

Star Properties

Equations are ideal for stars 0.18-1.2 solar masses and planets >0.01 Earth m

	System age (billion years)		0.0015	
	Primary		Secondary	
Star Mass (sun masses)		13.63		
	calculated	override	calculated	override
Effective Temperature (K)	#NUM!		0	
Luminosity (ratio to sun)	-10293.692		0	-3.9116E+30
Radius (sun radii)	6.4056668		0	-3.59202E-05
(equations assume P-type planets and negligible binary separation)				9.0319E-09
Peak wavelength of light (nm)	#NUM!		#DIV/0!	-3977.036298
Bolometric (0) or Visual (1) magnitudes?				
Bolometric Correction (rough)	#NUM!		#NUM!	-21.75322852
Absolute Magnitude	#NUM!	#NUM!	#NUM!	#NUM!
Combined Luminosity			-10293.7	-10293.69
Combined Absolute Magnitude			#NUM!	#NUM!

System Boundaries

	Semimajor axis (AU)	Period (days)
Roche limit (Earth)	0.0172059	0.223278
Rockline (rough)	#NUM!	#NUM!
Low-humidity extreme hab limit (rough)	#NUM!	#NUM!
Slow-rotating hab limit	#NUM!	#NUM!
Optimistic hab inner limit	#NUM!	#NUM!
Conservative hab inner limit	#NUM!	#NUM!
Conservative hab outer limit	#NUM!	#NUM!
Optimistic hab outer limit	#NUM!	#NUM!
50% H2 hab limit	#NUM!	#NUM!
100 bar H2 hab limit (rough)	#NUM!	#NUM!
Tidal-locking radius (12 hour initial)	0.283527	14.93558
Early iceline (rough)	#NUM!	#NUM!
CO2 required for 273 K surface temp		
0.01 bar CO2	#NUM!	#NUM!
0.1 bar CO2	#NUM!	#NUM!
1 bar CO2	#NUM!	#NUM!
CO2 bars at conservative outer limit (rough)	#NUM!	

Quick Calculators

Jupiter mass to Earth mass	Sun mass to Earth mass	Period ratio to semimajor r
Jupiter masses	Sun masses	Period ratio

Earth masses		0	Earth masses		0	Semimajor axis ratio
Average gas molar mass					total/ average	Smaller SMA
Gas 1	Gas 2	Gas 3	Gas 4			Larger SMA
% volume					0	Planet apparent magnitude
mol mass					0	Absolute magnitude
Tidal-locking time						Star-planet distance (AU)
SMA (A	1					Observer-planet dist. (AU)
initial d	12					Phase angle (°)
(hours)					#DIV/0!	Apparent magnitude
Time to	2.88876963					Equivalent irradiance to solar system
lock (byr)						Distance from star (AU)
						Equivalent distance in sol (AU)

Sources:

Optimistic/Conservative Hab Zones

<https://iopscience.iop.org/article/10.1088/0004-637X/777/2/166/meta>

Low-humidity extreme hab limit

<https://iopscience.iop.org/article/10.1088/0004-637X/778/2/109/meta#apj485301t1>

slow-rotating inner hab limit

<https://iopscience.iop.org/article/10.1088/2041-8205/787/1/L2/meta>

50% H2 hab limit

<https://arxiv.org/abs/1702.08618>

100 bar H2 hab limit

<https://arxiv.org/abs/1105.0021>

effective thermal distance for eccentric planets (for equilibrium temp)

<https://arxiv.org/pdf/1702.07314.pdf>

Mass-radius for planets of specified composition

<https://arxiv.org/pdf/astro-ph/0612671.pdf>

Mass-radius for planets of unspecified composition

<https://iopscience.iop.org/article/10.3847/1538-4357/834/1/17/meta#apjaa4b8cs3>

Star mass-radius and mass-temperature

<https://academic.oup.com/mnras/article/479/4/5491/5056185#119170698>

Bolometric correction factor

<https://arxiv.org/pdf/1008.3913.pdf>

Tidal-locking radius

<https://www.sciencedirect.com/science/article/pii/S0019103583710109>

SMA for given CO2 levels

<https://iopscience.iop.org/article/10.3847/1538-4357/ab1d52>

Blackbody radiation color

<http://www.vendian.org/mncharity/dir3/blackbody/>

Surface Temperature from CO2 partial pressure

<https://www.nature.com/articles/s41467-020-19896-2#Sec7>

(See heat model page for heat model sources and method)

Miscellaneous other equations pulled from wikipedia

asses

Planet Properties

(see notes and caveats under each column)

[illegible]

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0.32 for Earth

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"0" for tidal-
locked;
negative for
retrograde

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red-highlight means
orbit likely unstable
(unless in resonance)

adjusted for .0004 for
tidal-locked Earth
planets to
show dayside
temp, but not
other slow
rotators;
somewhat
accounts for
eccentricity

good for
sunlike stars, SMA, not
iffy
otherwise
surface
temp

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these do not account for eccentricity or atmosphere

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Does not use
bolometric
correction

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valid only for solid planets

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doesn't account for
equatorial bulge
(which is 7 km for
Earth)

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roughly 100 km 1.8 m high
on Earth observer