

PRACTICE EXAM 12: 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 drawing dimension is 943.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 23952.2 mm
- B. 11976.1 mm
- C. 35928.3 mm
- D. 23977.6 mm

2. A machine saves 20510 labor-hours annually at \$3827/h. Ignoring interest, its \$199100 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 4893291.88 \$/year
- B. 9836358.75 \$/year
- C. 9786583.75 \$/year
- D. 19573167.5 \$/year

3. A proposed fixture has a fixed fabrication cost of \$76380 and a variable cost of \$948000 spread over 3824 units. What is the average cost per unit?

- A. 38313.95 \$/unit
- B. 76627.91 \$/unit
- C. 84290.7 \$/unit
- D. 153255.82 \$/unit

4. A component is expected to experience 1913 MPa maximum stress, while its allowable design stress is 486.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.43
- C. 7.87
- D. 3.93

5. A drawing dimension is 945.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 12001.5 mm
- B. 36004.5 mm
- C. 24028.4 mm
- D. 24003 mm

6. A machine saves 20550 labor-hours annually at \$3835/h. Ignoring interest, its \$199500 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 6550812.5 \$/year
- B. 13101625 \$/year
- C. 13168125 \$/year
- D. 26203250 \$/year

7. A proposed fixture has a fixed fabrication cost of \$76540 and a variable cost of \$950000 spread over 3832 units. What is the average cost per unit?

- A. 38393.96 \$/unit
- B. 84466.7 \$/unit
- C. 76787.91 \$/unit
- D. 153575.82 \$/unit

8. A component is expected to experience 1917 MPa maximum stress, while its allowable design stress is 487.25 MPa. What design factor is implied?

- A. 3.93
- B. 1.97
- C. 4.43
- D. 7.87

9. A drawing dimension is 947.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 24053.8 mm
- B. 12026.9 mm
- C. 36080.7 mm
- D. 24079.2 mm

10. A machine saves 20590 labor-hours annually at \$3843/h. Ignoring interest, its \$199900 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 5637676.43 \$/year
- B. 11332467.14 \$/year
- C. 22550705.71 \$/year
- D. 11275352.86 \$/year

11. A proposed fixture has a fixed fabrication cost of \$76700 and a variable cost of \$952000 spread over 3840 units. What is the average cost per unit?

- A. 38473.96 \$/unit
- B. 76947.92 \$/unit
- C. 84642.71 \$/unit
- D. 153895.83 \$/unit

12. A component is expected to experience 1921 MPa maximum stress, while its allowable design stress is 488.25 MPa. What design factor is implied?

- A. 1.97
- B. 4.43
- C. 3.93
- D. 7.87

13. A drawing dimension is 949.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 12052.3 mm
- B. 24104.6 mm
- C. 36156.9 mm
- D. 24130 mm

14. A machine saves 20630 labor-hours annually at \$3851/h. Ignoring interest, its \$200300 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 4952864.38 \$/year
- B. 9955803.75 \$/year
- C. 19811457.5 \$/year
- D. 9905728.75 \$/year

15. A proposed fixture has a fixed fabrication cost of \$76860 and a variable cost of \$954000 spread over 3848 units. What is the average cost per unit?

- A. 38553.96 \$/unit
- B. 84818.71 \$/unit
- C. 77107.92 \$/unit
- D. 154215.84 \$/unit

16. A component is expected to experience 1925 MPa maximum stress, while its allowable design stress is 489.25 MPa. What design factor is implied?

- A. 3.93
- B. 1.97
- C. 4.43
- D. 7.87

17. At a point, $\sigma_x = 3820$ MPa, $\sigma_y = 1900$ MPa, and $\tau_{xy} = 960.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 3702.59 MPa
- B. 4266.43 MPa
- C. 1920 MPa
- D. 1851.3 MPa

18. A part has alternating stress 3852 MPa and mean stress 1941 MPa. With $S_e = 5813$ MPa and $S_{ut} = 9855$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.08
- C. 1.16
- D. 1.38

19. A prismatic bar carries 3784 kN axial tension over a net area of 9710 mm². What is the average normal stress?

- A. 194.85 MPa
- B. 389.7 MPa
- C. 195.26 MPa

D. 584.55 MPa

20. A solid circular shaft of diameter 56 mm transmits 38360 N·m torque. What is its maximum torsional shear stress?

A. 556.23 MPa

B. 2224.92 MPa

C. 2225.47 MPa

D. 1112.46 MPa

21. A rectangular beam 3828 mm wide and 3888 mm deep carries a maximum bending moment of 949.0 kN·m. What is the extreme-fiber bending stress?

