(1) (a) $C = \frac{n}{K}$ $C = \frac{1.10^{-1}}{9.10^{9}}$ $C = \frac{1}{9}.10^{-10}$ $C = 1,1.10^{-11}$ F

(b) $Q = C.V$ $Q = 1,1.10^{-11}.10^{4}$ $Q = 1,1.10^{-7}$ C

(2) (a) $C_1 = \frac{2.10^{-6}}{4.10^{3}}$ $C_2 = \frac{4.10^{-6}}{2.10^{3}}$ $C_3 = \frac{6.10^{-6}}{4.10^{3}}$

$C_1 = 0,5.10^{-9}$ F $C_2 = 2.10^{-9}$ F $C_3 = 1,5.10^{-9}$ F

(b) $V = \frac{Q_1 + Q_2 + Q_3}{C_1 + C_2 + C_3}$ $V = \frac{12.10^{-6}}{4.10^{-9}}$ $V = 3.10^{3}$ V

(c)

(3) (a) $C = \frac{Q}{V}$ $1 = \frac{Q}{12}$ $Q = 12$ C

(b) $E_p = \frac{Q^2}{2C}$ $E_p = \frac{144}{2}$ $E_p = 72$ J

(4) (a) $C = \frac{4,43.10^{-9}}{10^{2}}$ $C = 4,43.10^{-11}$ F

(b) $100 = \frac{Q.2.10^{-2}}{8,85.10^{-12}.4.10^{-1}}$ $10^{2} = \frac{Q.}{8,85}.10^{11}.Q$

$10^{-9} = \frac{2}{8,85}.Q$ $2Q = 8,85.10^{-9}$

$Q \simeq 4,43.10^{-9}$ C

(c)

(d)

(5) $10 = \frac{Q}{6}$ $Q = 60\,C$

(6) (d) a potencial elétrico

(7) (d) V inversamente proporcional a C.

(8) (b) d.d.p. aumenta

(9) (a) $2.10^{-6} = \frac{Q_1}{12}$ $Q_1 = 24.10^{-6}\,C = Q_2 = Q_3$

$6.10^{-6} = \frac{24.10^{-6}}{U_3}$ $U_3 = \frac{24.10^{-6}}{6.10^{-6}}$ $U_2 = 4V$

$12.10^{-6} = \frac{24.10^{-6}}{U_3}$ $U_3 = 2V$

(b) $U = 12 + 2 + 4$ $U = 18V$

(c) $\frac{1}{C} = \frac{1}{2.10^{-6}} + \frac{1}{6.10^{-6}} + \frac{1}{12.10^{-6}}$

$\frac{1}{C} = \frac{9}{12.10^{-6}}$ $9C = 12.10^{-6}$ $C \simeq 1{,}3.10^{-6}$

d

10 a) $U_1 = U_2 = U_3 = 20\,V$

$2 \cdot 10^{-6} = \frac{Q_1}{20}$ $\quad Q_1 = 4 \cdot 10^{-5}\,C$

$8 \cdot 10^{-6} = \frac{Q_2}{20}$ $\quad Q_2 = 16 \cdot 10^{-5}\,C$

$10^{-5} = \frac{Q_3}{20}$ $\quad Q_3 = 2 \cdot 10^{-4}\,C$

b) $Q = 2 \cdot 10^{-5} + 16 \cdot 10^{-5} + 20 \cdot 10^{-5}$

$Q = 38 \cdot 10^{-5}\,C$

c) $C = 20\,\mu F$

11 a) $\frac{1}{C_s} = \frac{1}{3} + \frac{1}{6} \Big/ \frac{1}{C_s} = \frac{3}{6}$ $\quad C_s = \frac{6}{3}$ $\quad C_s = 2\,\mu F$

$C_{total} = 2 + 8$ $\quad C = 10\,\mu F$

b) $U_1 = \frac{40}{3} = 13{,}3\,V$ $\quad Q_1 = 40\,\mu C = Q_2$ $\quad Q_s = 2 \cdot 20$

$Q_s = 40\,\mu C$

$U_2 = \frac{40}{6} = 6{,}6\,V$

$U_3 = 20\,V$ $\quad 8 = \frac{Q_3}{20}$ $\quad Q_3 = 160\,\mu C$

$Q_3 = 1{,}6 \cdot 10^{-4}\,C$

(12) (a) $\frac{1}{C} = \frac{1}{2} + \frac{1}{6}$ / $\frac{1}{C} = \frac{4}{6}$ $C = \frac{6}{4}$ $C = 1{,}5\,\mu C$

(b) $Q = 1{,}5 \cdot 20$
$Q = 30\,\mu C = Q_1 = Q_2$

(c) $U_1 = \frac{30}{2}$ $U_1 = 15\,V$ / $U_2 = \frac{30}{6}$ $U_2 = 5\,V$

(13) (a) $C_1 = C_2 = C_3 = 6\,\mu F$

$\frac{1}{C} = \frac{3}{6}$ $C = \frac{6}{3}$ $C = 2\,\mu F$

(b) $\frac{1}{C_s} = \frac{2}{6}$ $C_s = \frac{6}{2}$ $C_s = 3\,\mu F$

$C = 3 + 6$ $C = 9\,\mu F$

(c) $C_p = 12\,\mu F$

$\frac{1}{C} = \frac{1}{12} + \frac{1}{6}$ $C = \frac{12}{3}$

$C = 4\,\mu F$

(14) (a)

(b)

c)

d)

