

PRACTICE EXAM 18: 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 1453.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 18453.1 mm
- B. 55359.3 mm
- C. 36931.6 mm
- D. 36906.2 mm

2. A machine saves 30710 labor-hours annually at \$5867/h. Ignoring interest, its \$301100 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 11242154.38 \$/year
- B. 22559583.75 \$/year
- C. 22484308.75 \$/year
- D. 44968617.5 \$/year

3. A proposed fixture has a fixed fabrication cost of \$117180 and a variable cost of \$1458000 spread over 5864 units. What is the average cost per unit?

- A. 58714.32 \$/unit
- B. 117428.64 \$/unit
- C. 129171.5 \$/unit
- D. 234857.27 \$/unit

4. A component is expected to experience 2933 MPa maximum stress, while its allowable design stress is 741.25 MPa. What design factor is implied?

- A. 3.96
- B. 1.98
- C. 4.46
- D. 7.91

5. A drawing dimension is 1455.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 18478.5 mm
- B. 36957 mm
- C. 55435.5 mm
- D. 36982.4 mm

6. A machine saves 30750 labor-hours annually at \$5875/h. Ignoring interest, its \$301500 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 30059125 \$/year
- B. 15029562.5 \$/year
- C. 30159625 \$/year
- D. 60118250 \$/year

7. A proposed fixture has a fixed fabrication cost of \$117340 and a variable cost of \$1460000 spread over 5872 units. What is the average cost per unit?

- A. 58794.32 \$/unit
- B. 129347.5 \$/unit
- C. 117588.64 \$/unit
- D. 235177.28 \$/unit

8. A component is expected to experience 2937 MPa maximum stress, while its allowable design stress is 742.25 MPa. What design factor is implied?

- A. 1.98
- B. 4.46
- C. 7.91
- D. 3.96

9. A drawing dimension is 1457.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 18503.9 mm
- B. 55511.7 mm
- C. 37033.2 mm
- D. 37007.8 mm

10. A machine saves 30790 labor-hours annually at \$5883/h. Ignoring interest, its \$301900 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 12916833.57 \$/year
- B. 25833667.14 \$/year
- C. 25919924.29 \$/year
- D. 51667334.29 \$/year

11. A proposed fixture has a fixed fabrication cost of \$117500 and a variable cost of \$1462000 spread over 5880 units. What is the average cost per unit?

- A. 58874.32 \$/unit
- B. 129523.5 \$/unit
- C. 117748.64 \$/unit
- D. 235497.28 \$/unit

12. A component is expected to experience 2941 MPa maximum stress, while its allowable design stress is 743.25 MPa. What design factor is implied?

- A. 3.96
- B. 1.98
- C. 4.46
- D. 7.91

13. A drawing dimension is 1459.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 18529.3 mm
- B. 55587.9 mm
- C. 37084 mm
- D. 37058.6 mm

14. A machine saves 30830 labor-hours annually at \$5891/h. Ignoring interest, its \$302300 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 22664653.75 \$/year
- B. 11332326.88 \$/year
- C. 22740228.75 \$/year
- D. 45329307.5 \$/year

15. A proposed fixture has a fixed fabrication cost of \$117660 and a variable cost of \$1464000 spread over 5888 units. What is the average cost per unit?

- A. 58954.32 \$/unit
- B. 129699.51 \$/unit
- C. 117908.64 \$/unit
- D. 235817.28 \$/unit

16. A component is expected to experience 2945 MPa maximum stress, while its allowable design stress is 744.25 MPa. What design factor is implied?

- A. 1.98
- B. 3.96
- C. 4.46
- D. 7.91

17. A rectangular beam 5860 mm wide and 5920 mm deep carries a maximum bending moment of 1457.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.04 MPa
- B. 0.02 MPa
- C. 0.43 MPa
- D. 0.57 MPa

18. A steel tie, length 59020 mm and area 14955 mm², carries 5832 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 57.54 mm
- B. 115.08 mm
- C. 230.16 mm
- D. 58.09 mm

19. A ductile member has yield strength 14710 MPa and calculated von Mises stress 5879 MPa. What factor of safety against yielding results?

