Chapter

Star System Generation

Insert interesting quote here.

-From Someone

This chapter introduces a system that can be used to randomly generate star systems. Referees can use this to create interesting environments for when the players undoubtedly end up lost in space or stopping for fuel at an unexplored star system (yes, hydrogen scoops are designed to be plot devices).

To simplify their comparative analysis of knows space, scientists in the frontier have developed various galactic standards. They based these standards on one of the star systems of one of the habitable planets in the setting (either one that was deemed typical or one that was deemed ideal, for one reason or another). For instance, a galactic standard star mass of 2.5 is two and a half times the mass of whatever the galactic standard is for mass. For ease of reader understanding, all of these standards are based off our sun and earth, as represented below:

Galactic Standard Units of Measure

Galactic Standard	Equals
1.0 Stellar Mass	1.98892 × 10^{30} kilograms
1.0 Stellar Luminosity	3.75×10^{28} lumens, or 3.846x10^{26} watts
1.0 Stellar Diameter	1,391,000 kilometers
1.0 Astronomical Unit	149,598,000 kilometers
1.0 Planetary Mass	5.9742 × 10^{24} kilograms
1.0 Planetary Diameter	12,756.2 kilometers
1.0 Planetary Gravity	9.81 m/s^2, also called 1.0g

Normally, the galactic standard value is good enough for illustrative purposes. But giving handouts to the players that consist of real-world physical units can help provide atmosphere to the players, as long as you're not overloading them with data. Feel free to multiply your galactic standard values by these constants to provide such detail.

Glossary of Terms

In case you are not familiar with some of the terms, read this section. If you are already familiar with these, you can skip this section and continue on to Step 1.

Astronomical Unit – this represents a distance in space, the average distance from the star to the habitable planet on the galactic standard star system in the setting. Refer to the galactic standards table for a numeric definition.

FTL Drive – Faster-Than-Light engine that propels ships at incredible speeds, anywhere from 0.5 LY per day and higher. Few ships have drives which allow the ship to exceed 4 LY per day. An FTL Drive extends a field around the ship to induce this travel velocity, but cannot do so until outside various influences of a star's neighborhood.

FTL Horizon – this refers to the minimum distance from any given star where the FTL Drive can manifest its field. Any closer than this and the field fails to manifest. It just fizzles and fails. The FTL Horizon is noted as being at the outer extreme of the stars habitable zone (the same influences which allow the zone to be able to support life interfere with the field's manifestation, one reason why all races take so long to discover the FTL field effect).

Gravity Well – this represents a gravitational influence around a planet or star. An object or ship caught in gravity well will descend towards the object unless another force (like thrust) reacts against it. Larger, more massive objects in space have more impressive gravity wells. In space, a gravity well can be strong enough around certain types of stellar objects (such as stars or black holes) to cause objects to be pulled off course (even light particles!)

Light Year – a light-year (LY) is the distance that light travels in a vacuum in one Galactic year. It is not a measure of time but space. About 63,241 AU's

Orbital Zone – Although a star can have many objects in orbit, and those orbits follow no actual rules of relational position, for purposes of scientific classification astrophysicists of the frontier have identified ten basic orbital zones. They are like highway paths around a star. Some are empty while others contain objects such as planets or asteroid belts. Orbital zone numbers are only used to populate a star system and thereafter are unused. Orbital zones and Regions are not scientifically determined and are a construct of this game.

Region – The orbital zones are broken down into five types of areas. Near (the closest orbital zone to a star), Inner (the second zone), Habitable (the third zone – though not all habitable zones contain or support life), Outer (the three zones beyond the habitable zone) and Far (all zones beyond this). These represent different distances from a star, and affect the conditions found on any object in that zone. Orbital zones and Regions are not scientifically determined and are a construct of this generation system.

The Near region, for instance, is bombarded with so much heat and radiation from the system's star that it will never support life. Similarly, anything in the star's Far region suffers from the frigid conditions of being so far away from the star.

Although the orbital zones have numbers, after the star system is generated the numbers are no longer needed and a planet's position is known only by its region.

Stellar Mass – is a standard way to express mass in astronomy, used to describe the masses of other stars, galaxies and planets. The mass of a star determines a great deal about it, including the positioning and distances of the ten orbital zones and their named regions.

