① $R = \frac{U}{I} \rightarrow I = \frac{U}{R} \rightarrow U = I \times R$

a)

② $V_i = 10V \quad R = 5k\Omega \quad 2R = 10K\Omega$

$$R_{eq} = \frac{R_1 \times R_2}{R_1 + R_2}$$

$2R // 2R \rightarrow R_{eq} = \frac{2R \times 2R}{2R + 2R} = \frac{4R^2}{4R} = R$

⋮

$2R // 2R \Rightarrow R_{eq} = R$

$R = \frac{U}{I} \Leftrightarrow I = \frac{U}{R} \Leftrightarrow I = \frac{10}{5000} \Leftrightarrow I = 0,002\ A$

$P = U \times I \Leftrightarrow P = 0,002 \times 10 \Leftrightarrow P = 20mW$

a)

③ $P = 35W$

$U = 12V$

$P = U \times I \Leftrightarrow 35 = 12 \times I \Leftrightarrow I = \frac{35}{12} \Leftrightarrow I = 2,92A$

$R = \frac{U}{I} \Leftrightarrow R = \frac{12}{2,92} \Leftrightarrow R = 4,11\Omega$ (D)

④ $I(11A) = -\frac{9}{9+2} \times 11 = -9A$ (C)

⑤ $\frac{10}{3} = 3,3A$ $\quad 3,3 - 0,67 = 2,66A$

$\frac{4}{6} = 0,67A$ $\quad \frac{4}{2,66} = 1,5 \simeq 2$

⑥ $\frac{10mA}{0,5mF} = 20V$ $\quad 20 \times 0,1 = 2V$ (C)

⑦ b

⑧ d 4V $\quad I_{4\Omega} = \frac{1}{2} I_{R\,1\Omega}$ $\quad 1\Omega = \frac{1V}{1A}$

$I_{2\Omega} = \frac{1V}{2\Omega} \Leftrightarrow I_{2\Omega} = 0,5A$ $\quad 1 + 0,5 = 1,5A$

$4\Omega = \frac{4V}{1A} \Leftrightarrow x = 4V$

(9) $R_1 + R_2 = 16k\Omega$

$\frac{16 \times 4}{20} = \frac{64}{20} = \frac{32}{10} = 3{,}2k$ (C)

(11) $Z_C = \frac{1}{j\omega C} \Leftrightarrow 2k = \frac{1}{j\omega \times 1 \times 10^{-6}}$

$\Leftrightarrow 2 \times 10^3 \times 10^{-6} = \frac{1}{j\omega}$

$\Leftrightarrow 2 \times 10^{-3} \omega = \frac{1}{j}$

$\Leftrightarrow 2 \times 10^{-3} \times \frac{2\pi}{T} = \frac{1}{j}$

$\Leftrightarrow \frac{4 \times 10^{-3} \pi}{T} = \frac{1}{j} \Leftrightarrow \frac{1}{250} \times \frac{\pi}{T} = \frac{1}{j}$

$\Leftrightarrow \frac{\pi}{250} \times j = \frac{1}{j} \Leftrightarrow j = \frac{250 \times 1}{\pi} j$

$\Leftrightarrow f = 79{,}6\,Hz$

(5) $V_{R1} = V_1 - V_2 = 10 - 4 = 6\,V$

$I_1 = \frac{V_{R1}}{R1} = 2\,A$

$I_1 = I_2 + I_3 \Leftrightarrow I_3 = I_1 - I_2 \Leftrightarrow I_3 = 2 - \frac{4}{6}$

$\Leftrightarrow I_3 = \frac{12-4}{6} \Leftrightarrow I_3 = \frac{8}{6}$

$I_2 = \frac{4}{6}\,A$

$V_{R3} = V_2 = R_3 I_3$

$4 = R_3 \times \frac{8}{6} \Leftrightarrow R_3 = \frac{4}{\frac{8}{6}} \Leftrightarrow R_3 = \frac{4 \times 6}{8} \Leftrightarrow R_3 = \frac{24}{8}$

$\Leftrightarrow R_3 = 3\,\Omega$

(16) $10 - 0{,}7 = 9{,}3\,V$

$\frac{9{,}3}{10 \times 10^{3}} \times 6 \times 10^{8} = 5{,}58\,V$

$\frac{5{,}58}{6 \times 10^{3}} = 0{,}93\,mA$ (C)

