Two uncharged metal balls, X and Y stand on glass rods. A third ball Z, carrying a positive charge (+Q), is brought near the first two. Next a conducting wire is run between X and Y. The wire is then removed, and ball Z is finally removed. When this is all done, what is the final result?

A) Both X and Y are still uncharged.
B) Balls X and Y are now charged positively.
C) Balls X and Y are now charged negatively.
D) Ball X is positive, ball Y is negative.
E) Ball X is negative, ball Y is positive.
It is true that X and Y start uncharged, but that does not mean they do not have charge on them. They have + and - charges, all mixed up to produce a neutral result. When the charged ball is brought near, the two neutral balls will be polarized slightly because of the electric field that is set up by ball Z. What that means is that the - charges in the neutral balls are attracted to the + charge of Z, the + charges are repelled (but in fact, they don’t move. The positive charge on the left of X and Y are caused because the - charges moved away from there.) When the wire is connected, some electrons will flow from X to Y. You can look at it as one object now, where the - charges are trying to get even closer on the whole to the + of Z.

When the wire is then disconnected, the charges stay divided, so X will have + charge and Y will have - charge.

II) The situation is no different if the wire is connected first, and then the charged ball Z is brought near. The charges are still induced on the sphere as in picture +3.

III) If the ball Z is removed again before the wire is removed, the final situation is different. The charges on the ball X and Y now have a chance to flow back, and so they will (very rapidly too.) The final result would then be two neutral balls.