THE UNIVERSITY OF HONG KONG

Department of Physics

PHYS2261 Introductory heat and thermodynamics

Laboratory report 2261-1:

Adiabatic gas law

Student Name:_________________________ Student No.:___________________________

Group No.:____________________________ Date:________________________________

Part A. Ideal Gas Law

Record the Initial height of the piston at atmospheric pressure: h_0 = ___________ cm

Mean value of nR = ___________ J/K

Standard deviation of nR = ___________ J/K

% Random error = $100 \cdot \frac{Standard\, deviation}{Mean}$ = ___________ %

Initial volume of air: $V_0 = \pi r^2 h_0 =$ ¿ ___________ cm^3

Number of moles of gas: $n = \frac{\rho_{air} V_0}{M_{air}}$ = ___________ mol

Compute your measure value of R : $R_{mean} = \frac{n R_{mean}}{n}$ = ___________ J/mol · K

Compare your measure with the generally accepted value of $R = 8.314$ J/mol · K:

% Error = $\frac{|R_{mean} - 8.314|}{8.314} \times 100$ = ___________ %

Please attach graphs of P , V , T and nR vs time.

Part B. Adiabatic Gas Law

Gas used: air

Slope of the graph of $\ln(P)$ vs $\ln(V)$ = ___________

Ratio of specific heats measured γ = ___________

Compare your measured γ with 1.40: % Error = ___________ %

Please attach graph of $\ln(P)$ vs $\ln(V)$.

Gas used: Helium / Argon (Circle the one you used)

Slope of the graph of $\ln(P)$ vs $\ln(V)$ = ____________

Ratio of specific heats measured γ = ____________

Compare your measured γ with 1.67: % Error = ____________ %

Please attach graph of $\ln(P)$ vs $\ln(V)$.

Gas used: Carbon Dioxide

Slope of the graph of $\ln(P)$ vs $\ln(V)$ = ____________

Ratio of specific heats measured γ = ____________

Compare your measured γ with 1.30: % Error = ____________ %

Please attach graph of $\ln(P)$ vs $\ln(V)$.

Part C. Work Done by an Adiabatic Process

Record the Initial height of the piston at atmospheric pressure: h_0 = ____________ cm

Record the area under the P vs V curve: Area = $W_{experimental}$ = ____________ J

Record the minimum and maximum temperature and compute the change in temperature:

T_{min} = ____________ K T_{max} = ____________ K ΔT = ____________ K

Initial volume of air: $V_0 = \pi r^2 h_0 = ¿$ ____________ cm³

Number of moles of gas: $n = \frac{\rho_{air} V_0}{M_{air}}$ = ____________ mol

Compute the change in internal energy of the air: $\Delta U = \frac{5}{2} nR\Delta T$ = ____________ J

Compare the change in internal energy with the area under the P vs V curve:

% Difference = $\frac{|\Delta U - area|}{area} \times 100$ = ____________ %

Theoretical prediction of work done:

Initial Volume V_i = ____________ m³ Final Volume V_f = ____________ m³

Initial Pressure P_i = ____________ Pa Compression ratio r = ____________

Theoretical work done ($\gamma = 1.40$) = $W_{theoretical}$ = ____________ J

Compare the area under the curve with the theoretical prediction:

% Difference = $\frac{|W_{experimental} - W_{theoretical}|}{W_{theoretical}} \times 100$ = ____________ %

Please attach graphs of P, V, T vs time and P vs V.