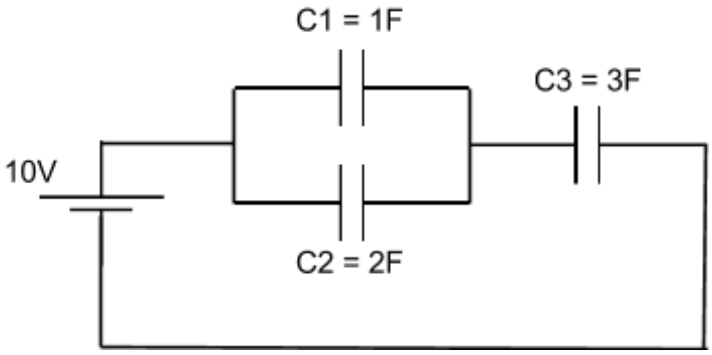
Capacitor Example (for a network of capacitors)

Calculate the total potential energy stored in the capacitors in the circuit.



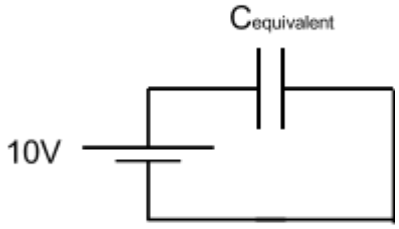
Solution

Step 1: Replace all capacitors with a single equivalent capacitor.

To calculate the equivalent capacitance, recall that for capacitors in parallel $C_{equivalent} = \Sigma C_i$ and for capacitors in series: $C_{equivalent} = \left[\Sigma \frac{1}{C_i}\right]^{-1}$
In this circuit, C1 and C2 are in parallel, and together they are in series with C3.

$$C_{equivalent} = [\frac{1}{C1+C2} + \frac{1}{C3}]^{-1} = \frac{C3(C1+C2)}{C1+C2+C3} = \frac{3(1+2)}{1+2+3} = \frac{3}{2} \text{ (F)}$$

Step 2: Draw the equivalent circuit.



Step 3: Calculate the total potential energy stored in the equivalent capacitor.

Recall that the equation for the energy stored in a capacitor is given by: $U = \frac{CV^2}{2}$
Thus, $U_{total} = \frac{C_{equivalent}V^2}{2} = \frac{1.5\,(10)^2}{2} = 75$ (J)

Answer: The total energy stored in the capacitors is 75 J.