

PHY882 – Assignment #2 – Due: Wed. Feb.08, 2012

(1) Give the standard tube diameters for the following KF-flanges:

KF-16, KF-25, KF-40, KF-50

Give the standard tube diameters for the following CFF-flanges:

2.75" CFF, 4.5" CFF, 6" CFF, 8" CFF, 10" CFF

Give the standard tube diameters for ISO-100, ISO-160, ISO-200 and ISO-250 flanges.

For all these tube diameters, list the conductance per meter length.

(2) Using a Varian (Agilent) TriScroll600 roughing pump what pressure will be obtained at the end of a 1m long standard KF-16 flanged fore-line, KF-25, and KF-40 roughing line, and what pumping speed can be obtained for roughing a large vacuum vessel using such a vacuum.

(3) For a UHV chamber different materials and surface preparation methods are available/suitable. List 3 materials suitable for UHV vacuum vessels, and different surface preparation methods. If possible find numerical values for the gas load introduced to the vacuum system per unit area from the materials.

(4) A vacuum chamber has a volume of 100 liters and an operating gas load of 10^{-4} mbar l/s. The design operating pressure is 10^{-7} mbar. Connections between the chamber, the turbo molecular pump and the fore pump meet good design practice with the value of $n' = C_p/S_p = 5$. $C_p \sim$ pipe conductance/ $S_p \sim$ pump-speed. Calculate the pumping speed at the chamber, the minimum connecting pipe conductance and the minimum turbo pump speed required to meet these performance figures. What is the system time constant for pump down?

(5) The turbo pump selected to meet the before mentioned vacuum system requirements has a speed of 360 l/s at 10^{-2} mbar and a critical backing pressure of 0.45 mbar. Determine the minimum speed required for the backing pump together with the minimum connecting pipe conductance. What pump down time will elapse before the chamber reaches 10^{-2} mbar, 10^{-4} mbar, 10^{-6} mbar?

(6) Calculate the mean and the average velocity of H_2 , N_2 , Ar, CO_2 , Kr, Xe gas molecules/atoms at standard temperature and pressure (STP). What is the mean free path of the gas constituents at STP, and at a pressure of 10^{-3} mbar and 10^{-6} mbar.

Please feel free to ask for clarification or additional specifications.

Please state the formulae used explicitly and define all variables used and reference the sources.

Please close off individual problems with a "conclusion".