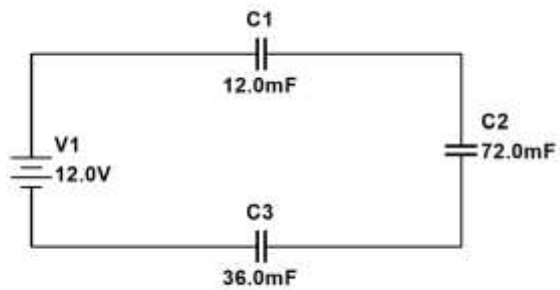
Quiz Average **7.60** **Quiz High Score** **10**

PH 221 **Quiz # 04 (10 pts)** **Name** **Solution**



In the circuit on the left, what is the total capacitance attached to the power source?

A. $120.\,\text{mF}$ **B.** $\mathbf{8.00\ mF}$ **C.** $0.125\ \text{mF}$ **D.** $8.33\ \mu\text{F}$

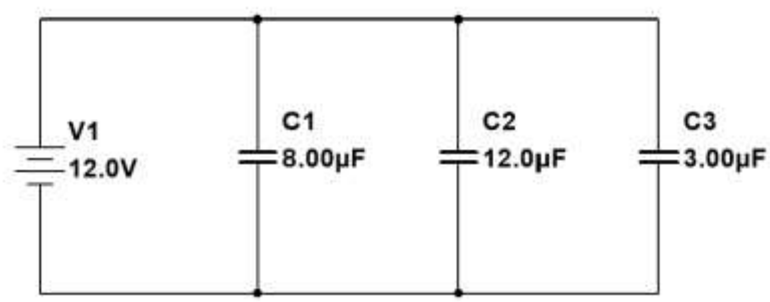
Capacitors in series!

$$\frac{1}{C_{Total}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} = \frac{1}{12.0\ mF} + \frac{1}{72.0\ mF} + \frac{1}{36.0\ mF} = \frac{6+1+2}{72.0\ mF} = \frac{9}{72.0\ mF}$$

$$C_{Total} = \frac{72.0\ mF}{9} = 8.00\ mF$$

So, the correct answer is B !

In the circuit on the right, what is the charge found on Capacitor C_3 after the circuit has been connected for a long time?



A. $276.\ \mu\text{C}$ **B.** $22.2\ \mu\text{C}$ **C.** $4.00\ \mu\text{C}$ **D.** $\mathbf{36.0\ \mu C}$

Since this is a parallel circuit all capacitors have the same voltage across them, so the charge on C_3 is found from:

$$Q_3 = C_3 V_3 = (3.00\ \mu F)(12.0\ V) = 36.0\ \mu C$$

So, the correct answer is D !

A parallel plate capacitor has a capacitance of $2.77\ \mathrm{nF}\ (\mathrm{nano} = 10^{-9})$. The plates are separated by $2.20 \times 10^{-4}\ \mathrm{m}$. What is the area of each of the plates used to make the capacitor?

A. $\mathbf{6.89 \times 10^{-2}\ m^2}$ **C.** $1.45 \times 10^{1}\ \mathrm{m}^2$

B. $3.81 \times 10^{0}\ \mathrm{m}^2$ **D.** $2.62 \times 10^{-1}\ \mathrm{m}^2$

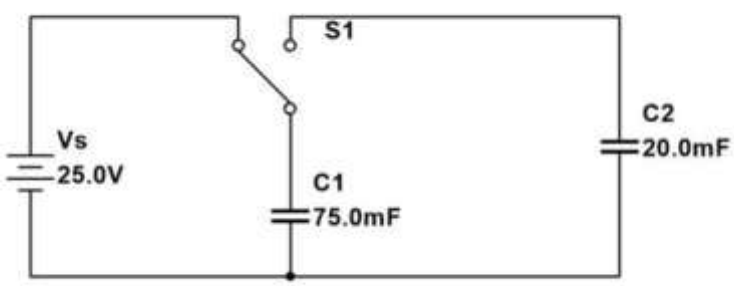
$$C_{Parallel\ Plate} = \frac{\varepsilon_0 A}{d}$$

