

PRACTICE EXAM 17: PE MECHANICAL—MACHINE DESIGN AND MATERIALS (100 QUESTIONS)

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

1. A proposed fixture has a fixed fabrication cost of \$110300 and a variable cost of \$1372000 spread over 5520 units. What is the average cost per unit?

- A. 55274.28 \$/unit
- B. 121603.41 \$/unit
- C. 221097.1 \$/unit
- D. 110548.55 \$/unit

2. A component is expected to experience 2761 MPa maximum stress, while its allowable design stress is 698.25 MPa. What design factor is implied?

- A. 1.98
- B. 3.95
- C. 4.45
- D. 7.91

3. A drawing dimension is 1369.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 34772.6 mm
- B. 17386.3 mm
- C. 52158.9 mm
- D. 34798 mm

4. A machine saves 29030 labor-hours annually at \$5531/h. Ignoring interest, its \$284300 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 10017539.38 \$/year
- B. 20106153.75 \$/year
- C. 20035078.75 \$/year
- D. 40070157.5 \$/year

5. A proposed fixture has a fixed fabrication cost of \$110460 and a variable cost of \$1374000 spread over 5528 units. What is the average cost per unit?

- A. 55354.28 \$/unit
- B. 121779.41 \$/unit
- C. 221417.11 \$/unit
- D. 110708.55 \$/unit

6. A component is expected to experience 2765 MPa maximum stress, while its allowable design stress is 699.25 MPa. What design factor is implied?

- A. 1.98
- B. 3.95
- C. 4.45
- D. 7.91

7. A drawing dimension is 1371.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 34823.4 mm
- B. 17411.7 mm
- C. 52235.1 mm
- D. 34848.8 mm

8. A machine saves 29070 labor-hours annually at \$5539/h. Ignoring interest, its \$284700 residual value is credited evenly over a 6-year evaluation. What is the annual net benefit?

- A. 13394502.5 \$/year
- B. 26789005 \$/year
- C. 26883905 \$/year
- D. 53578010 \$/year

9. A proposed fixture has a fixed fabrication cost of \$110620 and a variable cost of \$1376000 spread over 5536 units. What is the average cost per unit?

- A. 55434.28 \$/unit
- B. 121955.41 \$/unit
- C. 110868.55 \$/unit
- D. 221737.11 \$/unit

10. A component is expected to experience 2769 MPa maximum stress, while its allowable design stress is 700.25 MPa. What design factor is implied?

- A. 1.98
- B. 4.45
- C. 3.95
- D. 7.91

11. A drawing dimension is 1373.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 34874.2 mm
- B. 17437.1 mm
- C. 52311.3 mm
- D. 34899.6 mm

12. A machine saves 29110 labor-hours annually at \$5547/h. Ignoring interest, its \$285100 residual value is credited evenly over a 7-year evaluation. What is the annual net benefit?

- A. 11513433.57 \$/year
- B. 23108324.29 \$/year
- C. 46053734.29 \$/year
- D. 23026867.14 \$/year

13. A proposed fixture has a fixed fabrication cost of \$110780 and a variable cost of \$1378000 spread over 5544 units. What is the average cost per unit?

- A. 55514.28 \$/unit
- B. 111028.56 \$/unit
- C. 122131.41 \$/unit
- D. 222057.11 \$/unit

14. A component is expected to experience 2773 MPa maximum stress, while its allowable design stress is 701.25 MPa. What design factor is implied?

- A. 1.98
- B. 4.45
- C. 3.95
- D. 7.91

15. A drawing dimension is 1375.0 in. Convert this length to millimeters using 1 in = 25.4 mm.

- A. 17462.5 mm
- B. 52387.5 mm
- C. 34950.4 mm
- D. 34925 mm

16. A machine saves 29150 labor-hours annually at \$5555/h. Ignoring interest, its \$285500 residual value is credited evenly over a 8-year evaluation. What is the annual net benefit?

