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CH: 06

$d_o = 15.2mm$ $\quad E = 20.7 \times 10^{10}$

$l_o = 250mm$

$F = 48,900N$

(a) $\sigma = \frac{F}{A}$

$\frac{\Delta L}{L} E = \frac{F}{\pi\left(\frac{d_o}{2}\right)^2}$

$= \frac{48,900}{\pi\left(\frac{15.2 \times 10^{-3}}{2}\right)^2} \times \frac{250 \times 10^{-3}}{20.7 \times 10^{10}}$

$= 3.25 \times 10^{-4} m$

6.17

$d_o = 10mm$ $\quad \varepsilon_z = \frac{F}{AE}$

$F = 15,000N$

$\Delta d = 7 \times 10^{-3} mm$

$E = 100GPa$

$\nu = \frac{-\varepsilon_x}{\varepsilon_z}$

$= \frac{-\left(\frac{7 \times 10^{-6}}{10 \times 10^{-3}}\right)}{\frac{15,000}{\pi\left(\frac{10 \times 10^{-3}}{2}\right)^2 \times 100 \times 10^9}}$

$= -0.36$

6.18

$d_o = 30$, $d = 30.04$

$l = 105.20mm$ $\quad l_o = ?$

$G = 25.4$, $E = 65.5$

$E = 2G(1+\nu)$

$\nu = \frac{E}{2G} - 1$

$= \frac{65.5}{2(25.4)} - 1$

$= 0.28$

$\varepsilon_y = \frac{\Delta l}{l_o}$

$\varepsilon_x = 1.33 \times 10^{-3}$

$0.28 = \frac{-1.33 \times 10^{-3}}{\epsilon_z}$

$\epsilon_z = -4.6 \times 10^{-3}$

$\nu = \frac{\epsilon_y}{\epsilon_z}$

$\nu \epsilon_z = \frac{\Delta l}{l_o}$

$\Delta l = \nu \epsilon_z l_o$

$l = \nu \epsilon_z l_o + l_o$

$= 0.105 m$

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6.19

$d_o = 10mm$

$F = 1500N$

$d = 6.7 \times 10^{-4}$

$E = ?$

$v = 0.35$

$$v = \frac{-\varepsilon_x}{\varepsilon_z}$$

$$= -\frac{\Delta d}{d_o} \times \frac{EA}{F}$$

$$E = \frac{vFd_o}{-\Delta d \times A}$$

$$= 9.9 \times 10^{10} Pa$$

6.20

$d_o = 15mm$

$l_o = 150mm$

$\sigma = 50MPa$

$l = 0.072mm$

$$E = \frac{50 \times 10^6}{\frac{0.072}{150}}$$

$$= 1.04 \times 10^{11} Pa$$

(b) $\Delta d = 2.3 \times 10^{-3}$

$$v = \frac{-\varepsilon_x}{\varepsilon_z}$$

$$= \frac{\Delta d}{d_o} \div \frac{\Delta l}{l_o}$$

$$= 0.32$$

6.22

$d_o = 10.7mm$

$l_o = 95mm$

$F = 6300N$

(a) $\Delta l = 95.04$

$$E = \frac{6300 / \pi \left(\frac{10.7 \times 10^{-3}}{2}\right)^2}{\frac{95.04 - 95}{95}}$$

$$= 1.66 \times 10^{11} Pa$$

(b) $$v = \frac{\Delta d}{d_o} \div \frac{\Delta l}{l_o}$$

$$= \frac{10.7 - 10.698}{10.7} \div \frac{95.04 - 95}{95}$$

$$= 0.44$$

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CH: 16

16.8

$V_f = 0.45 \qquad \sigma_f = 3600$

$V_m = 0.55$

$\sigma_m = 35$

(a) $\sigma_c = \sigma_m V_m + \sigma_f V_f$

$= 35 \times 0.55 + 3600 \times 0.45$

$= 1639.29$

(b) $\varepsilon_c = \varepsilon_f V_f + \varepsilon_m V_m$

$= 60.27 \text{ GPa}$

16.10

$\varepsilon_{cl} = 33.1 \text{ GPa} \qquad V_f = 0.3$

$\varepsilon_{ct} = 3.66 \qquad V_m = 0.7$

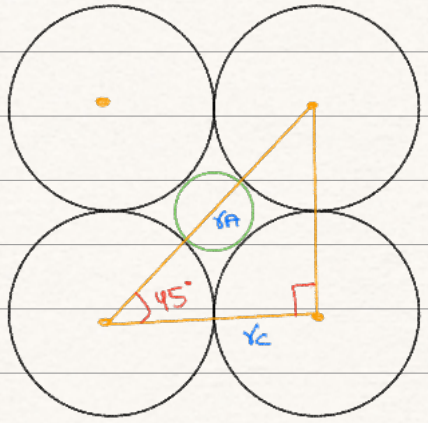
$\varepsilon_{cl} = \varepsilon_m V_m + \varepsilon_f V_f$

