

### Answer on Question #79543 - Physics - Electric Circuits

3. a) A positive  $20\mu\text{C}$  charge is placed at the centre of a circle of radius 20 cm. If we move a positive  $2\mu\text{C}$  charge once along the circumference of the circle, will any work be done in the process? Justify your answer.

#### Solution

Calculate the electric potential done by  $Q = 20\mu\text{C}$  charge at a distance  $r = 20\text{ cm}$  in any direction:

$$V_1 = \frac{Q}{4\pi\epsilon_0 r} = \frac{20 \cdot 10^{-6}}{4 \cdot 3.14 \cdot 8.85 \cdot 10^{-12} \cdot 0.2} = 8.99 \text{ MV.}$$

If the smaller charge is moved once along the circumference, it will constantly be at a distance 20 cm from the first charge where potential  $V$  is also equal to  $V_1$ . And the work done on the charge  $q = 2\mu\text{C}$  is:

$$W = q(V_1 - V) = 2 \cdot 10^{-6}(8.99 \cdot 10^6 - 8.99 \cdot 10^6) = 0.$$

Thus, no work will be done in this process; the  $2\mu\text{C}$  charge is moving along the *equipotential lines*.

#### Answer

No work will be done because the smaller charge moves along the equipotential lines.

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