GSC International Inc.
Phone: 417.374.7431
Fax: 417.374.7442
Toll Free: 888.756.4592
service@gosciencecrazy.com
2076 James River Court
Nixa, Missouri 65714

Neon Wand #1401

Warning:

- **Not a toy; use only in a laboratory or educational setting.**
- **California Proposition 65 Warning: This product can expose you to chemicals including lead, which are known to the State of California to cause cancer, birth defects, or other reproductive harm. For more information go to www.P65Warnings.ca.gov.**

Neon

Chemical Symbol: Ne

Atomic Weight: 20,183

Specific Gravity: 0.695

Boiling Point: -246°C

Melting Point: -248.52°C

Critical Temp: -228.7°C

Critical Pressure: 236.86 atm

Our atmosphere is one part neon to 55,000 parts air. It is colorless, odorless, tasteless, and will not burn.

Introduction

The Neon Wand is a beautiful, but simple device that demonstrates the ionizing of neon gas. When the wand is brought near a high voltage source, a bright orange glow is emitted. This fascinating device is simple to understand and also has a unique history.

The discovery of neon didn't occur until 1898 by Sir William Ramsay. Ramsay is also noted for discovering argon, helium, krypton, and xenon. All of these gases belonged to a group called "inert" gases (once thought to not combine with other elements). They are now known as "noble gases".

Neon and the other noble gases are obtained through a process known as fractional distillation. Ordinary air is cooled to about -330°F (-200°C) to liquefy it. This liquid air is then piped into a tall tower. Next, the temperature is slowly raised. When the temperature reaches that of one of the elements' boiling point, it vaporizes into a gas and is then drawn from the chamber. Because each element has a different boiling point they can be drawn off one at a time.

When electrodes are sealed in a neon filled chamber and voltage applied electrons are emitted. If there is enough voltage difference, the electrons will reach a velocity that will be high enough to ionize the neon that is closest to the negative electrode (cathode). When using a tesla coil with a sealed neon tube, the probe of the coil becomes the cathode. When ionized, the electrons will give off a reddish-orange illumination. It will glow only with a direct current present around the negative electrode. With an alternating current, the glow will alternate between electrodes. Usually the frequency is so rapid that the glow appears continuous.

There's an interesting difference between the use of a direct current an an alternating current for illumination. In direct current, the voltage can be lowered ten to fifteen volts after the illumination is started and the glow will continue. With an alternating current, the starting voltage and maintaining voltage are approximately the same.

Not all neon lights are actually neon. As we have already mentioned, neon gives off the reddish-orange color in neon lights. Argon gives off the reddish-blue color. Krypton gives off a yellow or green color. Xenon gives off a blue or blue-green color and helium gives off a white, yellow, or violet glow.

Not recommended for use with more than 75,000 volts. Place the tesla coil on the aluminum band near the tip of the neon wand for better conductivity. The probe of the coil will become the cathode.

Theory

Hold a tube filled with neon gas (or another of the various gas tubes) near the Van de Graff generator and it will glow. The gas is ionized as it passes through the electric field. The basic explanation for this is that the electricity created by the generator is flowing through the tube and exciting the gas particles. These gas particles then give off (emit) light once excited. Ionization occurs when 2 atoms collide, splitting off one or more electrons and giving off energy in the form of light. When the gas in the neon tube is subjected to high electrical stress at low pressure their atoms are excited and give off characteristic glows. Each gas will give off a different color gas depending on its identity. Neon's characteristic color output is a reddish orange glow. This experiment shows that a gas at low or reduced pressure, such as the nitrogen in the evacuated light bulb, will ionize more easily than the same gas at atmospheric pressure.

For use with a Van de Graff Generator-
Other Materials Needed:

- Van de Graff Generator
- Fluorescent light bulb (tube)
- Rubber bands
- Meter stick

Experiments

Neon Wand Lighting:

For best results, do these experiments in a darkened room or at night.
Bring your bulb toward the dome as the generator is operating. You may wish to make a non conducting holder for the light bulb to avoid receiving a shock as you approach the dome. The outside glass surface nearest the dome acquires a negative charge by induction. The charge builds up on the dome surface to discharge intensity. As discharge occurs, negative charges rush through the entire bulb, lighting it up for the duration of the discharge.

Experiment with distances between the bulb and dome. The bulb will light even when 12" away from the dome. Here, discharges will be stronger but the intervals between them will be longer. The light bulb will also glow more brightly. When you bring the bulb nearer, the discharges are more frequent but the light is dimmer. The bulb touches the dome, the light may be continuous (or flickering) but the intensity is low. Household (incandescent) bulbs will glow with the purple light. Fluorescent and other gas-filled tubes will glow with the characteristic lights of their respective gases.

Neon Bulb Probe:

Mount the neon wand on a meter stick with rubber bands. Attach the neon wand so that the end without wires is extended beyond the end of the meter stick by several inches. Attach a discharge wand (or wire) from the wired end of the neon wand to the ground at the base of the generator. As long as the person holding the meter stick stays behind the discharge wire, they should not get shocked. This allows the operator to experiment with different distances and angles of discharge safely.