# Teste 2018 - 19

① $P = V \times I$ ©

② $R // 2R = \frac{R \times 2R}{R + 2R} = \frac{2R^2}{3R} = \frac{2R}{3}$ (b)

③ $I_1 = \frac{10k \times I}{(5k + 10k)}$ $\quad I_2 = \frac{5k \times I}{(5k + 10k)}$

Fórmula: $\frac{R_1}{R_1 + R_2} \times I$ $\quad I_1 = 2 I_2$

④ Curto-circuito da fonte de tensão:

$V_a = (40 // 40) \times 2A \Rightarrow V_A = \frac{40 \times 40}{40 + 40} \times 2$

$\Rightarrow V_A = 20 \times 2 = 40V$

Abrindo a fonte de corrente: $V_B = \frac{10V \times 40\Omega}{40 + 40} = 5V$

$40 + 5 = 45V$ (B)

(6) $P = \frac{U^2}{R}$ $P = 10\,W$

$10\,W = \frac{U^2}{R} \Leftrightarrow 10 \times 40 = U^2$

$\Leftrightarrow 400 = U^2$

$\Leftrightarrow U = 20\,V$

$I_1 + I = I_2$

$I_2 = \frac{20}{40} \Leftrightarrow I_2 = 0,5A$

$I_1 + I = 0,5A \Leftrightarrow I = 0,5A + 0,25A \Leftrightarrow I = 0,75A$ (3)

$I_1 = \frac{10-20}{40} \Leftrightarrow I_1 = -0,25A$

$I_1 = \frac{10 - V_2}{R_1}$

(5) $P = \frac{U^2}{R} \Leftarrow$ $R \Leftarrow 2\,\Omega$ $\quad I = \frac{U}{R}$ $\quad I_1 + 6A = I_2$

$V_1 = 0,5V_0 - V_0 = -0,5V_0$

$\frac{V_1}{1\,\Omega} + 6A = \frac{V_0}{2\,\Omega} \Leftrightarrow -0,5V_0 + 6A = \frac{V_0}{2} \Leftrightarrow -V_0 + 12 = V_0$

$\Leftrightarrow V_0 = 6V$

$I_1$ ↓ $1\,\Omega$ $\quad$ $I_2$ ↓ $2\,\Omega$

$P = \frac{36}{2} = 18\,W$ (c)

⑦ $V(x) = \frac{x}{(V_1 + V_2 \text{ ou } V_1 // V_2)} \times$ Voltagem da fonte de tensão

$V_{th} = V(30k) = \frac{30k}{20k+30k} \times 10V \Rightarrow V(30k) = 6V$

Curto circuitando a fonte:

$R_{th} = 8k + (30k // 20k) = 8k + \frac{30k \times 20k}{30k + 20k}$

$= 8k + \frac{600k}{50} = 8k + 12k = 20k\,\Omega$

$V_{th} = 6V$ e $R_{th} = 20k\,\Omega$

⑧ Curto circuitando a saída:
(quando a corrente é nula em 30k Ω)

$I_n = \frac{10V}{20\Omega} = 0{,}5A = 500\,mA$

Curto circuitando a fonte de tensão:

$R_n = 30 // 20 = \frac{30 \times 20}{30+20} = 12\,\Omega$

(D)

(10) $f = \frac{1}{T} \Rightarrow f = \frac{1}{20 \times 10^{-3}} \Rightarrow f = 50\ Hz$

Valor eficaz: $\boxed{V_e = \frac{V_{Máx}}{\sqrt{2}}} \Rightarrow V_e = \frac{325}{\sqrt{2}}$

$\Rightarrow V_e = 230V$

R: C → 50 Hz ; 230V

(11) Incremento 1V/ms

$T(1V) = 1\ ms$ $\quad 9 - 1 = 8\ ms$ R: b

$T(9V) = 9\ ms$

(13) Passa alto pois o condensador está em série com o trajeto de $V_{in}$ para $V_{out}$

$f_c = \frac{1}{2\pi RC} \Rightarrow f_c = \frac{1}{2\pi \times 2k \times 1 \times 10^{-9}} \Rightarrow f_c = 79577 \simeq 80\ kHz$