Star Type – Also calls "class" this is an alpha-numeric code that represent the star's relative size, mass, temperature, brightness and coloring. The classification of a star is based on its spectral characteristics. Stars are classified using the spectrum letters O, B, A, F, G, K and M. O-type stars are very large hot stars while on the opposite end of the spectrum there are M-type stars which are much smaller and cooler.

Stars of different classes have specific apparent colors, and many use these colors in place of the star type in common speech. The apparent spectral color for each star type is listed below.

» O=bright-blue
» B=light-blue
» A=white
» F= white-yellow
» G=yellow
» K=orange
» M=red

In addition to the spectrum letter, a number from 0 to 9 indicates the tenths of the range between two star classes. For example, a star classified as "A5" is five tenths between an "A0" and a "F0" while an A2 is two tenths of the full range from A0 to F0.

Additionally a luminosity class is expressed by the Roman numbers I, II, III, IV, V, and VI. Class I are generally called supergiants, Class III simply giants and class V either dwarfs or more properly main sequence stars.

For example: the spectral type "G2V" can be expressed as "a yellow star two tenths towards orange main sequence star," but may also simply be called a "yellow dwarf" in slang.

Stellar Luminosity – This is the rate at which a star or other object emits energy, usually in the form of electromagnetic radiation. In simplest terms, it represents how brightly the star's chemical process appears. Related to, but not exactly the same as, a star's magnitude.

Creating a Star System

Creating a star system using this process is very simple.

» *Step 1 – Determine Primary Star Type, page 2*
» *Step 2 – Populate the Orbital Zones, page 3*
» *Step 3 – Determine Planetary Data, page 4*
» *Step 4 – Determine FTL Horizon Distance, page 7*

While using this system, it is important to keep one thing in mind: you can cheat. Don't be a slave to the dice. If something doesn't make sense, reroll or choose a value rather than randomize.

Step 1: Determine Primary Star Type

The first step in creating a star system is determining what type of primary star is at its center. Note that this process is not scientifically accurate, but skewed to provide a result that walks a delicate line between *interesting* and *realistic*. For instance, it is improbable that any given setting will have an O- or perhaps even a B-class star. Such stars are massive affairs, and would destabilize a reasonable star map. However, the idea of a star that relies on weeks of time to travel to the FTL horizon gives interesting plot ideas.

Star Type Determination Table

STEP 1A:

d100	Star Class
01	O
02-04	B
05-08	A
09-20	F
21-35	G
36-60	K
61-00	M

STEP 1B:

Progression = 1d10, treat results of 10 as a zero.

STEP 1C:

d100	Luminosity
01-05	Ia0
06-10	Ia
11-15	Ib
16-30	II
31-45	III
46-60	IV
61-85	V
86-00	VI

Step 1D:
Put the three results together (for instance, F4IV). Look up the stellar mass, luminosity, diameter, and temperature in the appendix, page ##.

First, roll d100 to determine Star Class. Next, roll 1d10 for the progression. Then roll d100 to give a luminosity code. Finally, put those results together to form a full star classification (such as "A5VI") and then look up the star's basic information, page ##.

Example: Joshua is preparing a star system for tonight's game (his players will be stranded in this system after a spaceship mishap). He grabs his dice and begins.

He rolls 11 and notes the result of "F" as the star class of his main star. He then rolls a 1d10 for progression and gets an 8 followed by a d100 for luminosity class and gets a 52. His primary star is of type F8-IV. Referring to the appendix tables beginning on page ##, he notes the following about his star:

Class:	*F8-IV*
Mass:	*2.7*
Luminosity:	*10.5*
Diameter:	*5.7*
Temperature:	*6,280ºK*

If he wished, he could multiply 2.7 times the galactic standard value for stellar mass (that is, $2.7 \times 1.98892 \times 10^{30}$ kilograms), then repeat the same for Luminosity (in lumens) and Diameter (in kilometers). But he's in a hurry and decides the galactic standard values are sufficient for tonight's game.

