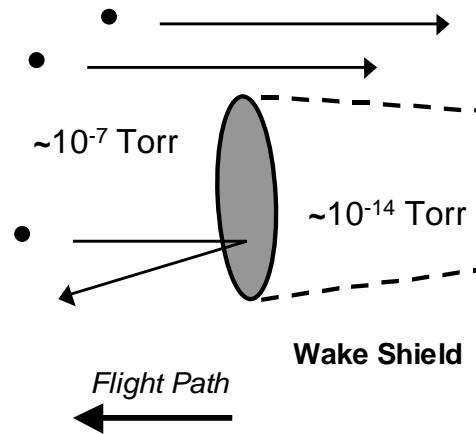


# Problem #1

Use the 1976 U. S. Standard Atmosphere (neutrals) data supplied to derive the 7 order of magnitude wake of a spacecraft orbiting at an altitude of approximately 200 nautical miles.



1976 U. S. STANDARD ATMOSPHERE (Neutrals)

Altitude (kilometers)	250	300	350	400	450	500
Altitude (nautical miles)	135	162	189	216	243	270
Orbital Speed (km/sec)	7.755	7.726	7.697	7.669	7.64	7.613
Kinetic Temperature (°K)	941.33	976.01	990.06	995.83	998.22	999.24
Kinetic Temperature (°C)	668.18	702.86	716.91	722.68	725.07	726.09
Molecular Scale Temperature (°K)	1420.8	1594.8	1713.5	1804.5	1869.3	2019.7
Pressure (Torr)	1.86E-07	6.58E-08	2.59E-08	1.09E-08	4.84E-09	2.27E-09
Density (kg/m <sup>3</sup> )	6.07E-11	1.92E-11	7.01E-12	2.80E-12	1.18E-12	5.22E-13
g (m/sec <sup>2</sup> )	9.0785	8.9427	8.8098	8.6799	8.5529	8.4286
Total Number Density (/m <sup>3</sup> )	1.91E+15	6.51E+14	2.52E+14	1.51E+14	4.68E+13	2.19E+13
Particle Speed (m/sec)	1019.1	1079.7	1119.2	1148.5	1177.4	1215
Collision Frequency (/sec)	1.1	0.42	0.17	0.072	0.033	0.016
Mean Free Path (m)	8.90E+02	2.60E+03	6.70E+03	1.60E+04	3.60E+04	7.70E+04
Molecular Weight (g/mole)	19.19	17.73	16.74	15.98	15.25	14.33
Number Density...N <sub>2</sub> (/m <sup>3</sup> )	4.83E+14	9.59E+13	2.07E+13	4.67E+12	1.09E+12	2.59E+11
O (/m <sup>3</sup> )	1.39E+15	5.43E+14	2.25E+14	9.58E+13	4.16E+13	1.84E+13
O <sub>2</sub> (/m <sup>3</sup> )	2.48E+13	3.94E+12	6.85E+11	1.25E+11	2.37E+10	4.61E+09
He (/m <sup>3</sup> )	9.69E+12	7.57E+12	6.04E+12	4.87E+12	3.95E+12	3.22E+12
H (/m <sup>3</sup> )	1.21E+11	1.05E+11	9.59E+10	8.96E+10	8.45E+10	8.00E+10
Other (/m <sup>3</sup> )	1.55E+11	1.59E+10	1.77E+09	2.12E+08	2.66E+07	3.45E+06

# Beer Can Problem

*(Also known as the “Not Newton Problem”)*

A physicist is sitting under a tree enjoying a cold beer when she notices that there are no level surfaces on which the set can. Realizing that when the can is full, the center-of-mass is located along the axis of the can at its mid-point, and the same is true when the can is empty, she can minimize the risk of spilling any beer by drinking just enough to minimize the height of the CM.

Without using calculus, determine how much beer she should drink before putting down the can.

Send requests for clarifications (and useful hints) and proposed solutions to:

[msterling@uh.edu](mailto:msterling@uh.edu)

Check this space regularly for updates.