

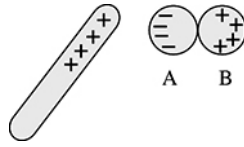
26.10.



The final state of each sphere and of the rod is neutral. The conducting rod allows the excess electrons in the negatively charged sphere to move to the positively charged sphere and exactly neutralize the charge there, leaving all three conductors neutral.

26.11. Each sphere ends up with one unit of negative charge. Once they touch, the two spheres become essentially one conductor. The overall net charge is $-4 + 2 = -2$. Charge is spread uniformly over the surface of a conductor.

26.12.



The rod will polarize the charges in the combined conductor A + B, attracting negative charges to A and leaving B with positive charges. The combined conductor is still neutral, while A has net negative charge.

26.1. Model: Use the charge model.

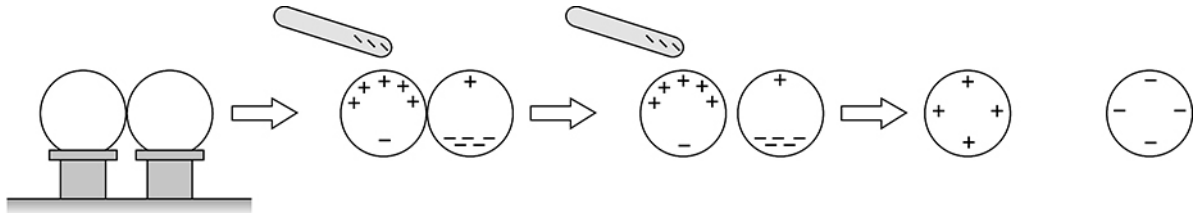
Solve: (a) In the process of charging by rubbing, electrons are removed from one material and transferred to the other because they are relatively free to move. Protons, on the other hand, are tightly bound in nuclei. So, electrons have been removed from the glass rod to make it positively charged.

(b) Because each electron has a charge of 1.60×10^{-19} C, the number of electrons removed is

$$\frac{8.0 \times 10^{-9} \text{ C}}{1.60 \times 10^{-19} \text{ C}} = 5.0 \times 10^{10}$$

26.9. Model: Use the charge model and the model of a conductor as a material through which electrons move.

Solve:



The first step shows two neutral metal spheres touching each other. In the second step, the negative rod repels the negative charges which will retreat as far as possible from the top of the left sphere. Note that the two spheres are touching and the net charge on these two spheres is still zero. While the rod is there on top of the left sphere, the right sphere is moved away from the left sphere. Because the right sphere has an excess negative charge by the same amount as the left sphere has an excess positive charge, the separated right sphere is negatively charged as shown in the third step. As the two spheres are moved apart further and the negatively charged rod is moved away from the spheres, the charges on the two spheres redistribute uniformly over the entire sphere surface. Thus, we have oppositely charged the two spheres.