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

D. 2.5

20. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 297300000 \text{ mm}^4$, and length 74525 mm . What is its Euler critical load?

- A. 422.65 kN
- B. 26.42 kN
- C. 105.66 kN
- D. 33.63 kN

21. At a point, $\sigma_x = 5868 \text{ MPa}$, $\sigma_y = 2924 \text{ MPa}$, and $\tau_{xy} = 1472.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 6556.16 MPa
- B. 5685.55 MPa
- C. 2944 MPa
- D. 2842.78 MPa

22. A part has alternating stress 5900 MPa and mean stress 2965 MPa . With $S_e = 8885 \text{ MPa}$ and $S_{ut} = 14975 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.05
- C. 1.16
- D. 1.37

23. A prismatic bar carries 5832 kN axial tension over a net area of 14830 mm^2 . What is the average normal stress?

- A. 196.63 MPa
- B. 197.04 MPa

- C. 589.89 MPa
- D. 393.26 MPa

24. A solid circular shaft of diameter 54 mm transmits 58840 N·m torque. What is its maximum torsional shear stress?

- A. 1903.1 MPa
- B. 951.55 MPa
- C. 3806.2 MPa
- D. 3806.75 MPa

25. A rectangular beam 5876 mm wide and 5936 mm deep carries a maximum bending moment of 1461.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa
- B. 0.04 MPa
- C. 0.43 MPa
- D. 0.57 MPa

26. A steel tie, length 59180 mm and area 14995 mm², carries 5848 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 57.7 mm
- B. 230.8 mm
- C. 58.25 mm
- D. 115.4 mm

27. A ductile member has yield strength 14750 MPa and calculated von Mises stress 5895 MPa. What factor of safety against yielding results?

- A. 2.5

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

28. A pin-ended column has $E = 200,000 \text{ MPa}$, $I = 298100000 \text{ mm}^4$, and length 74725 mm . What is its Euler critical load?

- A. 421.52 kN
- B. 26.35 kN
- C. 105.38 kN
- D. 33.54 kN

29. At a point, $\sigma_x = 5884 \text{ MPa}$, $\sigma_y = 2932 \text{ MPa}$, and $\tau_{xy} = 1476.0 \text{ MPa}$. What is the von Mises equivalent stress for plane stress?

- A. 6574.05 MPa
- B. 2952 MPa
- C. 5701.05 MPa
- D. 2850.52 MPa

30. A part has alternating stress 5916 MPa and mean stress 2973 MPa . With $S_e = 8909 \text{ MPa}$ and $S_{ut} = 15015 \text{ MPa}$, what Goodman fatigue factor of safety applies?

- A. 1.16
- B. 1.51
- C. 5.05
- D. 1.37

31. A prismatic bar carries 5848 kN axial tension over a net area of 14870 mm^2 . What is the average normal stress?

- A. 196.64 MPa
- B. 393.28 MPa
- C. 197.05 MPa
- D. 589.91 MPa

32. A solid circular shaft of diameter 50 mm transmits 59000 N·m torque. What is its maximum torsional shear stress?

- A. 1201.94 MPa
- B. 4807.75 MPa
- C. 4808.3 MPa
- D. 2403.88 MPa

33. A rectangular beam 5892 mm wide and 5952 mm deep carries a maximum bending moment of 1465.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa
- B. 0.43 MPa
- C. 0.57 MPa
- D. 0.04 MPa

34. A steel tie, length 59340 mm and area 15035 mm², carries 5864 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 57.86 mm
- B. 231.44 mm
- C. 115.72 mm
- D. 58.41 mm

35. A ductile member has yield strength 14790 MPa and calculated von Mises stress 5911 MPa. What factor of safety against yielding results?

