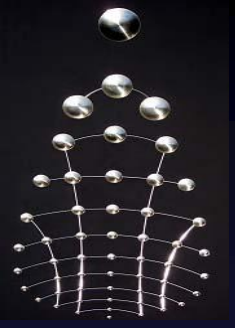
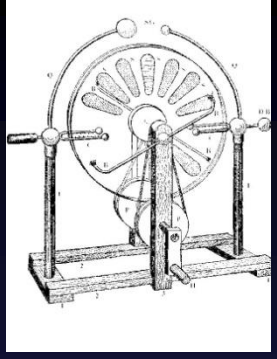


WIMSHURST MACHINE



What to do

1. Turn the crank of the machine
2. Use the white handles to change the separation between the ball terminals.

BEWARE OF SPARKS!!

How does the Wimshurst Machine work?

In conducting materials the charged particles are free to move within the material. When a charged object comes into contact with a neutral conductor, the conductor becomes polarized. Excess charges of opposite sign build up on opposite sides of the conductor. If one side of the conductor then interacts with another object, the excess charge will spread onto the second object. Only the charges on the other end of the conductor remain. The neutral conductor is now charged! This process is known as charging by induction.

Turning the crank rotates the two discs in opposite directions. Charging by induction occurs when the foil segments of opposite discs pass each other. This charge is collected at the sharp points. The brushes neutralize the charge on the segments, allowing the charging process to occur once more.

The collected charge accumulates at the ball terminals. The continuous charge collection causes the ball terminals to carry a large, equal and opposite charge. Thus, the Wimshurst Machine has used charging by induction to generate a high voltage.

How does the spark form?

One ball terminal carries a large positive charge and the other carries a large negative charge. The electric fields surrounding the terminals ionize the surrounding air. Electrons from the air are attracted to the positively charged terminal, neutralizing the positive charge. Positive ions from the air are attracted to the negatively charged terminal, neutralizing the negative charge.

The ionized air allows for a charge flow to occur. This neutralizes the charge separation created by the Wimshurst Machine.

Air emits light when the ions recombine with electrons from the terminal. This is what we see when a spark occurs.

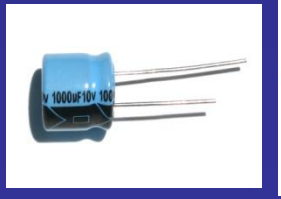
Induced charges are also the reason that lightning occurs.

Positively charged ice crystals in a storm cloud rise rapidly leaving the bottom of the cloud negatively charged. The negative charge induces a positive charge in the ground below the cloud. This ionizes the air between the ground and the cloud. The ionized air becomes superheated and explodes. When this occurs we observe lightning and hear the thunder.

What do the cylinders do?

The cylinders attached to the machine are called Leyden Jars. Leyden Jars consist of two individual metal cylinders, separated by a layer of plastic. The inside cylinder is connected to the Wimshurst Machine, and removes some of the charges collected by the sharp points. The inside cylinder becomes charged, and induces a charge in the outside cylinder. There is now a potential difference between the two cylinders, allowing the Leyden Jar to store electrical energy.

This is the energy used to power the discharge tube.



The Leyden Jar is an early example of a capacitor. Capacitors consist of two conductors, or ‘plates’, which carry equal and opposite charge. Often an insulator, a ‘dielectric’, is placed in between the plates to increase the amount of energy stored in the capacitor. The inner and outer jars of a Leyden Jar represent the plates and the plastic jar is the dielectric.

Because they can store electrical energy capacitors are used in most electrical circuits and electronic devices

Brought to you by Corridor Physics