3. Four identical metal spheres have charges of q_A = -8.0 μC, q_B = -2.0 μC, q_C = +5.0 μC, and q_D = +12.0 μC. **(a)** Two of the spheres are brought together so they touch, and then they are separated. Which spheres are they, if the final charge on each one is +5.0 μC? **(b)** In a similar manner, which three spheres are brought together and then separated, if the final charge on each of the three is +3.0 μC? **(c)** The final charge on each of the three separated spheres in part (b) is +3.0 μC. How many electrons would have to be added to one of these spheres to make it electrically neutral?

If two spheres are connected the charges will equilibrate until equal amounts of charge are on each sphere. This amount would be the average of the two charges.

$$Q_{final} = \frac{Q_1 + Q_2}{2}$$

So we need the average to be +5 μC Which also means that the sum of the two charges must be +10 μC. SO only way to get +10 μC is +12 μC and - 2 μC. Adding up any of the other combinations won't give +10 μC. You would get -10 μC, -3 μC, +3 μC, + 4 μC, +17 μC

So the two spheres are q_B and q_D.

For three spheres we would have

$$Q_{final} = \frac{Q_1 + Q_2 + Q_3}{3}$$

So if the average is +3 μC, the sum of the three charges would be +9 μC. So adding three we get +12 μC , + 5 μC ans -8 μC. Adding up any of the other combinations would give you +5 μC, +15 μC, -2 μC

So the three spheres are q_A, q_C, and q_D.

To make it electrically neutral we need – 3 μC of charge so

$$N = \frac{Q}{-e} = \frac{-3.0\ x\ 10^{-6} C}{-1.6\ x\ 10^{-19} C} = 1.875\ x\ 10^{13} e^-$$

So the two spheres are q_B and q_D.
So the three spheres are q_A, q_C, and q_D.
$$N = 1.9\ x\ 10^{13} e^-$$

Please send any comments or questions about this page to ddonovan@nmu.edu

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