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

36. A pin-ended column has $E = 200,000$ MPa, $I = 298900000$ mm⁴, and length 74925 mm. What is its Euler critical load?

- A. 105.1 kN
- B. 420.4 kN
- C. 26.27 kN
- D. 33.45 kN

37. At a point, $\sigma_x = 5900$ MPa, $\sigma_y = 2940$ MPa, and $\tau_{xy} = 1480.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 6591.93 MPa
- B. 5716.54 MPa
- C. 2960 MPa
- D. 2858.27 MPa

38. A part has alternating stress 5932 MPa and mean stress 2981 MPa. With $S_e = 8933$ MPa and $S_{ut} = 15055$ MPa, what Goodman fatigue factor of safety applies?

- A. 1.51
- B. 5.05
- C. 1.37
- D. 1.16

39. A prismatic bar carries 5864 kN axial tension over a net area of 14910 mm². What is the average normal stress?

- A. 196.65 MPa
- B. 197.06 MPa
- C. 393.29 MPa
- D. 589.94 MPa

40. A solid circular shaft of diameter 56 mm transmits 59160 N·m torque. What is its maximum torsional shear stress?

- A. 1715.67 MPa
- B. 857.84 MPa
- C. 3431.34 MPa
- D. 3431.89 MPa

41. Using the relation $T = KFd$, estimate bolt preload when installation torque is 29180 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 8582.62 kN
- B. 8582.35 kN
- C. 12873.53 kN
- D. 1716.47 kN

42. Two parallel fillet welds, each 5862 mm long with 8 mm leg size, carry 2911 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 43.9 MPa
- B. 62.07 MPa
- C. 31.04 MPa
- D. 87.8 MPa

43. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 5829 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 51539.68 MPa
- B. 6442.46 MPa
- C. 25769.84 MPa
- D. 12884.92 MPa

44. A bolt transfers 5846 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. 8458.36 MPa
- B. 13286.36 MPa
- C. 26572.73 MPa
- D. 53145.45 MPa

45. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 29220 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 8116.94 kN
- B. 12175 kN
- C. 1623.33 kN
- D. 8116.67 kN

46. Two parallel fillet welds, each 5870 mm long with 6 mm leg size, carry 2915 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 82.77 MPa
- B. 58.53 MPa
- C. 41.38 MPa
- D. 117.07 MPa

47. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 5837 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 37917.85 MPa
- B. 4739.73 MPa
- C. 9479.46 MPa
- D. 18958.93 MPa

48. A bolt transfers 5854 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. 24391.67 MPa
- B. 7764.11 MPa
- C. 12195.83 MPa
- D. 48783.33 MPa

49. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 29260 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 9143.75 kN
- B. 9144.02 kN
- C. 13715.62 kN
- D. 1828.75 kN

50. Two parallel fillet welds, each 5878 mm long with 7 mm leg size, carry 2919 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 70.94 MPa
- B. 35.47 MPa
- C. 100.34 MPa
- D. 50.17 MPa

51. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 5845 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 29070.65 MPa
- B. 3633.83 MPa
- C. 7267.66 MPa
- D. 14535.32 MPa

52. A bolt transfers 5862 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. 9329.66 MPa
- B. 29310 MPa
- C. 14655 MPa
- D. 58620 MPa

53. Using the relation $T = KF_d$, estimate bolt preload when installation torque is 29300 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 8617.92 kN
- B. 12926.47 kN
- C. 1723.53 kN
- D. 8617.65 kN

54. A 20-tooth pinion rotating at 30650 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 5284.48 rpm
- B. 20081.03 rpm
- C. 10568.97 rpm
- D. 30650 rpm

55. A shaft transmits 2906 hp at 59020 rpm. Using $T(\text{in} \cdot \text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 3103.2 in·lbf
- B. 1551.6 in·lbf
- C. 4654.79 in·lbf
- D. 6206.39 in·lbf

56. An open belt connects a 120-mm driver at 29820 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 5964 rpm
- B. 11928 rpm
- C. 17892 rpm
- D. 29820 rpm

