**Answer on Question 65307, Physics, Electric Circuits**

**Question:**

Two capacitors have an equivalent capacitance of $16.0\ pF$ when they are hooked up in parallel. The same two capacitors when hooked up in series have an equivalent capacitance of $1.75\ pF$. What is the capacitance of each capacitor?

**Solution:**

Let the capacitance of the first capacitor be $C_1$ and the second one - $C_2$. Then, we can write the equivalent capacitance of two capacitors connected in series or in parallel:

$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}, (1)$$

$$C_p = C_1 + C_2, (2)$$

here, $C_s = 1.75\ pF$ is the equivalent capacitance of two capacitors connected in series, $C_p = 16.0\ pF$ is the equivalent capacitance of two capacitors connected in parallel.

Let's express $C_2$ from the equation (2) and substitute it into the equation (1):

$$C_2 = C_p - C_1,$$

$$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_p - C_1},$$

$$\frac{1}{C_s} = \frac{C_p}{C_1(C_p - C_1)}.$$

After simplification we get the quadratic equation:

$$C_1^2 - C_1 C_p + C_p C_s = 0.$$

Let's substitute $C_s$ and $C_p$ into the equation:

$$C_1^2 - 16C_1 + 28 = 0.$$

This quadratic equation has two roots:

$$C_1 = \frac{16 + \sqrt{(16)^2 - 4 \cdot 28}}{2} = 14,$$

$$C_1 = \frac{16 - \sqrt{(16)^2 - 4 \cdot 28}}{2} = 2.$$

Both roots of the quadratic equation have the sense. If we have $C_1 = 14\ pF$, then we should take $C_2 = 2\ pF$ to obtain $C_s = 1.75\ pF$ and $C_p = 16.0\ pF$. Similarly, if we have $C_1 = 2\ pF$, then we should take $C_2 = 14\ pF$ and we obtain the same $C_s$ and $C_p$. Therefore, the capacitance of each capacitor is $14\ pF$ and $2\ pF$.

**Answer:**

The capacitance of each capacitor is $14\ pF$ and $2\ pF$.