Electrostatics - Part 2

When charged objects are brought into contact, the charge will rearrange itself in an attempt to balance or neutralize the charges. Protons can't move from one atom to another as they are fixed in the nucleus, so the electrons will move from the object that has more electrons to the object that has less electrons.

Different situations:

- If a positively charged sphere is brought into contact with a negatively charged sphere. Electrons would be transferred from the positive / negative to the positive / negative sphere.
- When a positively charged sphere touches a neutral sphere. Electrons will move from the positive / neutral sphere to the positive / neutral sphere.
- When a negatively charged sphere is brought into contact with a neutral sphere, then electrons will move from the negative / neutral sphere to the negative / neutral sphere.

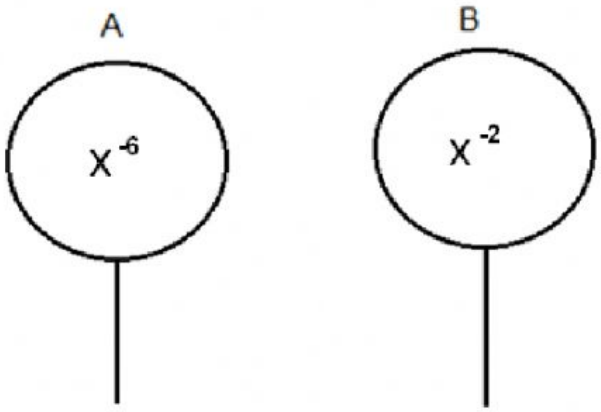
DEFINITION: Principle of conservation of charge

The principle of conservation of charge states that the net charge of an isolated system remains constant during any physical process, e.g. two charge objects making contacting and separating.

- This means that the OVERALL charge, if you add all the charges together, is the same at the beginning and the end. It is just distributed differently after the objects touch.
- After the objects touch and separate they will each have the SAME charge because the electrons will split themselves evenly between the 2 objects
- We call this new charge $\mathbf{Q_{new}}$. No matter what the charges were on the 2 objects before they touched, they will both have the same charge, Q_{new}, after they touch and separate.
- We calculate Q_{new} like this:

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

Example 1



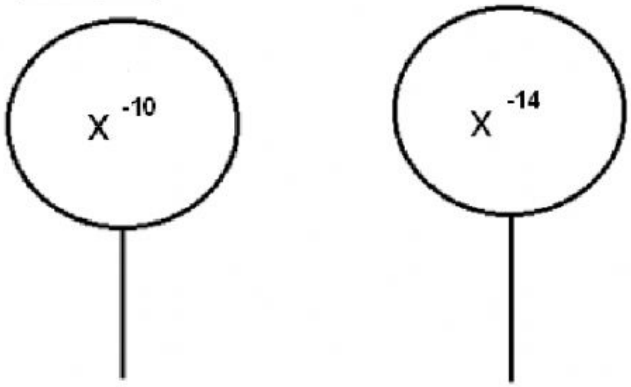
In this case sphere A has more electrons than sphere B, thus electrons are transferred from sphere to sphere , until they have the same number of electrons.

To calculate the charge on the new sphere: $\frac{\text{charge on A + charge on B}}{2}$

$$Q = \frac{Q_1 + Q_2}{2}$$

Q_{new} = $\frac{-6 + (-2)}{2}$ = electrons on each

Example 2



$$Q = \frac{Q_1 + Q_2}{2}$$

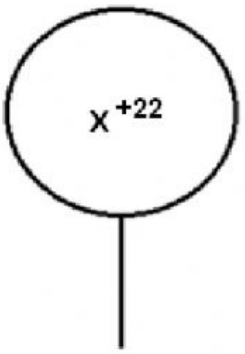
= $\frac{\quad + \quad}{2}$

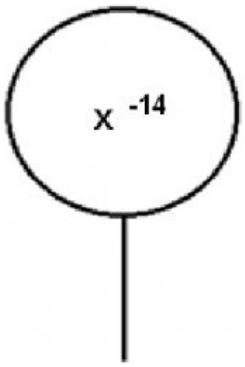
= electrons each

Exercise 1

Calculate the new charge on each sphere after they have touched:

1.



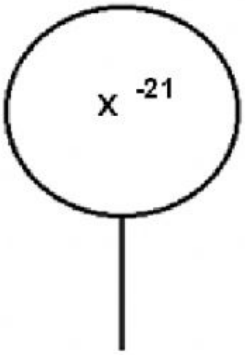


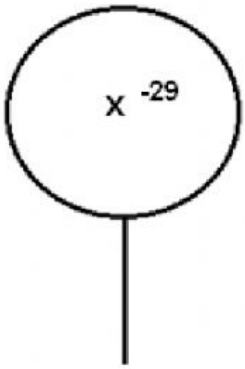
$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{+}{2}$$

$$=$$

2.



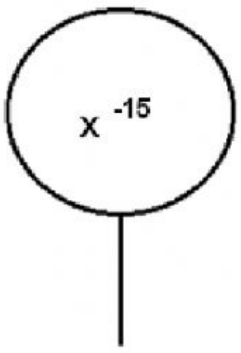


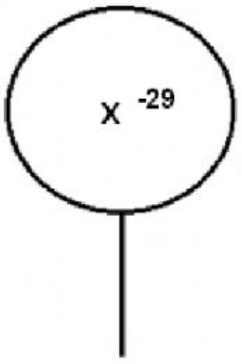
$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{+}{2}$$

$$=$$

3.



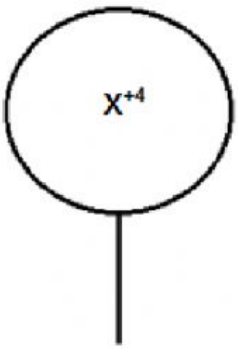


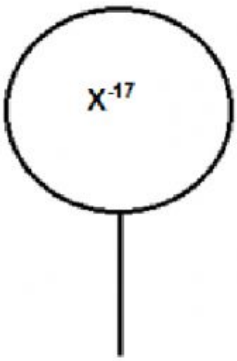
$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{+}{2}$$

$$=$$

4.



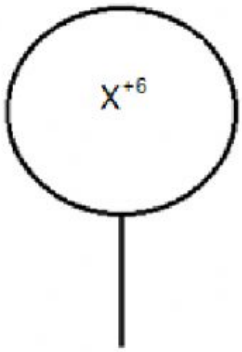


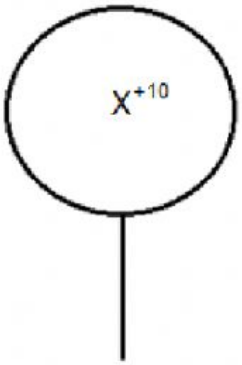
$$Q_{new} = \frac{Q_1 + Q_2}{2}$$

$$= \frac{\quad + \quad}{2}$$

$$=$$

5.





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

$$= \frac{\quad + \quad}{2}$$

$$=$$