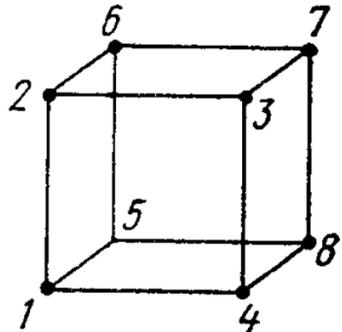


Answer on Question #41235, Physics, Electric Circuits

Twelve capacitors of capacitance 7 microfarad each are joined in 12 sides of a cube. What is equivalent capacitance b/w any two adjacent corners of cube??

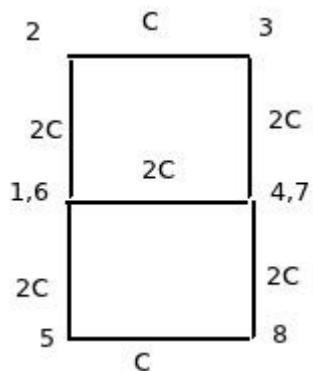
a) 12 microfarad b) 49/12 mf c) 35/6 mf d) 8 mf mf is microfarad

Solution



We have cube of capacitors with capacitance C . We need to find capacitance between vertices 1 and 4.

Hold the cube in air by vertices 2 and 3. Assuming rotation around the joints, edge 6-7 and 5-8 will start moving down and we would get a 2-D picture.

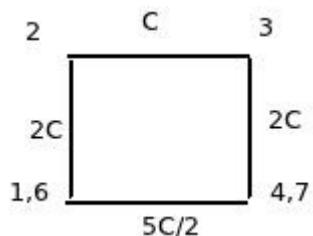


Now, we have to add {1,6}, {5}, {8}, {4,7} loop in series :

$$\frac{1}{C_1} = \frac{1}{2C} + \frac{1}{C} + \frac{1}{2C} = \frac{4}{2C} = \frac{2}{C} \rightarrow C_1 = \frac{C}{2}.$$

This is parallel to {1,6}, {4,7}:

$$C_2 = C_1 + 2C = \frac{C}{2} + 2C = \frac{5C}{2}.$$



Adding {2}, {1,6}, {4,7}, {3} in series

$$\frac{1}{C_3} = \frac{1}{C_2} + \frac{1}{2C} + \frac{1}{2C} = \frac{2}{5C} + \frac{1}{C} = \frac{7}{5C} \rightarrow C_3 = \frac{5C}{7}.$$

Adding that to {2},{3} in parallel

$$C_{\text{total}} = C_3 + C = \frac{5C}{7} + C = \frac{12C}{7}.$$

In our case $C = 7\mu F$, that's why

$$C_{\text{total}} = \frac{12 \cdot 7\mu F}{7} = 12 \mu F.$$

Answer: a) 12 microfarad.