

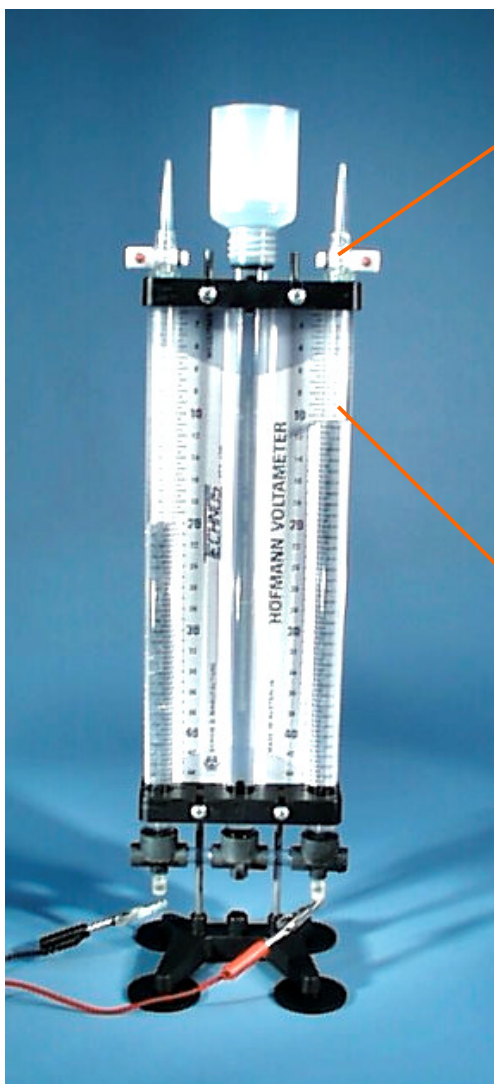
THE HOFMANN VOLTAMETER – non-glass design

Cat: GE5600-01 unique all plastic design

DESCRIPTION: The classic Hofmann Voltmeter has always been a slim, tall glass instrument that is renowned for its very fragile structure. A large proportion of Hofmann Voltmeters made throughout the world are broken somewhere in the “supply chain” from the shipper to the user in the classroom and many more are broken during use and storage in the school.

Technos & IEC have now designed a compact new model of Voltmeter that is plastic and stainless steel but it retains all the classic features of the original design. The materials are suitable for weak electrolyte that is required to make water conductive. The boldly graduated tubes for Hydrogen and Oxygen have a generous volume exceeding 40ml.

GE5600-01 The Hofmann Voltmeter



To fill the Voltmeter, open both taps and, using eye protection, carefully pour the solution into the central container so that it fills the 3x tubes right up to the white plastic plug in the tap.

Turn off both taps and continue to fill the container for another centimetre or two. Remember that as the gases are formed, the displaced water will begin to fill the central container. It must not overflow.

The two gas taps using PTFE plugs provide excellent sealing for gases. The slim outlet fittings enter into the mouths of test tubes for the collection of gases.

A solution of about 5% to 7% sulphuric acid makes a good electrolyte for the experiment. It conducts electric current so that when 6 to 12V.DC. is applied, the gases are created quickly. Total volume is about 150 ml.

The Voltmeter is not made from glass therefore it is much safer and easier to use in the classroom and much safer and easier to store. All components of the Voltmeter are available as spare parts.

Physical: 140 x 520 mm WxH

Weight: 0.58 kg.

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If platinum electrodes are to be stored, they are easily removed by hand from under each tube.

The platinum electrodes have a very long life and will not corrode. The Hydrogen appears over the negative electrode while Oxygen appears over the positive electrode. The volume of Hydrogen is double the volume of Oxygen. (ref H₂O)

The system is drained by removing a small plug in the bottom of the central tube. After draining, rinse out any residual acid with clean tap water.

INSTRUCTIONS FOR USE:

MAKING YOUR ELECTROLYTE:

Pure water is a very good insulator and electricity cannot flow through it. Normal tap water contains dissolved gases and minerals which make it slightly conductive but it is not sufficiently conductive for a Voltmeter. To increase the conductivity we must create an "electrolyte". This can be achieved in several ways, but it is important that unwanted gases are not created while we are splitting water into Hydrogen and Oxygen. One of the better ways is to add sulphuric acid to the water to make a 5% to 7% solution.

Note: when diluting acids, always add the acid to the water and never add the water to the acid.

Take a 500ml or 1000ml beaker containing say 200ml of normal tap water. To this water, while wearing eye protection, add about 14ml of concentrated sulphuric acid to make a weak acid solution so that it can conduct electric current.

FILLING THE VOLTAMETER:

On the Voltmeter, while using eye protection, carefully and gently pour the weak acid solution into the container fitted to the central tube. Open the two taps on the top of the outer tubes so that air can escape as the outer tubes fill. Be careful to stop filling JUST as the solution reaches the white PTFE plugs in the taps at the top of the tubes.

Continue to add just a few centimetres in the container, but leave plenty of volume for the level to rise in the container as the gases are generated and displace the water in the tubes.

Using alligator clips, connect 12V.DC. to the exposed stainless steel electrode wires. Current will flow and bubbles of gas will be seen coming from the top of each electrode.

TESTING THE GASES: always use eye protection.

REMOVE THE GASES:: When say 20 to 30ml of Hydrogen and 10 to 15ml of Oxygen has been created from the water, turn off the electric current. Invert a test tube over the hydrogen tap and partially open the tap. As the water rises, the hydrogen will enter the test tube but CLOSE THE TAP BEFORE THE WEAK ACID SQUIRTS FROM THE OUTLET.

The very light hydrogen will rise to the high point of the test tube and air will be displaced.

TEST FOR HYDROGEN:: Light a match and invert the test tube so that the hydrogen can escape to the flame. A small "POP" will occur as the hydrogen and air mixture explodes. After the 'explosion', see the water droplets inside the test tube and feel the heat that the small explosion generated. Discuss these events.

TEST FOR OXYGEN:: Repeat the above to obtain a test tube of Oxygen. Retain in the test tube by placing your thumb over the mouth of the test tube. Light a splinter and shake out the flame so it is slightly glowing. Plunge it into the test tube full of oxygen and see the splinter burn brightly. Discuss this event.

GENERAL SAFETY:

The electrolyte solution is a weak acid, nevertheless caution must be taken at all times.

- Always wear eye protection against splashing.
- Take extreme caution when handling the concentrated acid prior to diluting. Use protective clothing and gloves as recommended in general chemical safety precautions. It is preferred that large containers are avoided and that a small 500ml container of the acid be stored for the occasional making of the 7% solution.
- After an experiment, the solution from the Voltameter can be drained into a plastic bottle for later re-use. Classroom storage of the 7% solution is much safer than storing concentrated acid.
- If the acid solution appears on fingers or any other part of the body, rinse immediately with clean water.
- If the acid solution appears on clothing, sponge with clean water to dilute the acid to a harmless level.
- When lighting the hydrogen gas, a small explosion will occur with a 'pop' sound. Do not have the test tube close to face or eyes at the time of lighting. The tube must be kept inverted or held sealed with the thumb. Just before lighting, hold the tube upright and remove the thumb. If held upright without lighting for a few seconds, all the hydrogen gas will be lost.

Designed and manufactured in Australia