

PART II

Electronic Phenomena

Introduction

All physical phenomena in which electrons are directly or indirectly involved can in principle be divided into the following four groups.

1. Charging phenomena

Here a *displacement* of charge is produced by the supply of energy to matter, which is normally electrically neutral (it shows no net “charge” to its surroundings), so that in parts of the substance there is an excess of electrons, while in other parts there is an equal deficit.

The external forces acting on matter for this purpose can be of various kinds; in other words, the energy needed for the charge displacement (which is a form of work) can be supplied in various forms.

This displacement of charge, by which the body is said to be “electrified”, causes a tendency for the body to return to the original neutral state. The tendency, or *potential*, can be temporarily prevented from “expressing itself” by the action of other forces.

However, as soon as these “repressive forces” are removed, a *discharge phenomenon* takes place, which can take different forms depending on the nature of the means by which the discharge occurs, and on the possible action of forces having an influence on the discharge.

2. Excitation phenomena

Similarly, the supply of energy in one form or another can cause the energetic equilibrium in an atom (or a molecule) to be broken, the particle in question being brought into an *excited state*, that is, a state with higher energy than normal. And since every physical system always tends to a state of lowest possible energy, here too there will be a tendency for the excess energy to be given off, which happens in the form of *electromagnetic radiation*.

3. Ionization phenomena

A molecule can also be split into two or more electrically charged atoms or groups of atoms by the supply of energy. This is known as “*ionization*”, and occurs, for example, in “electrolytic dissociation”.

Similarly, electrons can be removed from an atom in this way, so that the remainder of the atom has a positive charge (“positive ion”), or electrons can be donated to a neutral atom so that the whole acquires a negative charge (“negative ion”).

4. Emission phenomena

It is also possible that when energy is applied to a body, the electrons (and sometimes even ions) can overcome the potential barrier at the surface of the substance, and escape into space as free particles.