$33.1 = 0.7\varepsilon_m + 0.3\varepsilon_f$

$\varepsilon_{ct} = \dfrac{\varepsilon_m \varepsilon_f}{\varepsilon_f V_m + \varepsilon_m V_f}$

$3.66 = \dfrac{\varepsilon_m \varepsilon_f}{0.7\varepsilon_f + 0.3\varepsilon_m}$

$= \dfrac{\varepsilon_m \varepsilon_f}{33.1}$



$\cos 45^\circ = \dfrac{2r_c}{2r_A + 2r_c}$

$\dfrac{1}{\sqrt{2}} = \dfrac{r_c}{r_A + r_c}$

$r_A + r_c = \sqrt{2} r_c$

$r_A = r_c(\sqrt{2} - 1)$

$\dfrac{r_c}{r_A} = (\sqrt{2} - 1)$

$= 0.414$

Subject: CH:10

18.10

(a) $V_d = \mathcal{E}\mu$

$= 500 \times (0.145)$

$= 72.5 m/s$

(b) $t = \frac{s}{v}$

$= \frac{25 \times 10^{-3}}{72.5}$

$= 3.4 \times 10^{-4} s$

18.11

$\sigma = 3.8 \times 10^{7} (\Omega m)^{-1}$

$\mu = 0.0012 m^2/V.s$

(a) $\sigma = n|e|\mu$

$n = \frac{\sigma}{e\mu}$

$= \frac{3.8 \times 10^{7}}{1.602 \times 10^{-19} \times 0.0012}$

$= 1.97 \times 10^{29} m^3$

18.12

(a) $N = \frac{nN_A\rho}{A}$

$= \frac{1.3 \times 6.022 \times 10^{23} \times 10.5}{107.8}$

$= 7.6 \times 10^{23} m^{-3}$

(b) $\sigma = ne\mu$

$\mu = \frac{\sigma}{ne}$

$= \frac{6.8 \times 10^{7}}{1.602 \times 10^{-19} \times 7.6 \times 10^{28}}$

$= 0.005 m^2/Vs$

18.1

(a) $d = 7mm$ $L = 45mm$

$l = 57mm$

$I = 0.25A$

$V = 24V$

$\sigma = \frac{L}{RA}$

$= \frac{LI}{VA}$

$= \frac{45 \times 10^{-3} \times 0.25}{24 \times \pi \left(\frac{7 \times 10^{-3}}{2}\right)^2}$

$= 12.18$

(b) $R = \frac{L}{\sigma A}$

$= \frac{57 \times 10^{-3}}{12.18 \times \pi \left(\frac{7 \times 10^{-3}}{2}\right)^2}$

$= 121.6\Omega$

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18.2

$l = 10m$

$V = 1V$

$I = 5A$

$d = ?$

$$\sigma = \frac{IL}{VA}$$

$$d = \sqrt{\frac{4IL}{\pi V \sigma}}$$

$=$ ☺

18.3

$d = 3mm$

$R = 10\Omega$

$l = ?$

$$R = \frac{L}{\sigma A}$$

$$L = R\sigma\pi\left(\frac{d}{2}\right)^2$$

$=$ ☺

18.5

(a) $d = 5mm$

$L = 5m$

$$R = \frac{L}{\sigma A}$$

$=$ ☺

(b) $V = IR$

$$I = \frac{V}{R}$$

$=$ ☺

(c) $$J = \frac{I}{A}$$

$=$ ☺

(d) $V = \mathcal{E}I$

$$\mathcal{E} = \frac{V}{I}$$

$=$ ☺

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$d_0 = 5mm$

$l_0 = 5m$

$\sigma = 3.8 \times 10^7$

(a) $\sigma = \frac{L}{RA}$

$R = \frac{L}{\sigma A}$ $\qquad J = \sigma \mathcal{E}$

$\mathcal{E} = \frac{J}{\sigma}$

$J = \frac{I}{A}$