

Answers for Problems 6

6.1

$$\frac{2F}{\pi d^2}$$

6.2

$$\text{Specific twist angle } \frac{32T}{\pi G(d_A^4 + d_1^4 - d_0^4)}$$

6.3

5.35 kNm

6.4

$$(1) \theta = \frac{32TL_A L_B}{\pi(G_A a^4 L_B + G_B b^4 L_A)}$$

$$(2) \frac{aG_A}{\tau_{yA} L_A} = \frac{bG_B}{\tau_{yB} L_B}$$

6.5

$$(1) \frac{16FDL}{G\pi} \left(\frac{2}{d_2^4} - \frac{1}{d_1^4} \right)$$

$$(2) \tau_1 = \frac{-8FD}{\pi d_1^3}, \quad \tau_2 = \frac{8FD}{\pi d_2^3} \quad \text{Bar I will fracture in first.}$$

6.6

$$(1) T_C = 2T_0$$

$$(2) \frac{1120T_0}{\pi d^3 G}$$

6.7

理由は各自で考えること

(1) (a), (b), (c)

(2) (c), (a), (b)

(3) (a), (b), (c)

(4) (b), (a), (c)

Consider the reason for each problem by yourself.

6.8

$$(1) \tau_I = \frac{2T}{\pi a^3}, \quad \tau_{II} = 0 \quad \text{on the surfaces.} \quad \tau_I = 0, \quad \tau_{II} = 0 \quad \text{at the centers.}$$

$$(2) \theta_A = \frac{32T}{G\pi(2a)^4} 16a = \frac{32T}{\pi G a^3}$$

$$(3) \tau_I = \frac{T}{\pi a^3}, \quad \tau_{II} = -\frac{T}{\pi a^3}$$

$$(4) \theta_B = \frac{16T}{\pi G a^3}$$

$$(5) \tau_I = \frac{DG}{32} + \frac{T}{\pi a^3}, \quad \tau_I = \frac{DG}{32} - \frac{T}{\pi a^3}$$

6.9

$$(1) \tau_A = \frac{1}{4\pi R^3} T_1, \quad \tau_B = \frac{2}{\pi R^3} T_1$$

$$(2) \tau_A = \frac{2RG}{17L} D_2, \quad \tau_B = \frac{16RG}{17L} D_2$$

$$(3) \tau_A = \frac{2RG}{L} D_3, \quad \tau_B = -\frac{RG}{L} D_3$$

$$(4) \tau_A = \frac{4}{17\pi R^3} T_4, \quad \tau_B = -\frac{2}{17\pi R^3} T_4$$

6.10

$$(1) T_B = \pi G D^3 \theta_A$$

$$(2) T_A = \frac{\pi D^3}{2} \tau_0$$

$$(3) \tau_I = \frac{G}{4} \theta_0$$

$$(4) T = \frac{\pi G D^3}{32} \theta_0$$

6.11

$$(1) m = n$$

$$(2) n = 1, m \text{ is arbitrary.}$$

6.12

$$(1) (C) \quad \frac{\omega_C}{\omega_A} = \frac{0.250}{0.190} = 1.32$$

$$(2) (A) \quad \frac{T_A}{T_C} = \frac{2.828}{2.309} = 1.22$$