- A. 20205343.75 \$/year
- B. 10102671.88 \$/year
- C. 20276718.75 \$/year
- D. 40410687.5 \$/year

17. A prismatic bar carries 5480 kN axial tension over a net area of 13950 mm². What is the average normal stress?

- A. 392.83 MPa
- B. 196.42 MPa
- C. 196.83 MPa
- D. 589.25 MPa

18. A solid circular shaft of diameter 52 mm transmits 55320 N·m torque. What is its maximum torsional shear stress?

- A. 1001.87 MPa
- B. 4007.49 MPa
- C. 4008.04 MPa
- D. 2003.74 MPa

19. A rectangular beam 5524 mm wide and 5584 mm deep carries a maximum bending moment of 1373.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa
- B. 0.43 MPa
- C. 0.05 MPa

D. 0.57 MPa

20. A steel tie, length 55660 mm and area 14115 mm², carries 5496 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 54.18 mm
- B. 108.36 mm
- C. 216.73 mm
- D. 54.73 mm

21. A ductile member has yield strength 13870 MPa and calculated von Mises stress 5543 MPa. What factor of safety against yielding results?

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

22. A pin-ended column has $E = 200,000$ MPa, $I = 280500000$ mm⁴, and length 70325 mm. What is its Euler critical load?

- A. 447.82 kN
- B. 27.99 kN
- C. 111.95 kN
- D. 35.64 kN

23. At a point, $\sigma_x = 5532$ MPa, $\sigma_y = 2756$ MPa, and $\tau_{xy} = 1388.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 5360.22 MPa
- B. 6180.5 MPa

- C. 2776 MPa
- D. 2680.11 MPa

24. A part has alternating stress 5564 MPa and mean stress 2797 MPa. With $S_e = 8381$ MPa and $S_{ut} = 14135$ MPa, what Goodman fatigue factor of safety applies?

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

25. A prismatic bar carries 5496 kN axial tension over a net area of 13990 mm². What is the average normal stress?

- A. 196.43 MPa
- B. 196.84 MPa
- C. 589.28 MPa
- D. 392.85 MPa

26. A solid circular shaft of diameter 58 mm transmits 55480 N·m torque. What is its maximum torsional shear stress?

- A. 1448.18 MPa
- B. 724.09 MPa
- C. 2896.36 MPa
- D. 2896.91 MPa

27. A rectangular beam 5540 mm wide and 5600 mm deep carries a maximum bending moment of 1377.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa

- B. 0.05 MPa
- C. 0.43 MPa
- D. 0.57 MPa

28. A steel tie, length 55820 mm and area 14155 mm², carries 5512 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 54.34 mm
- B. 217.36 mm
- C. 108.68 mm
- D. 54.89 mm

29. A ductile member has yield strength 13910 MPa and calculated von Mises stress 5559 MPa. What factor of safety against yielding results?

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

30. A pin-ended column has $E = 200,000$ MPa, $I = 281300000$ mm⁴, and length 70525 mm. What is its Euler critical load?

- A. 446.55 kN
- B. 111.64 kN
- C. 27.91 kN
- D. 35.54 kN

31. At a point, $\sigma_x = 5548$ MPa, $\sigma_y = 2764$ MPa, and $\tau_{xy} = 1392.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 5375.72 MPa
- B. 6198.39 MPa
- C. 2784 MPa
- D. 2687.86 MPa

32. A part has alternating stress 5580 MPa and mean stress 2805 MPa. With $S_e = 8405$ MPa and $S_{ut} = 14175$ MPa, what Goodman fatigue factor of safety applies?

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

33. A prismatic bar carries 5512 kN axial tension over a net area of 14030 mm². What is the average normal stress?

- A. 196.44 MPa
- B. 392.87 MPa
- C. 196.85 MPa
- D. 589.31 MPa

34. A solid circular shaft of diameter 54 mm transmits 55640 N·m torque. What is its maximum torsional shear stress?

- A. 899.8 MPa
- B. 3599.2 MPa
- C. 3599.75 MPa
- D. 1799.6 MPa

35. A rectangular beam 5556 mm wide and 5616 mm deep carries a maximum bending moment of 1381.0 kN·m. What is the extreme-fiber bending stress?

- A. 0.02 MPa
- B. 0.43 MPa
- C. 0.05 MPa
- D. 0.57 MPa

36. A steel tie, length 55980 mm and area 14195 mm², carries 5528 kN. Using $E = 200,000$ MPa, what is its elastic elongation?