A. 0.05 MPa

B. 0.46 MPa

C. 0.6 MPa

D. 0.1 MPa

22. A steel tie, length 38700 mm and area 9875 mm², carries 3800 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

A. 37.23 mm

B. 74.46 mm

C. 148.92 mm

D. 37.78 mm

23. A ductile member has yield strength 9630 MPa and calculated von Mises stress 3847 MPa. What factor of safety against yielding results?

A. 1.25

B. 1.5

- C. 2.5
- D. 3.5

24. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 195700000 \text{ mm}^4$, and length 49125 mm . What is its Euler critical load?

- A. 160.07 kN
- B. 640.29 kN
- C. 40.02 kN
- D. 50.95 kN

25. At a point, $\sigma_x = 3836 \text{ MPa}$, $\sigma_y = 1908 \text{ MPa}$, and $\tau_{xy} = 964.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 4284.32 MPa
- B. 3718.09 MPa
- C. 1928 MPa
- D. 1859.04 MPa

26. A part has alternating stress 3868 MPa and mean stress 1949 MPa . With $S_e = 5837 \text{ MPa}$ and $S_{ut} = 9895 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.08
- C. 1.38
- D. 1.16

27. A prismatic bar carries 3800 kN axial tension over a net area of 9750 mm^2 . What is the average normal stress?

- A. 389.74 MPa

- B. 194.87 MPa
- C. 195.28 MPa
- D. 584.62 MPa

28. A solid circular shaft of diameter 52 mm transmits 38520 N·m torque. What is its maximum torsional shear stress?

- A. 697.62 MPa
- B. 2790.46 MPa
- C. 1395.23 MPa
- D. 2791.01 MPa

29. A rectangular beam 3844 mm wide and 3904 mm deep carries a maximum bending moment of 953.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.05 MPa
- B. 0.46 MPa
- C. 0.1 MPa
- D. 0.6 MPa

30. A steel tie, length 38860 mm and area 9915 mm², carries 3816 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 37.39 mm
- B. 149.56 mm
- C. 37.94 mm
- D. 74.78 mm

31. A ductile member has yield strength 9670 MPa and calculated von Mises stress 3863 MPa. What factor of safety against yielding results?

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

32. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 196500000 \text{ mm}^4$, and length 49325 mm . What is its Euler critical load?

- A. 159.43 kN
- B. 637.7 kN
- C. 39.86 kN
- D. 50.75 kN

33. At a point, $\sigma_x = 3852 \text{ MPa}$, $\sigma_y = 1916 \text{ MPa}$, and $\tau_{xy} = 968.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 4302.2 MPa
- B. 1936 MPa
- C. 3733.58 MPa
- D. 1866.79 MPa

34. A part has alternating stress 3884 MPa and mean stress 1957 MPa . With $S_e = 5861 \text{ MPa}$ and $S_{ut} = 9935 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.16
- B. 1.51
- C. 5.08
- D. 1.38

35. A prismatic bar carries 3816 kN axial tension over a net area of 9790 mm^2 . What is the average normal stress?

- A. 194.89 MPa
- B. 195.3 MPa
- C. 584.68 MPa
- D. 389.79 MPa

36. A solid circular shaft of diameter 58 mm transmits 38680 N·m torque. What is its maximum torsional shear stress?

- A. 504.83 MPa
- B. 1009.65 MPa
- C. 2019.31 MPa
- D. 2019.86 MPa

37. A rectangular beam 3860 mm wide and 3920 mm deep carries a maximum bending moment of 957.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.05 MPa
- B. 0.46 MPa
- C. 0.1 MPa
- D. 0.6 MPa

38. A steel tie, length 39020 mm and area 9955 mm², carries 3832 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 75.1 mm
- B. 37.55 mm
- C. 150.2 mm
- D. 38.1 mm

39. A ductile member has yield strength 9710 MPa and calculated von Mises stress 3879 MPa. What factor of safety against yielding results?

