Useful Links

Link Good general discussion on thermal escape of gas from a planet

Link Interesting Quora post that got me thinking about the subject

Link NASA table of planet data

Units

$AU := 1.49597870700 \cdot 10^{8} \cdot km$ Astronomical Unit

$L_{\odot} := 3.846 \cdot 10^{26} W$ Luminosity of the Sun

$D_{\odot} := 864575.9 mi$ Diameter of the Sun

Constants

$k_b := 1.3806505 \cdot 10^{-23} \cdot \frac{joule}{K}$ Boltzmann's constant

$N_A := 6.0221415 \cdot 10^{23} \cdot mole^{-1}$ Avogadro's Number

$G_U := 6.6742 \cdot 10^{-11} \cdot \frac{m^3}{kg \cdot sec^2}$ Universal Gravitational Constant

$\sigma := 5.670400 \cdot 10^{-8} \cdot \frac{watt}{m^2 \cdot K^4}$ Steffan-Boltzmann's Constant

$R_G := 8.314472 \cdot \frac{joule}{mole \cdot K}$ Universal Gas Constant

Analysis

Planetary Data

$M_P :=$

	Name 0	Mass 1	Diameter 2	Escape Velocity 3	Solar Distance 4	Surface Temp 5
0	"Mercury"	0.33	$4.879 \cdot 10^3$	4.3	57.9	440.15
1	"Venus"	4.87	$1.21 \cdot 10^4$	10.4	108.2	315
2	"Earth"	5.97	$1.276 \cdot 10^4$	11.2	149.6	...

$Name := M_P^{\langle 0 \rangle}$ $\quad M := M_P^{\langle 1 \rangle} \cdot 10^{24} \cdot kg$ $\quad T_s := M_P^{\langle 4 \rangle} \cdot K$

$R_P := \frac{M_P^{\langle 2 \rangle}}{2} \cdot km$ $\quad V_e := M_P^{\langle 3 \rangle} \cdot \frac{km}{s}$ $\quad r := M_P^{\langle 5 \rangle} \cdot 10^6 \cdot km$

Escape Velocity

$$v_{Escape}(M, R) := \sqrt{\frac{2 \cdot G_U \cdot M}{R}}$$

$$v_e := Round\left(v_{Escape}(M, R_P), 0.01 \frac{km}{s}\right) = \begin{array}{c|c} & 0 \\ \hline 0 & 4.25 \\ 1 & 10.36 \\ 2 & 11.18 \\ 3 & 2.37 \\ 4 & ... \end{array} \cdot \frac{km}{s}$$

$$\max\left(\left|\frac{V_e - v_e}{V_e}\right|\right) = 2.38294 \cdot \%$$

Reasonable level of error

Exobase Temperature

$$(T_{Mercury}\ T_{Venus}\ T_{Earth}\ T_{Moon}\ T_{Mars}\ T_{Jupiter}\ T_{Saturn}\ T_{Uranus}\ T_{Neptune}\ T_{Pluto}) := (441\ 295\ 1000\ 295\ 250\ 1100\ 800\ 750\ 750\ 58) \cdot K$$

$$T_{exo} := (T_{Mercury}\ T_{Venus}\ T_{Earth}\ T_{Moon}\ T_{Mars}\ T_{Jupiter}\ T_{Saturn}\ T_{Uranus}\ T_{Neptune}\ T_{Pluto})^T$$

Graphical View

$T_1 := 40K, 41K .. 2000K \qquad f(T, MW) := \sqrt{\frac{8 \cdot R_G \cdot T}{\pi \cdot MW}}$