57. A collar bearing supports 1454.5 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 5192.57 N·m
- B. 3894.42 N·m
- C. 2596.28 N·m
- D. 5193.12 N·m

58. A power screw has lead 8 mm, input torque 5833 N·m, and raising efficiency 0.34. What axial load can it raise?

- A. 778.81 kN
- B. 2336.43 kN
- C. 3115.23 kN
- D. 1557.62 kN

59. A 21-tooth pinion rotating at 30700 rpm drives a 60-tooth gear. Neglecting slip, what is the gear speed?

- A. 10745 rpm
- B. 5372.5 rpm
- C. 19955 rpm
- D. 30700 rpm

60. A shaft transmits 2911 hp at 59120 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1551.64 in·lbf
- B. 3103.28 in·lbf
- C. 4654.92 in·lbf
- D. 6206.56 in·lbf

61. An open belt connects a 130-mm driver at 29870 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 6067.34 rpm
- B. 17735.31 rpm
- C. 29870 rpm
- D. 12134.69 rpm

62. A collar bearing supports 1457.0 kN at mean friction radius 0.020 m with friction coefficient 0.080. What friction torque must be overcome?

- A. 2331.2 N·m
- B. 4662.4 N·m
- C. 3496.8 N·m
- D. 4662.95 N·m

63. A power screw has lead 7 mm, input torque 5843 N·m, and raising efficiency 0.35. What axial load can it raise?

- A. 917.82 kN
- B. 2753.45 kN
- C. 1835.63 kN
- D. 3671.27 kN

64. A 18-tooth pinion rotating at 30750 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 5125 rpm
- B. 10250 rpm
- C. 20500 rpm
- D. 30750 rpm

65. A shaft transmits 2916 hp at 59220 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 3103.36 in·lbf
- B. 1551.68 in·lbf
- C. 4655.04 in·lbf
- D. 6206.72 in·lbf

66. An open belt connects a 125-mm driver at 29920 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 6032.26 rpm
- B. 17855.48 rpm
- C. 29920 rpm
- D. 12064.52 rpm

67. A 848-V DC source is applied across a 6- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 70.67 A
- B. 141.33 A
- C. 212 A
- D. 282.67 A

68. A thin-walled cylindrical vessel has internal pressure 292.1 MPa, inside diameter 14855 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 77484.74 MPa
- B. 309938.96 MPa
- C. 154969.48 MPa
- D. 77485.29 MPa

69. A linear spring has stiffness 2917 kN/m and is compressed 40 mm. What force does it exert?

- A. 58340 N
- B. 175020 N
- C. 58340.55 N
- D. 116680 N

70. An undamped single-degree system has mass 2911 kg and stiffness 1470500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.37 Hz
- D. 7.15 Hz

71. A hydraulic cylinder must produce 1459.0 kN using a piston area of 29840 mm². Neglecting losses, what gauge pressure is required?

- A. 48.89 MPa
- B. 24.45 MPa
- C. 24.86 MPa
- D. 97.79 MPa

72. A simply supported beam of span 2.7 m carries a central point load of 2913 kN. What is the maximum bending moment?

- A. 3932.55 kN·m
- B. 983.14 kN·m
- C. 1966.28 kN·m
- D. 1078.89 kN·m

73. A lever has an effort arm of 8808 mm and a load arm of 5832 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 1.51
- C. 2.27
- D. 3.02

74. A 850-V DC source is applied across a 8- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 106.25 A
- B. 53.12 A
- C. 159.38 A
- D. 212.5 A

75. A thin-walled cylindrical vessel has internal pressure 292.8 MPa, inside diameter 14890 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 90829 MPa
- B. 363316 MPa
- C. 90829.55 MPa
- D. 181658 MPa

76. A linear spring has stiffness 2924 kN/m and is compressed 46 mm. What force does it exert?

- A. 67252 N
- B. 201756 N
- C. 134504 N
- D. 67252.55 N

77. An undamped single-degree system has mass 2918 kg and stiffness 1474000 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.37 Hz
- D. 7.15 Hz

78. A hydraulic cylinder must produce 1462.5 kN using a piston area of 29910 mm². Neglecting losses, what gauge pressure is required?