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

40. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 197300000 \text{ mm}^4$, and length 49525 mm . What is its Euler critical load?

- A. 635.14 kN
- B. 39.7 kN
- C. 50.54 kN
- D. 158.78 kN

41. Using the relation $T = KF_d$, estimate bolt preload when installation torque is $18980 \text{ N}\cdot\text{m}$, nut factor $K = 0.2$, and nominal diameter is 17 mm .

- A. 5582.62 kN
- B. 8373.53 kN
- C. 5582.35 kN
- D. 1116.47 kN

42. Two parallel fillet welds, each 3822 mm long with 8 mm leg size, carry 1891 kN direct shear. Using throat $= 0.707h$, what average weld throat stress results?

- A. 43.74 MPa
- B. 61.85 MPa
- C. 30.92 MPa
- D. 87.48 MPa

43. A lap joint uses 4 identical 12-mm -diameter rivets in single shear to carry 3789 kN . Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 33502.12 MPa
- B. 8375.53 MPa
- C. 4187.76 MPa
- D. 16751.06 MPa

44. A bolt transfers 3806 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. 5506.76 MPa
- B. 8650 MPa
- C. 17300 MPa
- D. 34600 MPa

45. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 19020 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 5283.6 kN
- B. 7925 kN
- C. 1056.67 kN
- D. 5283.33 kN

46. Two parallel fillet welds, each 3830 mm long with 6 mm leg size, carry 1895 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 82.46 MPa
- B. 41.23 MPa
- C. 116.64 MPa
- D. 58.32 MPa

47. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 3797 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 6166.44 MPa
- B. 24665.77 MPa
- C. 3083.22 MPa
- D. 12332.88 MPa

48. A bolt transfers 3814 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. 5058.47 MPa
- B. 15891.67 MPa
- C. 7945.83 MPa
- D. 31783.33 MPa

49. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 19060 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 5956.52 kN
- B. 8934.38 kN
- C. 5956.25 kN
- D. 1191.25 kN

50. Two parallel fillet welds, each 3838 mm long with 7 mm leg size, carry 1899 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 70.68 MPa
- B. 49.99 MPa
- C. 35.34 MPa
- D. 99.98 MPa

51. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 3805 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 4731.13 MPa
- B. 18924.52 MPa
- C. 2365.56 MPa
- D. 9462.26 MPa

52. A bolt transfers 3822 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. 6082.9 MPa
- B. 9555 MPa
- C. 38220 MPa
- D. 19110 MPa

53. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 19100 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 5617.65 kN
- B. 5617.92 kN
- C. 8426.47 kN
- D. 1123.53 kN

54. A 20-tooth pinion rotating at 20450 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 3525.86 rpm
- B. 13398.28 rpm
- C. 7051.72 rpm
- D. 20450 rpm

55. A shaft transmits 1886 hp at 38620 rpm. Using $T(\text{in} \cdot \text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1538.91 in·lbf
- B. 4616.72 in·lbf
- C. 6155.63 in·lbf
- D. 3077.81 in·lbf

56. An open belt connects a 120-mm driver at 19620 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 3924 rpm
- B. 7848 rpm
- C. 11772 rpm
- D. 19620 rpm

57. A collar bearing supports 944.5 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 1685.93 N·m
- B. 3371.87 N·m
- C. 2528.9 N·m
- D. 3372.42 N·m