- A. 109 mm
- B. 54.5 mm
- C. 218 mm
- D. 55.05 mm

37. A ductile member has yield strength 13950 MPa and calculated von Mises stress 5575 MPa. What factor of safety against yielding results?

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

38. A pin-ended column has $E = 200,000$ MPa, $I = 282100000$ mm⁴, and length 70725 mm. What is its Euler critical load?

- A. 445.29 kN
- B. 27.83 kN
- C. 111.32 kN
- D. 35.44 kN

39. At a point, $\sigma_x = 5564$ MPa, $\sigma_y = 2772$ MPa, and $\tau_{xy} = 1396.0$ MPa. What is the von Mises equivalent stress for plane stress?

- A. 5391.21 MPa
- B. 6216.28 MPa
- C. 2792 MPa
- D. 2695.6 MPa

40. A part has alternating stress 5596 MPa and mean stress 2813 MPa. With $S_e = 8429$ MPa and $S_{ut} = 14215$ MPa, what Goodman fatigue factor of safety applies?

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

41. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 5485 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 27280.15 MPa
- B. 3410.02 MPa
- C. 13640.08 MPa
- D. 6820.04 MPa

42. A bolt transfers 5502 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. 27510 MPa
- B. 8756.7 MPa
- C. 13755 MPa
- D. 55020 MPa

43. Using the relation $T = KFd$, estimate bolt preload when installation torque is 27500 N·m, nut factor $K = 0.2$, and nominal diameter is 17 mm.

- A. 8088.51 kN
- B. 8088.24 kN
- C. 12132.35 kN
- D. 1617.65 kN

44. Two parallel fillet welds, each 5526 mm long with 8 mm leg size, carry 2743 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 62.05 MPa
- B. 31.02 MPa
- C. 43.88 MPa
- D. 87.76 MPa

45. A lap joint uses 4 identical 12-mm-diameter rivets in single shear to carry 5493 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 48568.78 MPa
- B. 6071.1 MPa
- C. 12142.2 MPa
- D. 24284.39 MPa

46. A bolt transfers 5510 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. 25045.45 MPa
- B. 7972.22 MPa
- C. 12522.73 MPa
- D. 50090.91 MPa

47. Using the relation $T = KFd$, estimate bolt preload when installation torque is 27540 N·m, nut factor $K = 0.2$, and nominal diameter is 18 mm.

- A. 7650.27 kN
- B. 7650 kN
- C. 11475 kN
- D. 1530 kN

48. Two parallel fillet welds, each 5534 mm long with 6 mm leg size, carry 2747 kN direct shear. Using $\text{throat} = 0.707h$, what average weld throat stress results?

- A. 82.73 MPa
- B. 41.37 MPa
- C. 117.02 MPa
- D. 58.51 MPa

49. A lap joint uses 4 identical 14-mm-diameter rivets in single shear to carry 5501 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 8933.79 MPa
- B. 35735.16 MPa
- C. 4466.89 MPa
- D. 17867.58 MPa

50. A bolt transfers 5518 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. 7318.47 MPa
- B. 11495.83 MPa
- C. 22991.67 MPa
- D. 45983.33 MPa

51. Using the relation $T = KFd$, estimate bolt preload when installation torque is 27580 N·m, nut factor $K = 0.2$, and nominal diameter is 16 mm.

- A. 8619.02 kN
- B. 12928.12 kN
- C. 1723.75 kN
- D. 8618.75 kN

52. Two parallel fillet welds, each 5542 mm long with 7 mm leg size, carry 2751 kN direct shear. Using throat = 0.707h, what average weld throat stress results?

- A. 70.91 MPa
- B. 50.15 MPa
- C. 35.46 MPa
- D. 100.3 MPa

53. A lap joint uses 4 identical 16-mm-diameter rivets in single shear to carry 5509 kN. Assuming equal load sharing, what average shear stress acts in each rivet?

