Physics 2020
Spring 2007
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COVER SHEET - EXAM 1

SEAT #

DATA:

1 kJ = 10^3 J
k = 1.38×10^{-23} J/K
$\log_{10} A^x = x \log_{10} A$
$\log_{10} A/B = \log_{10} A - \log_{10} B$

R = 8.31 J/mol·K
$N_A = 6.022 \times 10^{23}$ particles/mole
$\log_{10} AB = \log_{10} A + \log_{10} B$
If $y = \log_{10} N$, $N = 10^y$

EQUATIONS:

$$T(K) = T(^\circ C) + 273$$

$$PV = NkT$$

$$PV = nRT$$

$$n = \frac{N}{N_A} = \frac{m}{M}$$

$$\Delta U = \frac{3}{2} nR\Delta T \quad \text{(ideal monatomic gas)}$$

First Law of Thermodynamics

$$\Delta U = Q - W$$

Processes

(a) Isochoric: $W = 0$

(b) Isothermal: $W = nRT\,\ell n \frac{V_2}{V_1}$

(c) Isobaric: $W = P(V_2 - V_1)$

(d) Adiabatic (monatomic ideal gas):

$$W = \frac{3}{2} nR(T_1 - T_2)$$

Heat Engine Efficiency

$$e_{actual} = \frac{W_{net}}{Q_{added}}$$

$$e_{Carnot} = 1 - \frac{T_C}{T_H}$$

$$COP = \frac{Q_{out}}{W_{NET}}$$

Carnot Cycle

$$\frac{Q_H}{Q_C} = \frac{T_H}{T_C}$$

$$v = \lambda f = \frac{\lambda}{T}$$

$$f = \frac{1}{T}$$

$$v_{string} = \sqrt{\frac{T}{\rho}}$$

$$\rho = \frac{m}{L}$$

Sound

$$v_{gas} = \sqrt{\frac{\gamma kT}{m}} = \sqrt{\frac{\gamma P}{\rho}}$$

For spherically uniform (isotropic) sound radiation

$$I_{AV} = \frac{P_{AV}}{4\pi r^2}$$

$$d\beta = 10 \log_{10} \frac{I}{I_o}$$

or comparing one sound of intensity I_1 to another of intensity I_2

$$d\beta = 10 \log_{10} \frac{I_1}{I_2}$$

where

$$I_o = 1.0 \times 10^{-12} W / m^2$$

Doppler Effect

$$f_o = f_s \left(\frac{v \pm v_o}{v \mp v_s} \right)$$