58. A power screw has lead 8 mm, input torque 3793 N·m, and raising efficiency 0.34. What axial load can it raise?

- A. 506.43 kN
- B. 1519.3 kN
- C. 1012.87 kN
- D. 2025.73 kN

59. A 21-tooth pinion rotating at 20500 rpm drives a 60-tooth gear. Neglecting slip, what is the gear speed?

- A. 3587.5 rpm
- B. 7175 rpm
- C. 13325 rpm
- D. 20500 rpm

60. A shaft transmits 1891 hp at 38720 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1539 in·lbf
- B. 4617 in·lbf
- C. 6156.01 in·lbf
- D. 3078 in·lbf

61. An open belt connects a 130-mm driver at 19670 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 3995.47 rpm
- B. 7990.94 rpm
- C. 11679.06 rpm
- D. 19670 rpm

62. A collar bearing supports 947.0 kN at mean friction radius 0.020 m with friction coefficient 0.080. What friction torque must be overcome?

- A. 1515.2 N·m
- B. 3030.4 N·m
- C. 2272.8 N·m
- D. 3030.95 N·m

63. A power screw has lead 7 mm, input torque 3803 N·m, and raising efficiency 0.35. What axial load can it raise?

- A. 597.37 kN
- B. 1792.12 kN
- C. 1194.75 kN
- D. 2389.5 kN

64. A 18-tooth pinion rotating at 20550 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 3425 rpm
- B. 13700 rpm
- C. 20550 rpm
- D. 6850 rpm

65. A shaft transmits 1896 hp at 38820 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1539.1 in·lbf
- B. 4617.29 in·lbf
- C. 3078.19 in·lbf
- D. 6156.38 in·lbf

66. An open belt connects a 125-mm driver at 19720 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 7951.61 rpm
- B. 3975.81 rpm
- C. 11768.39 rpm
- D. 19720 rpm

67. A linear spring has stiffness 1895 kN/m and is compressed 44 mm. What force does it exert?

- A. 41690 N
- B. 83380 N
- C. 125070 N
- D. 41690.55 N

68. An undamped single-degree system has mass 1889 kg and stiffness 959500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.38 Hz
- C. 7.17 Hz
- D. 3.59 Hz

69. A hydraulic cylinder must produce 948.0 kN using a piston area of 19620 mm². Neglecting losses, what gauge pressure is required?

- A. 24.16 MPa
- B. 48.32 MPa
- C. 24.57 MPa
- D. 96.64 MPa

70. A simply supported beam of span 2.5 m carries a central point load of 1891 kN. What is the maximum bending moment?

- A. 2363.75 kN·m
- B. 590.94 kN·m
- C. 1181.88 kN·m
- D. 756.4 kN·m

71. A lever has an effort arm of 5742 mm and a load arm of 3788 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 3.03
- D. 1.52

72. A 558-V DC source is applied across a 6- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 93 A
- B. 46.5 A
- C. 139.5 A
- D. 186 A

73. A thin-walled cylindrical vessel has internal pressure 190.6 MPa, inside diameter 9780 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 71694.92 MPa
- B. 35847.46 MPa
- C. 143389.85 MPa
- D. 35848.01 MPa

74. A linear spring has stiffness 1902 kN/m and is compressed 42 mm. What force does it exert?

- A. 39942 N
- B. 79884 N
- C. 119826 N
- D. 39942.55 N

75. An undamped single-degree system has mass 1896 kg and stiffness 963000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.38 Hz
- C. 3.59 Hz
- D. 7.17 Hz

76. A hydraulic cylinder must produce 951.5 kN using a piston area of 19690 mm². Neglecting losses, what gauge pressure is required?

- A. 24.16 MPa
- B. 24.57 MPa
- C. 96.65 MPa
- D. 48.32 MPa

77. A simply supported beam of span 2.4 m carries a central point load of 1898 kN. What is the maximum bending moment?

- A. 2277.6 kN·m
- B. 569.4 kN·m
- C. 1138.8 kN·m
- D. 790.83 kN·m

78. A lever has an effort arm of 5763 mm and a load arm of 3802 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 3.03
- D. 1.52

79. A 560-V DC source is applied across a 8-Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 35 A
- B. 70 A
- C. 105 A
- D. 140 A

