P612 30 - 38, 73, 74, 76, 79, 83

(30) $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$N_s = \frac{N_p V_s}{V_p} = \frac{164(10\,000V)}{120V} = \underline{14\,000}$

(31) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$

$\frac{320}{120} = \frac{V_p}{V_s}$ $\underline{V_s = 0.38 V_p}$ $\underline{\text{step-down}}$

$\frac{N_p}{N_s} = \frac{I_s}{I_p}$

$\frac{320}{120} = \frac{I_s}{I_p}$ $\underline{I_s = 2.7 I_p}$

(32) $\frac{V_p}{V_s} = \frac{I_s}{I_p}$

$\frac{25V}{120V} = \frac{I_s}{I_p}$ $\underline{I_s = 4.8 I_p}$

(33) $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$\frac{240V}{12000V} = \frac{N_p}{N_s}$ $\underline{\frac{N_s}{N_p} = 50}$

If connected backwards

$\frac{N_s}{N_p} = \frac{V_s}{V_p}$

$50 = \frac{240V}{V_p}$ $\underline{V_p = 4.8V}$

(34) (a) $\frac{V_p}{V_s} = \frac{I_s}{I_p}$

$V_s = \frac{V_p I_p}{I_s} = \frac{(120\,V)(0.35\,A)}{(7.5\,A)} = \underline{5.6\,V}$

(b) step down

(35) $P = IV$

$I = \frac{P}{V} = \frac{95\,W}{12\,V} = 7.917\,A$

$\frac{V_p}{V_s} = \frac{I_s}{I_p}$

$V_s = \frac{I_p}{I_s} V_p$

$V_s = \frac{22\,A}{7.917\,A} V_p$ (b) $V_s = 2.8\,V_p$ (a) step up

(36) $\frac{V_p}{V_s} = \frac{N_p}{N_s}$

$V_s = \frac{N_s V_p}{N_p} = \frac{(1340)(120\,V)}{330} = \underline{490\,V}$

$\frac{I_p}{I_s} = \frac{N_s}{N_p}$

$I_p = \frac{N_s I_s}{N_p} = \frac{(1340)(15.0\,A)}{330} = \underline{61\,A}$

(37) Generator — Destination

Generator		Destination
? W	$4\,\Omega$	30 MW
? V		45 kV

(a) current is constant

$$P = IV$$

$$I = \frac{P}{V} = \frac{30\times10^6\,W}{45\times10^3\,V} = 667\,A$$

we lose emf (voltage) from transmission (voltage drop across a resistor)

$$V = IR$$

$$= (667A)(4\Omega) = 2668\,V$$

so the generation must have an emf of

$$45\times10^3\,V + 2668\,V = \underline{48\,kV}$$

(b) power dissipated (lost) in the transmission line

$$P = I^2R = (667\,A)^2(4\,\Omega) = 1.8\times10^6\,W$$

$$\frac{1.8\times10^6\,W}{30\times10^6\,W} = \underline{0.06\ W\ lost}$$

(38) transmitting at 120 V

$P = IV$

$I = \frac{P}{V} = \frac{65 \times 10^3 \, W}{120 \, V} = 542 \, A$

Power loss

$P = I^2 R = (542 A)^2 (0.2 \Omega) = 5.88 \times 10^4 \, W$

stepping up and stepping down

P_1 ∃||∈ P_2 ——————— P_3 ∃||∈ P_4

step up

$P_2 = .99 P_1$

$P_2 = .99(65 \times 10^3 \, W) = 64\,350 \, W$

Transmission current

$P = IV$

$I = \frac{P}{V} = \frac{64\,350 \, W}{1200} = 53.6 \, A$

Power loss

$P = I^2 R = (53.6 A)^2 (.2 \Omega) = 574.6 \, W$

$P_3 = P_2 - P_{loss} = 64\,350 - 575 = 63\,775 \, W$

step down

$P_4 = .99 P_3 = .99(63\,775 \, W) = 63\,137 \, W$

overall powerloss

$65 \times 10^3 \, W - 63\,137 \, W = 1863 \, W$

Power Saved. $= 5.88 \times 10^4 \, W - 1863 \, W = \underline{5.7 \times 10^4 \, W}$

(73) $\mathcal{E} = -N\dfrac{d\Phi}{dt} = \dfrac{-NBA\cos\theta}{\Delta t} = \dfrac{-(.665T)(.24m)^2}{40 \times 10^{-3}s} = 0.958V$

$\text{Power} = \dfrac{\text{Energy}}{\Delta t}$

$P = \dfrac{V^2}{R} = \dfrac{(.958V)^2}{5.2\Omega} = 0.176W$

$\text{Energy} = P\Delta t = (0.176W)(40 \times 10^{-3}s) = \underline{7.04 \times 10^{-3} J}$

(74) (a) step down

(b) $P = IV$

$I = \dfrac{P}{V} = \dfrac{45W}{12V} = \underline{3.8A}$

(c) $\dfrac{I_s}{I_p} = \dfrac{V_p}{V_s}$

$I_p = \dfrac{V_s I_s}{V_p} = \dfrac{(12V)(3.8A)}{(120V)} = \underline{0.38 A}$

(d) $P = I^2 R$

$R = \dfrac{P}{I^2} = \dfrac{45W}{(3.8A)^2} = \underline{3.1\Omega}$

or

$V = IR$

$R = \dfrac{V}{I} = \dfrac{12V}{3.8A} = 3.1\Omega$

or

$P = \dfrac{V^2}{R}$

$R = \dfrac{V^2}{P} = \dfrac{12V^2}{45W} = 3.2\Omega$

(76) (a) $P_s = .80 P_p$

$$P_p = \frac{P_s}{.8} = \frac{75\,W}{.8} = 93.75\,W$$

$$P = IV$$

$$I = \frac{P}{V} = \frac{93.75\,W}{110\,V} = 0.85\,A$$

(b) current on secondary side

$$P = I^2 R$$

$$I = \sqrt{\frac{P}{R}} = \sqrt{\frac{75\,W}{2.4\,\Omega}} = 5.59\,A$$

$$\frac{N_p}{N_s} = \frac{I_s}{I_p} = \frac{5.59\,A}{0.85\,A} = \underline{6.6}$$

(79) Generator ———————— R_L ———————— User P_T V

current transmitted

$$I = \frac{P}{V} = \frac{P_T}{V}$$

power loss

$$P = I^2 R$$

$$P_L = \frac{P_T^{\,2} R_L}{V}$$

(83) $V_0 = 2\pi f N A B = 2\pi (120\,Hz)(155)(.066\,m)^2(0.2\,T)$

$= \underline{16.2\,V}$