A — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.37 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

45. A — A — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 6712.12 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

46. D — D — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 17291.67 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

47. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 6481.25 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

48. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 50.03 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

49. D — D — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 5148.91 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

50. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 20790 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

51. B — B — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 6111.76 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

52. C — C — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.78 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

53. C — C — Equal load sharing divides the applied force among the rivets, and single-shear area is the circular cross-sectional area of one rivet. Substitution gives 9171.3 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

54. D — D — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 7383.33 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

55. A — A — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3083.76 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

56. B — B — Equal belt speed at both pulley rims gives $N_1 D_1$ equal to $N_2 D_2$, so driven speed is driver speed times the diameter ratio. Substitution gives 8661.25 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

57. A — A — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 1647.2 N·m. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

58. C — C — Efficiency is output work divided by input work per revolution. Equating output F times lead to efficiency times 2π torque gives the load. Substitution gives 1187.13 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

59. D — D — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 7532.14 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

60. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3083.92 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

61. D — D — Equal belt speed at both pulley rims gives N_1D_1 equal to N_2D_2 , so driven speed is driver speed times the diameter ratio. Substitution gives 8616.94 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

62. A — A — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 2043.36 N·m. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

63. C — C — Efficiency is output work divided by input work per revolution. Equating output F times lead to efficiency times 2π torque gives the load. Substitution gives 1431.72 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

64. B — B — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 7672.41 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

65. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3084.08 in·lbf. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the

66. A — A — Equal belt speed at both pulley rims gives N_1D_1 equal to N_2D_2 , so driven speed is driver speed times the diameter ratio. Substitution gives 8568 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

67. C — C — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.45 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

68. D — D — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1286.88 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

69. C — C — Moment equilibrium about the fulcrum makes effort times effort arm equal load times load arm, so ideal mechanical advantage is their arm ratio. Substitution gives 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

70. A — A — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 67.33 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

71. D — D — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 84714.92 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

72. B — B — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 86940 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

73. B — B — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2 pi converts it to cycles per second. Substitution gives 3.58 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

74. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.46 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

75. A — A — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1239.6 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

76. C — C — Moment equilibrium about the fulcrum makes effort times effort arm equal load times load arm, so ideal mechanical advantage is their arm ratio. Substitution gives 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

77. C — C — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 101.33 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

78. D — D — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 79189.48 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

79. A — A — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 83080 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

80. B — B — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2π converts it to cycles per second. Substitution gives 3.58 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

81. A — A — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.46 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

82. C — C — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1399.28 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

83. B — B — Moment equilibrium about the fulcrum makes effort times effort arm equal load times load arm, so ideal mechanical advantage is their arm ratio. Substitution gives 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

84. D — D — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 76.25 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

85. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 93003 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can

86. A — A — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 95864 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

87. D — D — Natural circular frequency is the square root of stiffness divided by mass. Dividing radians per second by 2π converts it to cycles per second. Substitution gives 3.58 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

88. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.47 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature rounding can shift a close design

89. C — C — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1352 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

90. A — A — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.06 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

91. B — B — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.81 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

92. D — D — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.19 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

93. C — C — The arithmetic mean is the sum of all readings divided by their count. Range and total are not estimates of the central measured value. Substitution gives 70.43 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

94. D — D — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.07 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

95. A — A — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.81 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

96. B — B — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.19 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

97. A — A — The arithmetic mean is the sum of all readings divided by their count. Range and total are not estimates of the central measured value. Substitution gives 70.47 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

98. B — B — Diametral clearance is the actual hole diameter minus the actual shaft diameter. Radius differences would give only half the requested diametral value. Substitution gives 0.08 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

99. D — D — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.81 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

100. C — C — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.19 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the