

Homework 1

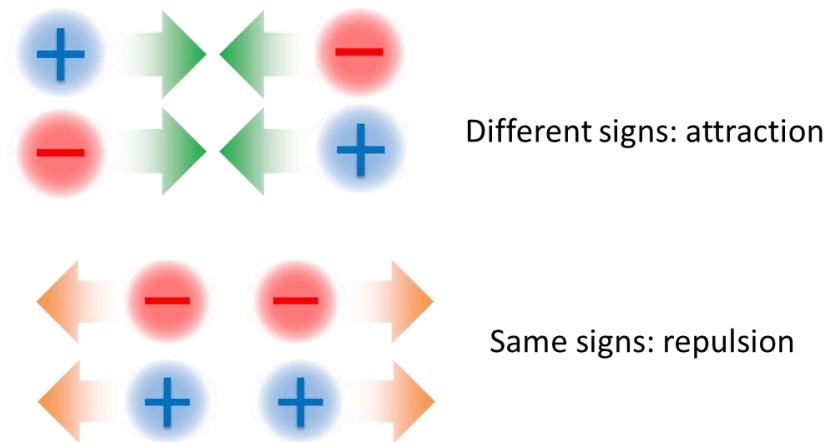
Electric charge

We started discussing electricity.

Experiment shows that certain objects being prepared by rubbing or other surface interactions become able to attract or repel each other. We will call these “electrically prepared” objects as charged objects. Typical examples of the materials which easily show electrical properties are amber / wool and glass / silk.

- It was established experimentally that there are two kinds of electrical charge. Historically they are called as “positive” and “negative” (it could have been A and B, for example...). We will also use the term “sign” to show the type of charge: “+” is the positive charge “-” is the negative one. If there are equal quantities of positive and negative charge in the object, then total net charge of the object is zero. We will call these objects “neutral”.
- Charged objects attract objects with the charge of opposite sign and repel objects which bear the charge of the same sign.

What happens with the objects after we charged them by rubbing? It is natural to assume that some small particles which carry the electrical charge are transferred from one object to another. Later we will talk a lot about these particles. Now we can ask: what makes these particles charged? What is the charge?



Charge unit in SI is “Coulomb” or just “C”

Figure 1. Interaction of point charges. Point charges is small charged objects. “Small” means that size of the objects is much less than the distance between them

I believe that the best way to think about charge is as of *property* of matter. This property is closely related to the symmetry. Like there are “right” and “left”, there are “positive” and “negative” charges.

- Another important property of the charge is its conservation. There is not possible to create an isolated, say, positive charge like there is not possible to create an object with only left side. By rubbing the objects or doing other work to charge objects we can only *separate* the charges.

Please answer for the following questions:

1. How the charge can be transferred from one object to another?
2. If we rub a glass rod with a silk cloth, the rod will charge. Does it mean that we have created electric charge?
3. Design a simple device or suggest a way to detect the presence of electrical charge.
4. A glass rod being rubbed with a silk cloth is charged positively. How we can use such a rod to determine the type of charge of a charged object?
5. Why do we have to perform work to separate the charges?
6. Would it be correct to say that there are two types of charge: “attractive” and “repulsive”?