R: A

(14) C $\quad V_o = V_i \quad f_c >> 2kHz$

(15) $\omega L = \frac{1}{\omega C} \rightarrow \omega^2 LC = 1 \rightarrow \omega^2 \times 10^{-4} \times 25 \times 10^{-9} = 1$

$\rightarrow \omega^2 = 632 \times 10^3$

$f = \frac{\omega}{2\pi} \Rightarrow f = \frac{632 \times 10^3}{2\pi} \Rightarrow f = 100\ kHz$

C

(13) $V_2 = \frac{10V \times R_2}{R_1 + R_2} = 5V = V_2(0s) = V_{inicial}$

$V_2(1ms) = V_{inicial} \times e^{\frac{-T}{1ms}} = 5 \times e^{-1} = 1,84V$

$\tau = R2C \rightarrow \tau = 10^{+4} \times 10^{-7} = 10^{-3} = 1ms$

só descarrega por R2

(C)

(16) tensão: $9,8 - 0,6 - 0,6$ = em série: $(1k + R2) \times 2mA$

$9,8 - 0,6 - 0,6$ → 2 diodo

$(1k + R2) \times 2mA$ → Tensão

$\Leftrightarrow 8,6 = (1k + R_2) \times 2mA \Leftrightarrow \frac{8,6}{2 \times 10^{-3}} = 1k + R2$

$\Leftrightarrow 4300 = 1k + R2$

$\Leftrightarrow R2 = 3,3k\Omega$

R: A

(17) a) $I = \frac{5}{2000} = 2,5mA$

b) $I = \frac{10}{4000} = 2,5mA$

c) $I = \frac{10}{3000} = 3,3mA$ ⟸

d) $I = 0A$ (diodo sentido contrário)

(18) $P_z = 0{,}5\,W = V_z I_z$

$V_z \times I_z = 0{,}5 \Leftrightarrow 2{,}4\,V \times I_z = 0{,}5\,W$

($V_z \downarrow 2{,}4\,V$)

$\Leftrightarrow I_z = 208\,mA$

$5 - 0{,}6 - 2{,}4 = R \times 208\,mA$

$\Leftrightarrow \frac{2}{208 \times 10^{-3}} = R \Leftrightarrow R = 9{,}6\,\Omega$ R: c

(19) $V_{sp} = V_{rms} \times \sqrt{2} \Leftrightarrow V_{sp} = 16\sqrt{2} \Leftrightarrow V_{sp} = 22{,}6\,V$

$V_{LMAX} = V_{sp} - 2 \times V_\gamma = 21\,V$ $\quad V_{ripple} = 2\,V$

($V_{sp} \downarrow 22{,}6\,V$; $V_\gamma \downarrow 0{,}8\,V$)

$V_{Lmed} = V_{LMAX} - \left(\frac{V_{ripple}}{2}\right) = 21 - 1 = 20\,V$

$i_{LMED} = \frac{V_{Lmed}}{20\,\Omega} \simeq 1\,A$ ($20\,\Omega \downarrow R_L$)

$C = \frac{i_{Lmed}}{2f \times V_{ripple}} = \frac{1}{100 \times 2} = \frac{1}{200} = 5000\,\mu F$

(20) $V_\gamma = 0{,}6V \quad V_z = 12V$

$f = 50\,Hz \quad V_{seff} = 16$

$V_{ip} = 16 \times \sqrt{2} = 22{,}6V$

$I_2 = \frac{V_z}{1200} = \frac{12}{1200} = \frac{1}{100} = 0{,}01\,A = 10\,mA$

$V_{ip} - 0{,}6 - V_z = 400\,\Omega \times I_1 \Leftrightarrow 22 - 12 = 400 \times I_1$

$\Leftrightarrow \frac{10}{400} = I_1 \Leftrightarrow I_1 = 25\,mA$ → Kirchhoff da malha da esquerda