80. A thin-walled cylindrical vessel has internal pressure 191.3 MPa, inside diameter 9815 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 67057.48 MPa
- B. 33528.74 MPa
- C. 134114.96 MPa
- D. 33529.29 MPa

81. A linear spring has stiffness 1909 kN/m and is compressed 40 mm. What force does it exert?

- A. 38180 N
- B. 114540 N
- C. 38180.55 N
- D. 76360 N

82. An undamped single-degree system has mass 1903 kg and stiffness 966500 N/m. What is its natural frequency in hertz?

- A. 3.59 Hz
- B. 1.79 Hz
- C. 5.38 Hz
- D. 7.17 Hz

83. A hydraulic cylinder must produce 955.0 kN using a piston area of 19760 mm². Neglecting losses, what gauge pressure is required?

- A. 24.16 MPa
- B. 48.33 MPa
- C. 24.57 MPa
- D. 96.66 MPa

84. A simply supported beam of span 2.7 m carries a central point load of 1905 kN. What is the maximum bending moment?

- A. 2571.75 kN·m
- B. 642.94 kN·m
- C. 1285.88 kN·m
- D. 705.56 kN·m

85. A lever has an effort arm of 5784 mm and a load arm of 3816 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.52
- C. 2.27
- D. 3.03

86. A 562-V DC source is applied across a 10- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 28.1 A
- B. 84.3 A
- C. 56.2 A
- D. 112.4 A

87. A thin-walled cylindrical vessel has internal pressure 192.0 MPa, inside diameter 9850 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 39400 MPa
- B. 157600 MPa
- C. 39400.55 MPa
- D. 78800 MPa

88. A linear spring has stiffness 1916 kN/m and is compressed 46 mm. What force does it exert?

- A. 88136 N
- B. 44068 N
- C. 132204 N
- D. 44068.55 N

89. An undamped single-degree system has mass 1910 kg and stiffness 970000 N/m. What is its natural frequency in hertz?

- A. 3.59 Hz
- B. 1.79 Hz
- C. 5.38 Hz
- D. 7.17 Hz

90. A machining operation reduces a diameter from 1902 mm to 1898 mm. What percent reduction in diameter occurs?

- A. 0.48 %
- B. 0.32 %
- C. 0.42 %
- D. 0.21 %

91. Four repeated measurements are 68.73, 68.69, 68.72, and 68.70 mm. What is their arithmetic mean?

- A. 34.36 mm

- B. 274.84 mm
- C. 68.71 mm
- D. 68.73 mm

92. A mating hole measures 1897.04 mm and its shaft measures 1896.98 mm. What diametral clearance exists?

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

93. Inspection accepts 9845 of 9865 manufactured parts. What is the observed percent yield?

- A. 49.9 %
- B. 149.7 %
- C. 100.2 %
- D. 99.8 %

94. A machining operation reduces a diameter from 1906 mm to 1902 mm. What percent reduction in diameter occurs?

- A. 0.48 %
- B. 0.31 %
- C. 0.21 %
- D. 0.42 %

95. Four repeated measurements are 68.77, 68.73, 68.76, and 68.74 mm. What is their arithmetic mean?

- A. 68.75 mm
- B. 34.38 mm

- C. 275 mm
- D. 68.77 mm

96. A mating hole measures 1901.05 mm and its shaft measures 1900.98 mm. What diametral clearance exists?

- A. 0.05 mm
- B. 0.07 mm
- C. 0.02 mm
- D. 0.03 mm

97. Inspection accepts 9865 of 9885 manufactured parts. What is the observed percent yield?

- A. 49.9 %
- B. 149.7 %
- C. 99.8 %
- D. 100.2 %

98. A machining operation reduces a diameter from 1910 mm to 1906 mm. What percent reduction in diameter occurs?

- A. 0.21 %
- B. 0.48 %
- C. 0.31 %
- D. 0.42 %

99. Four repeated measurements are 68.81, 68.77, 68.80, and 68.78 mm. What is their arithmetic mean?

- A. 34.39 mm
- B. 68.79 mm
- C. 275.16 mm

D. 68.81 mm

100. A mating hole measures 1905.06 mm and its shaft measures 1904.98 mm. What diametral clearance exists?

A. 0.06 mm

B. 0.02 mm

C. 0.04 mm

D. 0.08 mm

Practice Exam 12: Answer Key and Explanations

1. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 23952.2 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