15) a) $C_p = 10\ \mu F$

$\frac{1}{C} = \frac{1}{40} + \frac{1}{10}$ $\quad \frac{1}{C} = \frac{5}{40}$ $\quad C = \frac{40}{5}$ $\quad C = 8\ \mu F$

b)

d) $Q_1 = 3{,}2 \cdot 10^{-4}\ C$ $\quad Q_2 = 2 \cdot 3{,}2$ $\quad Q_3 = 8 \cdot 10^{-6} \cdot 3{,}2$

$Q_2 = 6{,}4 \cdot 10^{-5}\ C$ $\quad Q_3 = 2{,}56 \cdot 10^{-4} C$

c) $V_{AC} = \frac{3{,}2 \cdot 10^{-4}}{4 \cdot 10^{-5}}$ $\quad V_{AC} = 8\ V$ $\quad V_{CB} = 32\ V$

d)

h) $Q = 8 \cdot 40$ $\quad Q = 320\ \mu C$

$Q = 3{,}2 \cdot 10^{-4} C$

16 a) $C = \frac{n}{k}$ $C_1 = \frac{27}{9.10^9}$ $C_1 = 3.10^{-9}\,F$

$C_2 = \frac{9}{9.10^9}$ $C_2 = 10^{-9}\,F$ $C_3 = \frac{54}{9.10^9}$ $C_3 = 6.10^{-9}\,F$

b) $V = \frac{6.10^{-9} + 4.10^{-9} + 5.10^{-9}}{3.10^{-9} + 1.10^{-9} + 6.10^{-9}}$ $V = \frac{15.10^{-9}}{10.10^{-9}}$ $V = 1,5\,V$

c) $Q_1'' = 3.10^{-9}.1,5$ $Q_2' = 1,5.10^{-9}\,C$ $Q_3' = 6.10^{-9}.1,5$

$Q_1' = 4,5.10^{-9}\,C$ $Q_3' = 9.10^{-9}\,C$

17) $4.10^{-10} = \frac{4,10^{-6}.4,10^{-6}}{2C}$ $2C = \frac{16.10^{-12}}{4.10^{-10}}$ $C = \frac{4.10^{-2}}{2}$

16.10^{-12}

$C = 2.10^{-2}\,F$

18)

19)

20) a) $\frac{1}{C} = \frac{1}{60} + \frac{1}{30} + \frac{1}{20} \Big/ \frac{1}{C} = \frac{6}{60}$ $C = \frac{60}{6}$ $C = 10\,pF$

b) $Q = 10 \cdot 12$ $Q = 120\,pC = Q_1 = Q_2 = Q_3$

$V_1 = \frac{120}{60}$ $V_1 = 2V$ $V_2 = \frac{120}{30}$ $V_2 = 4V$ $V_3 = \frac{120}{20}$ $V_3 = 6V$

21) a) $C = 10 + 20 + 30 + 40 + 50$
$C = 150\,pF$

b) $Q_1 = 10 \cdot 12$ | $Q_2 = 20 \cdot 12$ | $Q_3 = 30 \cdot 12$
$Q_1 = 120\,pC$ | $Q_2 = 240\,pC$ | $Q_3 = 360\,pC$

$Q_4 = 40 \cdot 12$ | $Q_5 = 50 \cdot 12$
$Q_4 = 480\,pC$ | $Q_5 = 600\,pC$

(22) a) $C_p = 60\,pF$ $\frac{1}{C} = \frac{1}{30} + \frac{1}{60}$ $C = \frac{60}{3}$ $C = 20\,pF$

b) $Q = 20 \cdot 12$ $V_2 = 4V$

$Q = 240\,pC = Q_1$ $Q_2 = 20 \cdot 4$ $Q_3 = 40 \cdot 4$

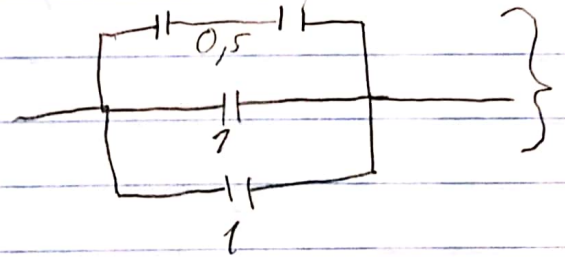
$V_1 = \frac{240}{30}$ $V_1 = 8\,V$ $Q_2 = 80\,pC$ $Q_3 = 160\,pC$

c) $Q = 20 \cdot 10$ $Q = 2\,pF$

(23) $C_p = 20\,\mu F$ $\frac{1}{C} = \frac{1}{12} + \frac{1}{20} + \frac{1}{30}$ $\frac{1}{C} = \frac{10}{60}$ $C = \frac{60}{10}$ $C = 6\,\mu F$

(24) $\frac{1}{C} = \frac{1}{1} + \frac{1}{1}$ $\frac{1}{C} = 2$ $C = 0{,}5\,\mu F$

4 capacitores



$C = 2{,}5\,\mu F$

(25) $C = \frac{n}{K}$ $C = \frac{9 \cdot 10^{-3}}{9 \cdot 10^{9}}$ $C = 10^{-12}\,F$

$\frac{1}{C} = \frac{2}{10^{-12}}$ $C = \frac{1 \cdot 10^{-12}}{2} = 0{,}5 \cdot 10^{-12} = 5 \cdot 10^{-13}\,F$

(26) c) 2xQ e C constante

/ /

27) d) falsa

28) alternativa d)

29) d) falsa (igual a 27)

30) e) I, IV, V