R: $I_z = I_1 - I_2 = 25 - 10 = 15\,mA$

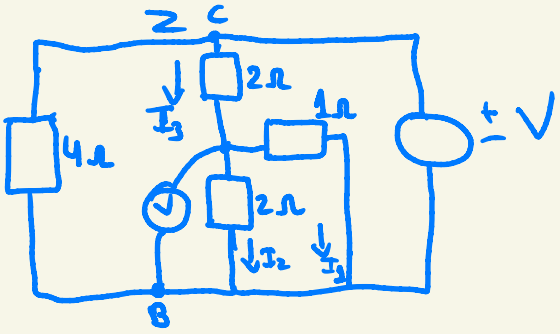
C

---

(8) $I_1 = 1A \quad I_2 = \frac{1}{2} = 0{,}5A \quad I_3 = I_2 + I_1$

$V_{AB} = 1V \quad \Leftrightarrow I_3 = 1{,}5A$

$V_{CA} = 2 \times \frac{3}{2} = 3V \quad V_{CB} = 1 + 3 = 4V$



# Teste 2018

① D

② $i_2 = i_{2A} + i_{2B}$ C $\Rightarrow i_2 = 1 - 0{,}5 = 0{,}5A$

$\frac{R_1}{R_1+R_2} \times I$

$i_{2A} \rightarrow \frac{5}{5+15} \times 4 = \frac{20}{20} = 1A$

$i_{2B} \rightarrow \frac{5}{5+15} \times (-2) = \frac{-10}{20} = -0{,}5A$

③

(11) $Z = \sqrt{(R)^2 \times \left(\frac{j}{\omega C}\right)^2} = 2000\ \Omega$

$4 \times 10^6 - 1 \times 10^6 = \left(\frac{1}{\omega C}\right)^2$

$\Leftrightarrow \left(\frac{1}{\omega C}\right)^2 = 3 \times 10^6 \Leftrightarrow \frac{1}{\omega C} = 1732 \Rightarrow \omega C = 5{,}77 \times 10^{-4}$

$\omega = \frac{5{,}77 \times 10^{-4}}{10^{-6}} \Leftrightarrow \omega = 577$

$f = \frac{\omega}{2\pi} \Leftrightarrow f = 91{,}8\ Hz$

(12) $I_1 = \frac{2{,}71}{1500} = 1{,}8\ mA$

$I_2 = \frac{13{,}55}{1500} = 2{,}88\ mA$

$V_{AB} = (3300 + 2700) I_1 + 2{,}71$

$= 10{,}84 + 2{,}71 = 13{,}55$

$I_3 = I_1 + I_2 \Leftrightarrow I_3 = 1{,}8 + 2{,}88$

$\simeq 4{,}7\ mA$

⑥ $V = \frac{1}{C} \int_0^{0,1} i\,dt + V_0$ ($V_0 = 0$)

$\Leftrightarrow V = \frac{1}{C} \times I \times T$

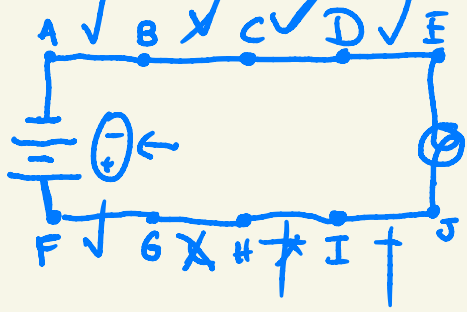
$\Leftrightarrow V = \frac{1}{0,0005} \times 10 \times 10^{-3} \times 0,1$

$\Leftrightarrow V = 2000 \times 10^{-4}$

$\Leftrightarrow V = 2\,V$

# Teste tipo 2023

**1**




Tensão entre B e G: 12V
" " C e I: 0V
" " E e G: 12V
" " D e H: 0V

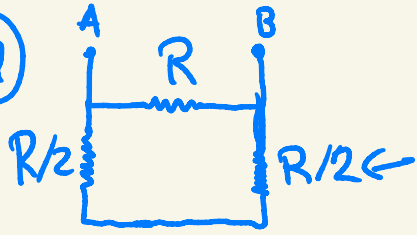
(C)

**2** período de tempo infinito (d)

**3** $i_1 + i_2 + i_3 = 0 \Leftrightarrow 2 - 3 + x = 0$

$\Leftrightarrow x = 1\,A$ (C)