ZONE POPULATION TABLE

O	B	A	F	G	K	M	Astronomical Object
--	01-05	01-10	01-15	01-15	01-35	01-50	Empty Zone
01-10	06-17	11-25	16-30	16-35	36-49	51-60	Dwarf Planetoid
11-20	18-29	26-40	31-45	36-55	50-63	61-70	Terrestrial Planet
21-30	30-40	41-50	46-60	56-70	64-75	71-80	Asteroid Belt
31-40	41-50	51-60	61-70	71-80	76-85	81-90	Jovian: Ice (If rolling for zone 1, change this result as Jovian: Gas)
41-50	51-60	61-70	71-80	81-90	86-95	91-00	Jovian: Gas
51-60	61-68	71-77	81-86	91-95	96-97	--	Companion Star (Cannot have more mass than primary star)
61-00	69-70	78-00	87-00	96-00	98-00	--	Co-Populated Zone (Roll twice, ignore Empty Zone results)

Step 2: Populate the Orbital Zones

Now that you know what kind of star is primary in your star system, you'll need to know what's in orbit around it. There are several types of orbital bodies, and only sketchy details will be provided in this system. To round out planets, refer to the Planetary Generation system in chapter #.

As has been noted, a star has ten orbital zones. These zones represent a range of distances. The range of distance for each zone is dependent on the primary star's mass as represented in the Zone Distance Table at the bottom of this page. For instance, for a star whose mass is 3.5, zone 1 represents anything between 1.9AU and 4.2AU from the star. These distances are summarized on the Zone Distance Table at the bottom of this page.

To populate the zones, roll d100 ten times (once for each zone) on the Zone Population Table shown at the top of this page and record the results. Use the column that matches the primary star in your star system. For any object you place in a zone, note the distance from the star (pick a value in the range shown in the Zone Distance Table below) and the zone's region (near, inner, habitable, outer, or far). You need not record "Empty Zone" results. After determining these, you need not keep track of zone number anymore. All that matters is the planet's distance from the star (in AU) and what region it is in.

If you roll "Co-Populated Zone" then you must roll twice and place both results in that zone. Of course, a zone can get pretty densely populated if one of those second rolls also results in "Co-Populated Zone."

If you roll "Companion Star" then you may roll another star using Step 1's tables, but you must be certain that if you roll a companion star which is more massive than the system's primary star you must roll or choose another. At the end of this chapter exists some general guidelines on how to populate star systems with more than one star.

Remember that your results can spark imaginative ideas but don't get hung up on strange results. In fact, if the randomization is frustrating you or you're in a hurry, just choose values as you wish.

Example: Joshua has a primary star of type F8-IV and rolls d100 once for each zone, using the "F" column. He records the following:

Zone	*Region*	*Roll*	*Result*	*Distance*
1	*Near*	*19*	*Dwarf*	*0.95AU*
2	*Inner*	*40*	*Terrestrial*	*3.3AU*
3	*Habitable*	*31*	*Terrestrial*	*4.2AU*
4	*Outer*	*26*	*Dwarf*	*11.8AU*
5	*Outer*	*70*	*Jovian: Ice*	*15.1AU*
6	*Outer*	*91*	*Co-Populated, roll twice:*	
			21 Dwarf	*35.5AU*
			33 Terrestrial	*55.1AU*
7	*Far*	*86*	*Companion Star*	*102.8AU*
8	*Far*	*90*	*Co-Populated, roll twice:*	
			41 Terrestrial	*155AU*
			58 Asteroid Belt	*228AU*
9	*Far*	*62*	*Jovian: Gas*	*343AU*
10	*Far*	*11*	*Empty Zone*	*--*

Joshua rolls for the star type of his Companion Star in the seventh zone using the tables in step 1. He rolls 83, 7, and 58 and writes that the companion star is of type M7-IV. It has a mass of 0.1 (which is smaller than his primary star, so it's allowed), a luminosity of 0.00194, a diameter of 0.6, and a temperature of 2,333 °K. If desired, he could roll up the objects in orbit around the M star, but he decides its mass is so small that anything in its orbit would eventually be drawn to orbit the larger primary star.

Hereafter, Joshua need not keep track of the zone number, the die roll, or the empty zone.

Already, his imagination is being filled with ideas. There is a terrestrial world located adjacent to the asteroid belt, near the companion star. He decides that world was once in orbit around the companion star and was habitable in the distant past. Long ago, however, when the companion star settled into orbit around the F-class primary star, the terrestrial planet was jarred loose and became a cold frigid world devoid of life. Nothing is left on that world but fossils and bone remnants of the creatures which once walked that world's surface. Joshua even decides that the asteroid belt is what's left of the remaining worlds of the companion star – collided into a field of loose rocks.

