

# VPAL ADVANCED VACUUM TRAINER

The VPAL-A is an integrated and expandable vacuum teaching system that is intended primarily for technical college and undergraduate level use. This system can be used to provide a sound understanding of vacuum physics as well as to demonstrate practical applications of vacuum in industry.

The standard package comes with a manifold with inlet leak and isolation valves, Bourdon (dial) and wide-range Pirani gauges, a plastic chamber with electrical feedthroughs, a borosilicate glass chamber for low pressure and plasma exercises, 6 cfm 2-stage mechanical pump and full documentation. Optional accessory kits currently include Vernier brand data logging hardware and software for data capture, a 50 sccm mass flow controller and a complete package of equipment for plasma and DC sputtering exercises. All critical components are industrial quality.

The precision wide range Pirani absolute scale transducer has two electrical outputs: a scaled analog voltage output and an RS232 interface. The analog output of the gauge may be monitored with a standard digital voltmeter or it may be interfaced to a PC with a data logger for graphical display and data storage.

The system incorporates a gas inlet needle valve supplemented with precision orifices. These are used for flow exercises and enable the user to control the system pressure dynamically. The plastic base plate incorporates three electrical feedthroughs and one tubing connector. These feedthroughs may be used for powering devices placed within the chamber and for monitoring sample temperatures.

## With the VPAL Advanced Vacuum Trainer you can cover the following topics:

- ✓ Triple point of water, sublimation
- ✓ Adiabatic (evaporative) cooling
- ✓ A variety of Boyle's Law exercises
- ✓ Dynamic pressure control
- ✓ Leak detection methods (pressure rate of rise, gas selective sensor)
- ✓ Mass flow (standard condition volumetric flow and relationship to Ideal Gas and Avogadro's Laws)
- ✓ Mass flow calculations based on constant volume/variable pressure and constant pressure/variable volume)
- ✓ Flow through an orifice (sonic flow)
- ✓ Outgassing & permeation
- ✓ Freeze drying process



## Specifications

**Base pressure (typical):** 150mTorr (plastic chamber), 25 mTorr (glass chamber)

**Gauges:** 0-30 inHg atm referenced Bourdon gauge, 1 mTorr – 1000 Torr MKS MicroPirani gauge

**Valves:** Foreline bellows valve plus needle gas inlet valve

**Chamber connection fitting:** 1.375 o-ring compression fitting and KF40 flange

## ADVANCED VPAL TRAINER SYSTEM



### 46000 Advanced VPAL Trainer

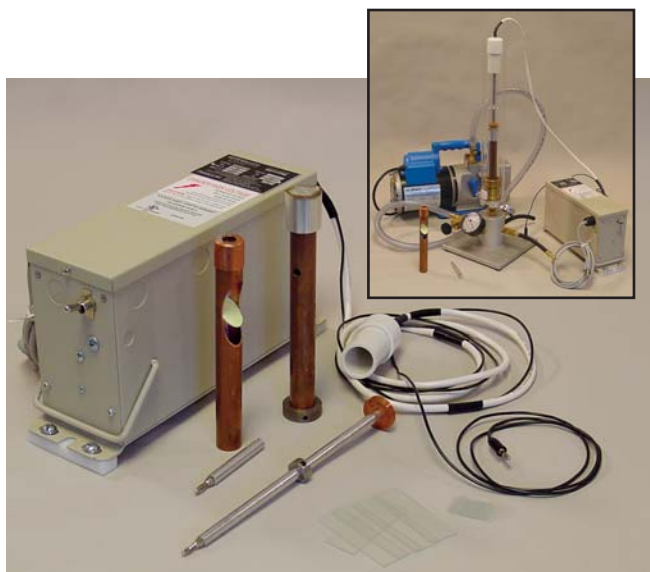
Complete basic system with pump, less supplemental accessories. Includes base manifold, MKS 925C-11 MicroPirani vacuum gauge, glass chamber with feed-through fitting and plastic safety shield, plastic Nalgene bell jar with base plate, isolation and inlet/vent (needle) valves, 20 micron and 200 micron orifices, bubble flow meter, glass thermometer, piezo buzzer, 6 CFM vacuum pump, and all hoses, clamps, and connectors.

**46000** Advanced VPAL Trainer **\$3,250.00**

### 46102

As above but without pump (we recommend at least a 3 CFM 2-stage pump with gas ballast).

**46102** **\$2,950.00**



### 46010 Plasma Topics Kit

With current limited high voltage power supply and chamber fixtures.

- Plasma & glow discharge fundamentals
  - Electron beam formation, magnetic deflection
  - Electron microscope/CRT demonstration
  - Sputtered Metals (deposit metal films on a substrate)
- Now includes Hittorf Detour Tube as part of kit.

**46010** Plasma Topics Kit **\$1,150.00**

*Other available accessories include:*

- |              |   |                 |
|--------------|---|-----------------|
| <b>46005</b> | 6 CFM, two stage, Robinair vacuum pump with fittings.   | <b>\$375.00</b> |
| <b>46040</b> | Crooke's Radiometer to demonstrate outgassing & thermal transpiration                                       | <b>\$150.00</b> |
| <b>46042</b> | Thermal conductivity and mean free path - determine the diameter of an air molecule and make a vacuum gauge | <b>\$125.00</b> |
| <b>46046</b> | Hot wire vacuum evaporation kit for the deposition of metal films   | <b>\$550.00</b> |



### 46020 Vernier Data Collection Kit

LabPro Interface, Logger Pro 3 Software, Differential Voltage Probe, SS Temperature Probe, Surface Temperature Sensor, and Gas Pressure Sensor.

**46020** Vernier Data Collection. **\$575.00**

*Available supplemental kits include the following:*

**46030** Thermal Mass Flow Controller with power supply and readout - 50 sccm full scale. **\$1,975.00**