**4**

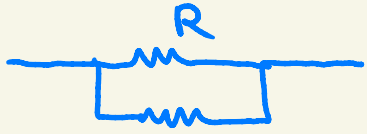



$\frac{R}{2} + \frac{R}{2} = R$

$R // R = \frac{R^2}{2R} = \frac{R}{2}$

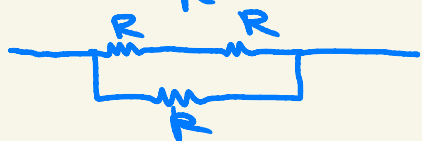
(C)

**5** A →



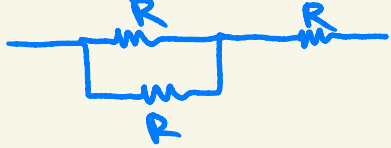

$R // R = \frac{R}{2}$

C →



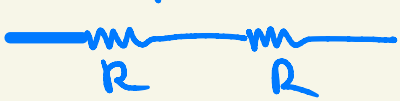

$2R // R = \frac{2R^2}{3R} = \frac{2}{3}R$

B →




$R // R = \frac{R}{2}$ $\frac{R}{2} + R = \frac{3}{2}R$

D →

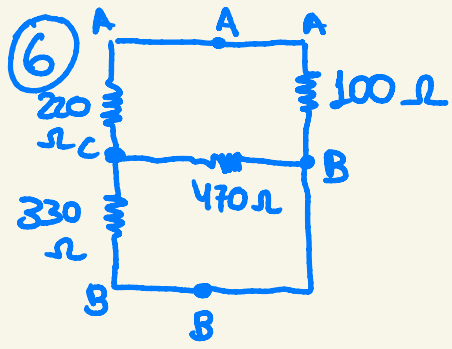



$2R$

Ordem: DBCA

(A)

⑥




$$R = \frac{470 \times 330}{470 + 330} + 220$$

$$\Leftrightarrow R = 413{,}875$$

$$R_{eq} = \frac{413{,}875 \times 100}{413{,}875 + 100} \Leftrightarrow R_{eq} = 80{,}5\ \Omega$$

(A)

⑦

$$V_1 = \frac{790 // 8600}{790 // 8600 + 1000} \times 32$$

$$\Leftrightarrow V_1 = \frac{\frac{790 \times 8600}{790 + 8600}}{\frac{790 \times 8600}{790 + 8600} + 1000} \times 32$$

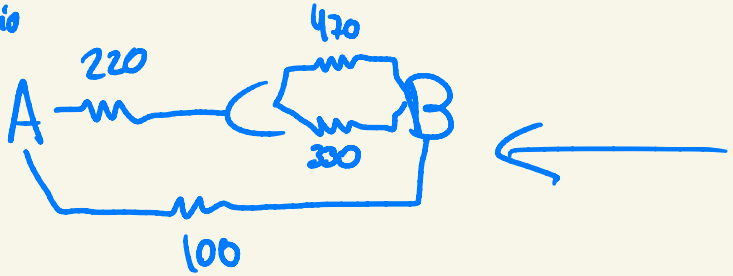
$$\Leftrightarrow V_1 = 13{,}43\,V$$

$$I_1 = -\frac{V_1}{8{,}6k} \Leftrightarrow I_1 = -\frac{13{,}43}{8600} \Leftrightarrow I_1 = -1{,}56\,mA$$

(A)

↓ sentido contrário

⑥



(8) d $|V_S| = \sqrt{|V_R|^2 + |V_C|^2}$

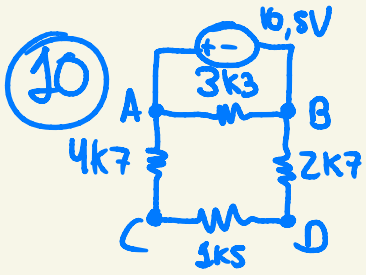
(9) $V = \frac{I}{G} \Leftrightarrow V = \frac{0,5 + 0,3}{0,01 + 0,04}$

$\Leftrightarrow V = \frac{0,8}{0,05} \Leftrightarrow V = 16V$

$I = I_{S1} - I_1 \Leftrightarrow I = 0,5 - (16 \times 0,01)$

$\Leftrightarrow I = 0,34\,A$ (C)

(10)