2. C — C — 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 9786583.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

3. B — B — 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 76627.91 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

4. 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 3.93 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

5. D — D — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 24003 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

6. 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 13101625

\$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

7. 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 76787.91 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

8. A — A — The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.93 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

9. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 24053.8 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

10. 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 11275352.86 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

11. B — B — 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 76947.92 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

12. 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 3.93 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

13. B — B — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 24104.6 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

14. 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 9905728.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

15. 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 77107.92 \$/unit. Keeping the

calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

16. A — A — The design factor is the ratio of the expected maximum stress to the allowable design stress, not the inverse or a difference. Substitution gives 3.93 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

17. 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 3702.59 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,

18. C — C — 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

19. 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 389.7 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

20. 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 1112.46 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

21. D — D — Using $\sigma = Mc/I$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

22. B — B — Elastic axial elongation follows PL/AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 74.46 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,

23. 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

24. A — A — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI/L^2$. Substitution gives 160.07 kN. Keeping the calculation consistent

with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

25. B — B — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 3718.09 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,

26. D — D — 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

27. A — A — 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 389.74 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

28. 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 1395.23 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

29. C — C — Using $\sigma = Mc/I$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

30. D — D — Elastic axial elongation follows PL/AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 74.78 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,

31. 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

32. A — A — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI/L^2$. Substitution gives 159.43 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

33. C — C — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 3733.58

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,

34. 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

35. D — D — 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 389.79 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

36. B — B — 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 1009.65 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

37. C — C — Using σ equals $M c$ over I for a rectangle reduces to $6M$ divided by $b h$ squared. The moment must be expressed in newton-millimeters. Substitution gives 0.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

38. A — A — Elastic axial elongation follows PL divided by AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 75.1 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,

39. 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

40. D — D — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI$ divided by L^2 . Substitution gives 158.78 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

41. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 5582.35 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

42. A — A — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.74 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

43. 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 8375.53 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

44. C — C — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 17300 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

45. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 5283.33 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

46. D — D — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.32 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

47. 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 6166.44 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

48. B — B — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 15891.67 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

49. C — C — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 5956.25 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

50. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 49.99 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

51. 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 4731.13 MPa. Keeping the calculation

consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

52. D — D — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 19110 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

53. A — A — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 5617.65 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

54. C — C — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 7051.72 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. D — D — 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 3077.81 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 7848 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 1685.93 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 1012.87 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

59. B — B — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 7175 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. D — D — 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 3078 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. B — B — 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 7990.94 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 1515.2 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

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 1194.75 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

64. D — D — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 6850 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. C — C — 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 3078.19 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 7951.61 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

67. 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 83380 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

68. 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 3.59 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

69. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.32 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

70. 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 $1181.88 \text{ kN}\cdot\text{m}$. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

71. D — D — 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 1.52 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

72. 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 93 A . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

73. A — A — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 71694.92 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

74. 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 79884 N . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

75. C — C — 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 3.59 Hz . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

76. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.32 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

77. 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 $1138.8 \text{ kN}\cdot\text{m}$. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

78. D — D — 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 1.52 . Keeping the

calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

79. B — B — 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 70 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

80. A — A — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 67057.48 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

81. D — D — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 76360 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

82. A — A — 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 3.59 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

83. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.33 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

84. 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 1285.88 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

85. 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 1.52 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

86. 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 56.2 A. 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 — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 78800 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

88. 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 88136 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

89. A — A — 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 3.59 Hz. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied

90. D — D — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.21 %. 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

91. 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 68.71 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

92. 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 0.06 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

93. 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 99.8 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

94. C — C — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.21 %. 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

95. 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 68.75 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

96. 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 0.07 mm. Keeping the

calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

97. C — C — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.8 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

98. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.21 %. 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

99. B — B — 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 68.79 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

100. 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 0.08 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,