Solve for Area

$$\mathbf{A} = \frac{\mathbf{d C_{Parallel\ Plate}}}{\boldsymbol{\varepsilon_0}} = \frac{\mathbf{(2.20 \times 10^{-4}\ m)(2.77 \times 10^{-9}\ F)}}{\mathbf{8.85 \times 10^{-12}\ C^2/Nm^2}} = \frac{\mathbf{6.094 \times 10^{-13}\ F\ m}}{\mathbf{8.85 \times 10^{-12}\ C^2/Nm^2}}$$

$$\mathbf{A = 6.89 \times 10^{-2}\ m^2}$$

So, the correct answer is A !



A circuit on the left shows a capacitor ($C_1 = 75.0\ \mathrm{mF}$) is connected in parallel to a power source ($V_S = 25.0\ \mathrm{V}$). If the switch is moved after the capacitor C_1 has fully charged, the capacitor is now connected to capacitor C_2 now in parallel. What is the voltage across C_1 after the switch was thrown for a long time?

A. 25.0 V **B.** 5.30 V **C.** **19.7 V** **D.** 34.1 V

When C_1 is fully charged by the power source it ends up with a charge on its plates. We can find that amount of charge by:

$$Q_{10} = C_1 V_S = (75.0\ mF)(25.0\ V) = 1875.\ mC$$

When the second capacitor is added and the power source is removed, the total charge on the pair in parallel must remain $1875.\ mC$. First find the new capacitance of the parallel pair.

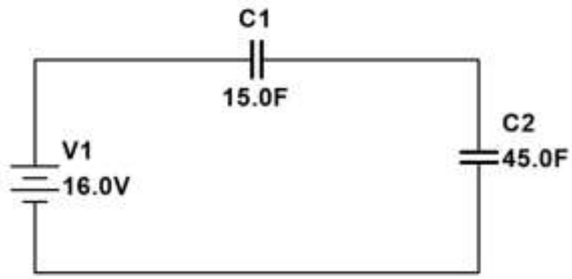
$$C_{Total\ Parallel} = C_1 + C_2 = 75.0\ mF + 20.0\ mF = 95.0\ mF$$

Since the capacitors are in parallel they must have the same voltage, so we can find that by

$$V_{Final} = \frac{Q_{total}}{C_{Total}} = \frac{1875.\ mC}{95.0\ mF} = 19.74\ V$$

So, the correct answer is C !

Consider the circuit shown on the right. Assume the circuit has been connected for a long time so that the capacitors are fully charged. What is the energy stored in the capacitor C_2?



A. 1080. J **B.** **360. J** **C.** 1440. J **D.** 2.00 J

Energy stored in a capacitor can be found from:

$$U_{Stored} = \frac{Q^2}{2C}$$

Since the two capacitors are in series, the charge will be the same on both, so first find the effective capacitance of the pair in series

$$\frac{1}{C_{Total\ Series}} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{15.0\ F} + \frac{1}{45.0\ F} = \frac{3+1}{45.0\ F} = \frac{4}{45.0\ F}$$

$$C_{Total\ Series} = \frac{45.0}{4} F$$

Now

$$Q_2 = Q_{Total} = C_{Total} V_S = \left(\frac{45.0}{4} F\right)(16.0\ V) = 180.\ C$$

Finding Energy

$$U_{Stored} = \frac{Q^2}{2C} = \frac{(180.\ C)^2}{2(45.0\ F)} = \frac{32,400.\ C^2}{90.0\ F} = 360.\ J$$

So, the correct answer is B !

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This page last updated on September 27, 2024

A.

B.

C.

D.

A. C.

B. D.

A. B. $360. J$ C. D.