- A. 6849.88 MPa
- B. 27399.52 MPa
- C. 3424.94 MPa
- D. 13699.76 MPa

54. A 18-tooth pinion rotating at 28950 rpm drives a 54-tooth gear. Neglecting slip, what is the gear speed?

- A. 4825 rpm
- B. 9650 rpm
- C. 19300 rpm
- D. 28950 rpm

55. A shaft transmits 2736 hp at 55620 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1550.13 in·lbf
- B. 4650.39 in·lbf
- C. 6200.52 in·lbf
- D. 3100.26 in·lbf

56. An open belt connects a 125-mm driver at 28120 rpm to a 310-mm driven pulley. Neglecting slip, what is driven speed?

- A. 5669.35 rpm
- B. 16781.29 rpm
- C. 11338.71 rpm
- D. 28120 rpm

57. A collar bearing supports 1369.5 kN at mean friction radius 0.022 m with friction coefficient 0.090. What friction torque must be overcome?

- A. 5423.22 N·m
- B. 4067.41 N·m
- C. 5423.77 N·m
- D. 2711.61 N·m

58. A power screw has lead 6 mm, input torque 5493 N·m, and raising efficiency 0.32. What axial load can it raise?

- A. 920.36 kN
- B. 2761.08 kN
- C. 1840.72 kN
- D. 3681.44 kN

59. A 19-tooth pinion rotating at 29000 rpm drives a 56-tooth gear. Neglecting slip, what is the gear speed?

- A. 9839.29 rpm
- B. 4919.64 rpm
- C. 19160.71 rpm
- D. 29000 rpm

60. A shaft transmits 2741 hp at 55720 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1550.18 in·lbf
- B. 3100.35 in·lbf
- C. 4650.53 in·lbf
- D. 6200.7 in·lbf

61. An open belt connects a 120-mm driver at 28170 rpm to a 300-mm driven pulley. Neglecting slip, what is driven speed?

- A. 5634 rpm
- B. 16902 rpm
- C. 11268 rpm
- D. 28170 rpm

62. A collar bearing supports 1372.0 kN at mean friction radius 0.021 m with friction coefficient 0.085. What friction torque must be overcome?

- A. 4898.04 N·m
- B. 2449.02 N·m
- C. 3673.53 N·m
- D. 4898.59 N·m

63. A power screw has lead 8 mm, input torque 5503 N·m, and raising efficiency 0.33. What axial load can it raise?

- A. 713.14 kN
- B. 2139.41 kN
- C. 2852.55 kN
- D. 1426.28 kN

64. A 20-tooth pinion rotating at 29050 rpm drives a 58-tooth gear. Neglecting slip, what is the gear speed?

- A. 10017.24 rpm
- B. 5008.62 rpm
- C. 19032.76 rpm
- D. 29050 rpm

65. A shaft transmits 2746 hp at 55820 rpm. Using $T(\text{in}\cdot\text{lbf}) = 63,025 \text{ hp/rpm}$, what torque is transmitted?

- A. 1550.22 in·lbf
- B. 3100.44 in·lbf
- C. 4650.66 in·lbf
- D. 6200.88 in·lbf

66. An open belt connects a 130-mm driver at 28220 rpm to a 320-mm driven pulley. Neglecting slip, what is driven speed?

- A. 5732.19 rpm
- B. 16755.62 rpm
- C. 11464.38 rpm
- D. 28220 rpm

67. A simply supported beam of span 2.4 m carries a central point load of 2738 kN. What is the maximum bending moment?

- A. 1642.8 kN·m
- B. 3285.6 kN·m
- C. 821.4 kN·m
- D. 1140.83 kN·m

68. A lever has an effort arm of 8283 mm and a load arm of 5482 mm. Neglecting friction, what is its ideal mechanical advantage?

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

69. A 800-V DC source is applied across a 8- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 50 A
- B. 150 A
- C. 200 A
- D. 100 A

70. A thin-walled cylindrical vessel has internal pressure 275.3 MPa, inside diameter 14015 mm, and wall thickness 14 mm. What is the membrane hoop stress?

