

Problem 1

R_uni 1545 ft-lbf/lbmole-R
 8314 J/kmole-K
T 77 F
1 32.17 lbm-ft/lbf-sec^2

$$c = (k \cdot R_{\text{spec}} \cdot \text{conv} \cdot T)^{0.5}$$

	k	MM (lbm/lbmole)	R_spec (ft-lbf/lbm-R)	R_spec (J/kg-K)	c (ft/sec)	c(m/s)
air	1.40	28.97	53.33	286.99	1135	346
N2	1.40	28.01	55.16	296.82	1155	352
O2	1.40	32.00	48.28	259.81	1080	329
CO2	1.30	44.01	35.11	188.91	888	271
CO	1.40	28.01	55.16	296.82	1155	352
H2	1.40	2.02	765.61	4119.92	4302	1311
He	1.67	4.00	385.96	2076.94	3336	1017
H2O	1.33	18.02	85.74	461.38	1403	428

R value is worth 2 points

velocity is 4 for each

Problem 2

To **73 F**

532.7 R

cp 0.24 Btu/lbm-F

 1 32.17 lbm-ft/lbf-sec²

 1 778 lbf-ft/Btu

$$T_o = T_1 + V_1^2/2c_p$$

V1 367 ft/sec

$$T_1 = T_o - V_1^2/(2*0.24*32.17*778)$$

$$M_1 = V_1/(1.4*53.33*32.17*T_1)^{0.6}$$

T1 **521.49 R**

61.79 F

M1 **0.328**

c **1119.174 ft/sec**

*** Note that we use T1 and NOT To**

Wrong sonic temperature -3

Units on the Mach number -1

Problem 3

To 540 R
cp 0.24 Btu/lbm-R
 1 32.17 lbm-ft/lbf-sec²
 1 778 ft-lbf/Btu

The largest velocity would be at absolute 0

$$V = (To * 2cp * 32.17 * 778)^{0.5}$$

Vmax 2547 ft/sec
 776 m/sec