

615-3175 (10-213) Neon Wand



Warranty and Parts:

We replace all missing or defective parts free of charge. All products are guaranteed free from defect for 90 days after sale, defined as 90 days after date of invoice. This guarantee does not include accident, misuse, or normal wear and tear.

Introduction:

This 24-cm long glass tube is filled with neon gas at reduced pressure. It demonstrates the ionization and excitation of different gases following the same process as a corona discharge.

When you pass the wand through a *high-frequency* or *high-voltage* field - such as the **615-3190 Wimshurst Machine**, **615-3130 Van de Graaff Generator** or the **615-3100 Van de Graaff generator** - the neon inside will glow a vivid red, which is the characteristic color of this gas.

What happens exactly? Some atoms or molecules may not receive sufficient energy for ionization. But if the amount they do receive satisfies conditions set by quantum mechanics, the energy can be released at a very few discrete frequencies.

If these frequencies are visible, you'll see a burst of light, the color of which will characterize the substance in the tube.

Safety:

The neon wand is designed to be used with high-voltage and high-frequency power supplies. Follow the manufacturer's instructions with these instruments to prevent shock or injury. Even when following proper techniques it is possible to be shocked by electricity. The neon wand is made of glass, and will break if dropped on a hard surface. Do not drop the neon wand.

Theory:

Hold a tube filled with neon gas (or another of the various gas tubes) near the Van de Graaff 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 glow 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 Graaff Generator:

Other materials needed:

- Van de Graaff generator; we suggest the **615-3130 200kV** or **615-3100 400kV Van de Graaff Generators**.
- Van de Graaff generator discharge wand (or length of wire to ground the wand to the generator base). We recommend the **Science First® 615-3115 Discharge Wand**.
- Fluorescent light bulb (tube); preferably 18 inch, 40 watts
- Incandescent Bulb
- Rubber bands
- Meter stick

Experiments:

1) 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 (see Neon Probe below). The outside glass surface nearest the dome acquires 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 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 purple light. Fluorescent and other gas-filled tubes will glow with the characteristic lights of their respective gases.

2) 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.

National Science Education Standards: Levels 5-8 Physical Sciences Standards: Properties and changes of properties in matter. Transfer of energy Levels 9-12 Physical Sciences Standards: Structure of atoms Structure and properties of matter Interactions of energy and matter	P/N 24-0213 © Science First [®] / Morris & Lee Inc. All rights reserved. Science First [®] is a registered trademark of Morris & Lee Inc.
--	---