- A. 24.45 MPa
- B. 24.86 MPa
- C. 48.9 MPa
- D. 97.79 MPa

79. A simply supported beam of span 2.6 m carries a central point load of 2920 kN. What is the maximum bending moment?

- A. 3796 kN·m
- B. 949 kN·m
- C. 1123.08 kN·m
- D. 1898 kN·m

80. A lever has an effort arm of 8829 mm and a load arm of 5846 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 1.51
- B. 0.66
- C. 2.27
- D. 3.02

81. A 852-V DC source is applied across a 10- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 85.2 A
- B. 42.6 A
- C. 127.8 A
- D. 170.4 A

82. A thin-walled cylindrical vessel has internal pressure 293.5 MPa, inside diameter 14925 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 84240.14 MPa
- B. 336960.58 MPa
- C. 84240.69 MPa
- D. 168480.29 MPa

83. A linear spring has stiffness 2931 kN/m and is compressed 44 mm. What force does it exert?

- A. 64482 N
- B. 128964 N
- C. 193446 N
- D. 64482.55 N

84. An undamped single-degree system has mass 2925 kg and stiffness 1477500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.37 Hz
- C. 3.58 Hz
- D. 7.15 Hz

85. A hydraulic cylinder must produce 1466.0 kN using a piston area of 29980 mm². Neglecting losses, what gauge pressure is required?

- A. 24.45 MPa
- B. 24.86 MPa
- C. 97.8 MPa
- D. 48.9 MPa

86. A simply supported beam of span 2.5 m carries a central point load of 2927 kN. What is the maximum bending moment?

- A. 3658.75 kN·m
- B. 1829.38 kN·m
- C. 914.69 kN·m
- D. 1170.8 kN·m

87. A lever has an effort arm of 8850 mm and a load arm of 5860 mm. Neglecting friction, what is its ideal mechanical advantage?

- A. 0.66
- B. 2.27
- C. 1.51
- D. 3.02

88. A 854-V DC source is applied across a 7- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 122 A
- B. 61 A
- C. 183 A
- D. 244 A

89. A thin-walled cylindrical vessel has internal pressure 294.2 MPa, inside diameter 14960 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 78593.43 MPa
- B. 314373.71 MPa
- C. 157186.86 MPa
- D. 78593.98 MPa