- A. 68898.74 MPa
- B. 137797.48 MPa
- C. 275594.96 MPa
- D. 68899.29 MPa

71. A linear spring has stiffness 2749 kN/m and is compressed 40 mm. What force does it exert?

- A. 109960 N
- B. 54980 N
- C. 164940 N
- D. 54980.55 N

72. An undamped single-degree system has mass 2743 kg and stiffness 1386500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 5.37 Hz
- C. 3.58 Hz
- D. 7.16 Hz

73. A hydraulic cylinder must produce 1375.0 kN using a piston area of 28160 mm². Neglecting losses, what gauge pressure is required?

- A. 24.41 MPa
- B. 24.82 MPa
- C. 48.83 MPa
- D. 97.66 MPa

74. A simply supported beam of span 2.7 m carries a central point load of 2745 kN. What is the maximum bending moment?

- A. 3705.75 kN·m
- B. 1852.88 kN·m
- C. 926.44 kN·m
- D. 1016.67 kN·m

75. A lever has an effort arm of 8304 mm and a load arm of 5496 mm. Neglecting friction, what is its ideal mechanical advantage?

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

76. A 802-V DC source is applied across a 10- Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 40.1 A
- B. 120.3 A
- C. 160.4 A
- D. 80.2 A

77. A thin-walled cylindrical vessel has internal pressure 276.0 MPa, inside diameter 14050 mm, and wall thickness 12 mm. What is the membrane hoop stress?

- A. 80787.5 MPa
- B. 323150 MPa
- C. 161575 MPa
- D. 80788.05 MPa

78. A linear spring has stiffness 2756 kN/m and is compressed 46 mm. What force does it exert?

- A. 63388 N
- B. 126776 N
- C. 190164 N
- D. 63388.55 N

79. An undamped single-degree system has mass 2750 kg and stiffness 1390000 N/m. What is its natural frequency in hertz?

- A. 3.58 Hz
- B. 1.79 Hz
- C. 5.37 Hz
- D. 7.16 Hz

80. A hydraulic cylinder must produce 1378.5 kN using a piston area of 28230 mm². Neglecting losses, what gauge pressure is required?

- A. 24.42 MPa
- B. 48.83 MPa
- C. 24.83 MPa
- D. 97.66 MPa

81. A simply supported beam of span 2.6 m carries a central point load of 2752 kN. What is the maximum bending moment?

- A. 3577.6 kN·m
- B. 894.4 kN·m
- C. 1058.46 kN·m
- D. 1788.8 kN·m

82. A lever has an effort arm of 8325 mm and a load arm of 5510 mm. Neglecting friction, what is its ideal mechanical advantage?

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

83. A 804-V DC source is applied across a 7-Ω resistive sensor circuit. Neglecting lead resistance, what current flows?

- A. 114.86 A
- B. 57.43 A
- C. 172.29 A
- D. 229.71 A

84. A thin-walled cylindrical vessel has internal pressure 276.7 MPa, inside diameter 14085 mm, and wall thickness 13 mm. What is the membrane hoop stress?

- A. 74948.45 MPa
- B. 299793.81 MPa
- C. 149896.9 MPa
- D. 74949 MPa

85. A linear spring has stiffness 2763 kN/m and is compressed 44 mm. What force does it exert?

- A. 60786 N
- B. 182358 N
- C. 60786.55 N
- D. 121572 N

86. An undamped single-degree system has mass 2757 kg and stiffness 1393500 N/m. What is its natural frequency in hertz?

- A. 1.79 Hz
- B. 3.58 Hz
- C. 5.37 Hz
- D. 7.16 Hz

87. A hydraulic cylinder must produce 1382.0 kN using a piston area of 28300 mm². Neglecting losses, what gauge pressure is required?

- A. 48.83 MPa
- B. 24.42 MPa
- C. 24.83 MPa
- D. 97.67 MPa

88. A simply supported beam of span 2.5 m carries a central point load of 2759 kN. What is the maximum bending moment?

- A. 3448.75 kN·m
- B. 862.19 kN·m
- C. 1724.38 kN·m
- D. 1103.6 kN·m

89. A lever has an effort arm of 8346 mm and a load arm of 5524 mm. Neglecting friction, what is its ideal mechanical advantage?