$V_D = \frac{2k7}{4k7 + 1k5 + 2k7} \times 10,5$

$\Leftrightarrow V_D = 3,19\,V$

$V_{AD} = V_A - V_D \Leftrightarrow V_{AD} = 10,5 - 3,19 \Leftrightarrow V_{AD} = 7,31V$ (A)

(11) $|Z_T| = 4K\Omega$ a $100\,Hz$ $R = 2200$

$C = \frac{1}{2\pi f \sqrt{|Z_T|^2 - R^2}} \Leftrightarrow C = \frac{1}{2\pi \times 100 \sqrt{4000^2 - 2200^2}}$ $\omega C = \frac{1}{200\pi\sqrt{3340}}$

$\Leftrightarrow C = 4,8\,\mu F$ (A)

$|Z_T| = \sqrt{R^2 + \left(\frac{1}{j\omega C}\right)^2}$

(12) $V_{eq} = \sqrt{\frac{1}{T}\int_0^{100} v(t)^2 dt}$

$\Leftrightarrow V_{eq} = \sqrt{\frac{1}{100\mu} \times \left(\int_0^{10} 8^2 dt + \int_{10}^{100} (-2)^2 dt\right)}$

$\Leftrightarrow V_{eq} = \sqrt{\frac{1}{100\mu} \times [64t]_0^{10} + [4t]_{10}^{100}}$

$\Leftrightarrow V_{eq} = \sqrt{\frac{1}{100\mu} \times (0{,}00064 + 0{,}00036)}$

$\Leftrightarrow V_{eq} = \sqrt{\frac{1}{100\times10^{-6}} \times 0{,}001}$ $\Leftrightarrow V_{eq} = \sqrt{\frac{0{,}001}{100\times10^{-6}}}$ $\Leftrightarrow V_{eq} = \sqrt{10}$

$\Leftrightarrow V_{eq} = 3{,}16\,V$ (A)

(13) $V_{out} = \frac{Z_{C_2}}{Z_{C_2} + Z_{C_1}} V_{in}$

$\Leftrightarrow V_{out} = \frac{\frac{1}{j\omega C_2}}{\frac{1}{j\omega C_2} + \frac{1}{j\omega C_1}} \times V_{in}$

$\Leftrightarrow V_{out} = \frac{C_1}{C_1 + C_2} \times V_{in}$ $\Leftrightarrow V_{out} = \frac{0{,}1\times10^{-6}}{0{,}1\times10^{-6} + 0{,}47\times10^{-6}} \times 10$

$\Leftrightarrow V_{out} = \frac{0{,}1}{0{,}1 + 0{,}47} \times 10$ $\Leftrightarrow V_{out} = 1{,}75\,V$

(14) $|G| = 20 \log\left(\frac{R1}{R2}\right) \Leftrightarrow |G| = 20 \log\left(\frac{150 \times 10^3}{68 \times 10^3}\right)$

$R_1 = 150\,k\Omega$ $\Leftrightarrow |G| = 6{,}87\,dB$

$R_2 = 68\,k\Omega$

(15) $G = G_1 \times G_2$ ← Inversora

$\Leftrightarrow G = \left(-\frac{12}{1{,}8}\right) \times \left(1 + \frac{6{,}8}{4{,}7}\right)$ ← Ganho não Inversora

$\Leftrightarrow G = -16{,}31$ (a)

(16) Vai variar entre $-0{,}7V$ e $8V$

$-8 + V_R + V_0 = 0 \Leftrightarrow V_0 = 8V$ (a)

(17) $V_S = 30V$

$-30 + V_R + 0{,}7 + 10 = 0$

$\Leftrightarrow V_R = 30 - 10{,}7 \Leftrightarrow V_R = 19{,}3V$

$I = \frac{19{,}3}{100} \Leftrightarrow I = 0{,}193 \Leftrightarrow I = 193\,mA$

(18) $I_2 = I_1 - I_2$

$\Leftrightarrow I_2 = \frac{15 - 5,1}{500} - \frac{5,1}{1000} \Leftrightarrow I_2 = 14,7\,mA$

$I_2$ sentido oposto ao díodo

(19) $I_2 = 0$ $\quad I_1 = \frac{15}{4k + 1k} \Leftrightarrow I_1 = 3\,mA$

b

(20) d