90. A machining operation reduces a diameter from 2922 mm to 2918 mm. What percent reduction in diameter occurs?

- A. 0.14 %
- B. 0.41 %
- C. 0.21 %
- D. 0.27 %

91. Four repeated measurements are 78.93, 78.89, 78.92, and 78.90 mm. What is their arithmetic mean?

- A. 39.45 mm
- B. 78.91 mm
- C. 315.64 mm
- D. 78.93 mm

92. A mating hole measures 2917.04 mm and its shaft measures 2916.98 mm. What diametral clearance exists?

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

93. Inspection accepts 14945 of 14965 manufactured parts. What is the observed percent yield?

- A. 49.93 %
- B. 149.8 %
- C. 100.13 %
- D. 99.87 %

94. A machining operation reduces a diameter from 2926 mm to 2922 mm. What percent reduction in diameter occurs?

- A. 0.14 %
- B. 0.41 %
- C. 0.21 %
- D. 0.27 %

95. Four repeated measurements are 78.97, 78.93, 78.96, and 78.94 mm. What is their arithmetic mean?

- A. 39.47 mm

- B. 78.95 mm
- C. 315.8 mm
- D. 78.97 mm

96. A mating hole measures 2921.05 mm and its shaft measures 2920.98 mm. What diametral clearance exists?

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

97. Inspection accepts 14965 of 14985 manufactured parts. What is the observed percent yield?

- A. 49.93 %
- B. 149.8 %
- C. 100.13 %
- D. 99.87 %

98. A machining operation reduces a diameter from 2930 mm to 2926 mm. What percent reduction in diameter occurs?

- A. 0.14 %
- B. 0.41 %
- C. 0.2 %
- D. 0.27 %

99. Four repeated measurements are 79.01, 78.97, 79.00, and 78.98 mm. What is their arithmetic mean?

- A. 39.5 mm
- B. 315.96 mm

- C. 78.99 mm
- D. 79.01 mm

100. A mating hole measures 2925.06 mm and its shaft measures 2924.98 mm. What diametral clearance exists?

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

Practice Exam 18: Answer Key and Explanations

1. D — D — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 36906.2 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 22484308.75 \$/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 117428.64 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

4. 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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

5. B — B — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 36957 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. 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 30059125 \$/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 117588.64 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 8. 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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 9. D — D —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 37007.8 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. 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 25833667.14 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 11. 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 117748.64 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 12. 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 3.96 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 13. D — D —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 37058.6 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. 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 22664653.75 \$/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 117908.64 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

16. 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 3.96 . 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 — Using $\sigma = \frac{M c}{I}$ for a rectangle reduces to $6M$ divided by $b h^2$. The moment must be expressed in newton-millimeters. Substitution gives 0.04 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

18. B — B — Elastic axial elongation follows $\Delta L = \frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 115.08 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,

19. D — D — 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

20. C — C — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $P = \frac{\pi^2 EI}{L^2}$. Substitution gives 105.66 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

21. 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 5685.55 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,

22. 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

23. 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 393.26 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

24. 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 1903.1 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

25. 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 0.04 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

26. D — D — Elastic axial elongation follows PL divided by AE . Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 115.4 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,

27. 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

28. 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 105.38 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

29. 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 5701.05 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,

30. 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

31. 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 393.28 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

32. 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 2403.88 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

33. D — D — 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 0.04 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

34. C — C — Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 115.72 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,

35. 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

36. 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 105.1 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

37. 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 5716.54 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,

38. 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

39. 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 393.29 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

40. A — A — For a solid circular shaft, maximum shear stress is $\frac{16T}{\pi d^3}$. Torque is converted from newton-meters to newton-millimeters. Substitution gives 1715.67 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

41. B — B — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 8582.35 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 43.9 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. 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 12884.92 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 26572.73 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 8116.67 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. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.53 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

47. 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 9479.46 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. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 24391.67 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. A — A — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 9143.75 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. D — D — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 50.17 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. 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 7267.66 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. B — B — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 29310 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. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 8617.65 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 10568.97 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 3103.2 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 11928 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

57. C — C — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 2596.28 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. D — D — 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 1557.62 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

59. A — A — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 10745 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 3103.28 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 12134.69 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 2331.2 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 1835.63 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 10250 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. 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 3103.36 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. 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 12064.52 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 — 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 141.33 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

68. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 154969.48 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

69. 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 116680 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

70. 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

71. A — A — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.89 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

72. 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 1966.28 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

73. 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,

74. 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 106.25 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

75. D — D — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 181658 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

76. C — C — Hooke's law gives spring force as stiffness times deflection. Converting kilonewtons per meter to newtons per meter makes the result newtons. Substitution gives 134504 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

77. 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

78. C — C — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.9 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

79. 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 1898 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

80. A — A — 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,

81. 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 85.2 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

82. D — D — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 168480.29 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

83. 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 128964 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

84. C — C — 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

85. D — D — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.9 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

86. B — B — 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 1829.38 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

87. 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,

88. 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 122 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

89. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 157186.86 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

90. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.14 %. 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. 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 78.91 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

92. 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 0.06 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 99.87 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

94. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.14 %. 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. 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 78.95 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

96. C — C — 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. 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 99.87 %. 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 0.14 %. 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. 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 78.99 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

100. 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,