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

90. A mating hole measures 2745.06 mm and its shaft measures 2744.98 mm. What diametral clearance exists?

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

91. Inspection accepts 14085 of 14105 manufactured parts. What is the observed percent yield?

- A. 49.93 %
- B. 149.79 %
- C. 99.86 %
- D. 100.14 %

92. A machining operation reduces a diameter from 2754 mm to 2750 mm. What percent reduction in diameter occurs?

- A. 0.42 %
- B. 0.15 %
- C. 0.22 %
- D. 0.29 %

93. Four repeated measurements are 77.25, 77.21, 77.24, and 77.22 mm. What is their arithmetic mean?

- A. 38.61 mm
- B. 77.23 mm
- C. 308.92 mm
- D. 77.25 mm

94. A mating hole measures 2749.04 mm and its shaft measures 2748.98 mm. What diametral clearance exists?

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

95. Inspection accepts 14105 of 14125 manufactured parts. What is the observed percent yield?

- A. 49.93 %

- B. 149.79 %
- C. 99.86 %
- D. 100.14 %

96. A machining operation reduces a diameter from 2758 mm to 2754 mm. What percent reduction in diameter occurs?

- A. 0.15 %
- B. 0.42 %
- C. 0.22 %
- D. 0.29 %

97. Four repeated measurements are 77.29, 77.25, 77.28, and 77.26 mm. What is their arithmetic mean?

- A. 38.64 mm
- B. 309.08 mm
- C. 77.27 mm
- D. 77.29 mm

98. A mating hole measures 2753.05 mm and its shaft measures 2752.98 mm. What diametral clearance exists?

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

99. Inspection accepts 14125 of 14145 manufactured parts. What is the observed percent yield?

- A. 49.93 %
- B. 99.86 %

- C. 149.79 %
- D. 100.14 %

100. A machining operation reduces a diameter from 2762 mm to 2758 mm. What percent reduction in diameter occurs?

- A. 0.15 %
- B. 0.22 %
- C. 0.29 %
- D. 0.14 %

Practice Exam 17: Answer Key and Explanations

1. D — D — 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 110548.55 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

2. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

3. A — A — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 34772.6 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

4. 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 20035078.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

5. D — D — 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 110708.55 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents

- 6. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 7. A — A —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 34823.4 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent
- 8. 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 26789005 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 9. C — C —** Average unit cost equals the fixed cost plus the allocated variable cost per unit; costs are combined only after using the common per-unit basis. Substitution gives 110868.55 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 10. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically
- 11. A — A —** Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 34874.2 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent
- 12. D — D —** Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 23026867.14 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis
- 13. 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 111028.56 \$/unit. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents
- 14. 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 3.95 . Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically

15. D — D — Length conversion requires multiplying inches by 25.4 millimeters per inch so the inch unit cancels and millimeters remain. Substitution gives 34925 mm. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis prevents a numerically tidy but physically inconsistent

16. A — A — Annual labor savings are first converted to dollars, the stated residual credit is subtracted, and the remaining benefit is distributed evenly across the evaluation life. Substitution gives 20205343.75 \$/year. Keeping the calculation consistent with the stated units identifies the keyed option. Checking units and the stated design basis

17. 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 392.83 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

18. D — D — For a solid circular shaft, maximum shear stress is $16T$ divided by π times diameter cubed. Torque is converted from newton-meters to newton-millimeters. Substitution gives 2003.74 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

19. C — C — 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 0.05 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

20. 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 108.36 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

21. 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

22. 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 111.95 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

23. A — A — Plane-stress von Mises stress combines both normal stresses and shear through the distortion-energy expression, including three times shear stress squared. Substitution gives 5360.22 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

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

25. 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 392.85 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

26. 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 1448.18 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

27. 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 0.05 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

28. C — C — Elastic axial elongation follows $\Delta L = \frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 108.68 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

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

30. B — B — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\pi^2 EI$ divided by L^2 . Substitution gives 111.64 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

31. 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 5375.72 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

32. 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

33. 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 392.87 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

34. 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 1799.6 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load

35. C — C — 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 0.05 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving

36. A — A — Elastic axial elongation follows $\frac{PL}{AE}$. Consistent newton and millimeter units make the modulus directly usable in megapascals. Substitution gives 109 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

37. 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

38. C — C — Euler buckling for a pin-ended column uses effective length equal to actual length, giving $\frac{\pi^2 EI}{L^2}$. Substitution gives 111.32 kN. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path,

39. 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 5391.21 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. The competing choices represent common errors involving geometry, load path, sign convention,

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

41. 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 6820.04 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

42. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 27510 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

43. B — B — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 8088.24 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

44. C — C — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 43.88 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

45. 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 12142.2 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

46. A — A — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 25045.45 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified

47. B — B — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 7650 kN. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

48. D — D — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 58.51 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

49. 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 8933.79 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

50. C — C — Average bearing stress uses the projected contact area, bolt diameter times plate thickness, rather than the bolt's circular area. Substitution gives 22991.67 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

51. D — D — Rearranging the torque-preload approximation gives preload F equal to T divided by K_d , with diameter expressed in meters. Substitution gives 8618.75 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

52. B — B — The resisting throat area is two weld lengths multiplied by the effective fillet throat, 0.707 times leg size. Substitution gives 50.15 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting area specified in

53. 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 6849.88 MPa. Keeping the calculation consistent with the stated units identifies the keyed option. Connection calculations must use the actual load path and the resisting

54. B — B — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 9650 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 3100.26 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. C — C — 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 11338.71 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

57. D — D — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 2711.61 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 1840.72 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 9839.29 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 3100.35 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. C — C — 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 11268 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

62. B — B — Collar friction torque equals friction coefficient times axial load times mean friction radius; kilonewtons are converted to newtons. Substitution gives 2449.02 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. 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 1426.28 kN. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the

64. A — A — For an external gear pair, pitch-line velocity is equal, so rotational speed is inversely proportional to tooth count. Substitution gives 10017.24 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship help reject the nearby

65. B — B — The stated horsepower-speed relation directly produces torque in inch-pounds; substituting horsepower and rotational speed avoids mixing foot-pounds and inch-pounds. Substitution gives 3100.44 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. C — C — 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 11464.38 rpm. Keeping the calculation consistent with the stated units identifies the keyed option. A dimensional check and a comparison with the operating relationship

67. A — A — For a simply supported beam with a centered point load, reactions are equal and the maximum moment at midspan is PL divided by four. Substitution gives 1642.8 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

68. 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 1.51. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

69. D — D — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 100 A. 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 — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 137797.48 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

71. 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 109960 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

72. 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

73. C — C — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.83 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

74. 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 1852.88 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

75. 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,

76. D — D — Ohm's law gives current as applied voltage divided by resistance. Multiplication gives power-related units, while the inverse ratio has incorrect dimensions. Substitution gives 80.2 A. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

77. C — C — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 161575 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

78. 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 126776 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

79. A — A — 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

80. B — B — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.83 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

81. 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 1788.8 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

82. 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 1.51. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

83. 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 114.86 A. 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 — Thin-cylinder hoop stress equals pressure times diameter divided by twice wall thickness; longitudinal stress would be half this value. Substitution gives 149896.9 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

85. 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 121572 N. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding, because premature

86. 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

87. A — A — Hydraulic pressure equals force divided by piston area. Newtons per square millimeter are numerically megapascals. Substitution gives 48.83 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

88. 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 1724.38 kN·m. Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before

89. 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 1.51 . Keeping the calculation consistent with the stated units identifies the keyed option. The governing component relation must be applied before rounding,

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

91. 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 99.86 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

92. B — B — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.15 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

93. 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 77.23 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

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

95. 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 99.86 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

96. A — A — Percent reduction uses the original dimension as the reference denominator, after determining the absolute decrease. Substitution gives 0.15 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent, and the measurement definition used in the

97. 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 77.27 mm. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units,

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

99. B — B — Percent yield is accepted quantity divided by total inspected quantity, multiplied by one hundred. The rejected fraction is a different quality metric. Substitution gives 99.86 %. Keeping the calculation consistent with the stated units identifies the keyed option. The result should also be checked against units, manufacturing intent,

100. D — D — 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