

## **COURSE BASICS**

**Safety Rules :** Never underrate the danger of electricity in any form even from a battery

- Avoid working on live/hot wire appliances. Disconnect or pull fuses before any operation
- Ground all electric motor and frames of portable and mobile machines
- Do not probe into any appliance with just any screw driver, use the approved type
- Do not touch electrical appliances, switches etc tucked in water
- Avoid touching/holding electric fence
- Check all wires to ensure the connections are well made

### **Generation and flow of electricity using the atomic theory**

Atoms are made of electrons moving and arranged on shells in an orderly manner with 2 in the first shell, 8 in the second..... This is similar to the solar system arrangement as explained by Rutherford theory. The metallic elements mostly have one electrons on the outer shell which makes them loose i.e. Weak binding/attractive force to the protons in the nucleus (have equal positive charges to the negatively charged electrons). When there is an external force these electrons are easily attracted by the force and lost or knocked off their orbit (resulting in inbalance in the +ve and -ve). This result in the atom becoming positively charged (ion). The electrons move in space towards the force and this drift of electron is what is known as flow of electricity. Current is measured in terms of the number of electrons moving through a point at a particular time as defined by Coloumb.

### **Conductivity and resistance to electricity**

The electrons when flowing may collide with each other or with the atoms depending on the concentration of the electrons and the ions. The collisions results in the reduction of the number of electrons passing through a particular point at a time. The extent of the

reduction in the flow is what is used as a measure of resistance to flow and vice versa for conductivity

### **Fluid flow phenomenon**

In a fluid flow, the pressure to convey water up to a higher level is often provided by a pump, or down a slope by gravity from a storage tank. This results in a flow rate through the pipe, the rate is also determined by the extent of the roughness or smoothness of the pipe which determines the resistance to flow i.e friction

Electricity flow is analogous to this as the VOLTAGE is the pressure produced from a storage device e.g. battery or a generator (pump). These constitute the force attracting or pulling the charges as explained in (a). The rate of flow of the electrons escaping from the charged ions (CURRENT) is analogous to the flow rate of water in the pipe. The friction is the resistance to flow as explained in (b)

### **Heavy machineries**

Drawing of very high current in heavy machineries at the detriment of other equipment can be prevented by the use of capacitor. Capacitors have two conductive plates separated by dielectric materials which are insulators that doesn't allow the passage of electricity. As shown below when the circuit is off, because the circuit to the capacitor is still closed, the charges are however not able to pass through the insulator but are deposited on the plates as positive and negative charges. This continues until the main circuit is on. During this period, current will flow to the machine from the battery of the main supply. In addition the charges stored are also released to complement the current drawn from the main circuit to start the equipment.