ZONE DISTANCE TABLE

Stellar Mass	NEAR Zone 1	INNER Zone 2	HABITABLE Zone 3	OUTER Zone 4	OUTER Zone 5	OUTER Zone 6	FAR Zone 7	FAR Zone 8	FAR Zone 9	FAR Zone 10
…0.5	0.02–0.05	0.05–0.09	0.09–0.18	0.18–0.36	0.36–0.73	0.73–1.46	1.46–2.92	2.92–5.84	5.84–11.67	11.67–23.35
0.6–1.5	0.2–0.4	0.4–0.8	0.8–1.5	1.5–3.0	3.0–6.0	6.0–12.0	12.0–24.0	24.0–48.0	48.0–96.0	96.0–192.0
1.6–3.0	0.8–1.9	1.9–3.7	3.7–7.5	7.5–14.9	14.9–29.8	29.8–59.6	59.6–119.3	119.3–238.6	238.6–477.2	477.2–954.3
3.1–5.0	1.9–4.2	4.2–8.5	8.5–17.0	17.0–33.9	33.9–67.9	67.9–135.8	135.8–271.5	271.5–543.1	543.1–1,086.1	1,086.1–2,172.2
5.1–8.0	4.4–9.9	9.9–19.8	19.8–39.7	39.7–79.4	79.4–158.8	158.8–317.5	317.5–635.1	635.1–1,270.1	1,270.1–2,540.2	2,540.2–5,080.4
8.1–12.0	9–21	21–42	42–84	84–169	169–337	337–675	675–1,350	1,350–2,699	2,699–5,398	5,398–10,797
12.1–20.0	21–48	48–96	96–192	192–384	384–768	768–1,536	1,536–3,072	3,072–6,144	6,144–12,288	12,288–24,576
20.1–36.0	57–128	128–256	256–511	511–1,022	1,022–2,045	2,045–4,090	4,090–8,180	8,180–16,359	16,359–32,719	32,719–65,438
36.1–68.0	168–378	378–755	755–1,510	1,510–3,021	3,021–6,042	6,042–12,083	12,083–24,167	24,167–48,333	48,333–96,667	96,667–193,333
68.1–132.0	527–1,186	1,186–2,372	2,372–4,743	4,743–9,487	9,487–18,974	18,974–37,947	37,947–75,895	75,895–151,789	151,789–303,579	303,579–607,157
132.1…	1,072–2,411	2,411–4,822	4,822–9,644	9,644–19,288	19,288–38,575	38,575–77,151	77,151–154,302	154,302–308,604	308,604–617,207	617,207–1,234,414

All distances in AU (Astronomical Units) from the star. Distances are not scientifically-based, but work well for the purposes of this game.

STEP 3: Determine Planetary Data

In this step you will be defining the gravity, diameter and mass of each planet. Note that mass of a planet will determine the number of moons that could potentially orbit the planet, the greater the mass the greater the likelihood the planet will have one or more moons. Additional resources tables are provided for gas giants, planets, moons and asteroids (ore, minerals, gasses, etc.).

Note: If you are creating a world that can support life make sure you refer to the Planetary Creation Chapter: Planets Capable of Supporting Life before proceeding with this step.

Asteroid Belt

These tables are used to determine the size, population density and types of asteroids found in the belt. Note that these tables are for representative purposes only. At any given point in an asteroid belt larger or smaller asteroids can exist as well as different population densities. These tables are not scientific, just cinematic.

Optionally use the Moon Size Table to define unique asteroids found in the belt. For very large asteroid consider using the Dwarf table. Use the Precious Resource Table later in this step to provide some additional detail to your asteroid belt.

Asteroid Belt Tables

1d10	Size
1-2	Tiny <500km
3-4	Small 500km-1km
5-6	Medium 1km-5km
7-8	Large 6km – 50km
9-0	Huge 1000km+

1d10	Population Density
1-2	Sparse
3-4	Light
5-6	Moderate
7-8	Dense
9-0	Very Dense

Dwarf Planetoid

These are typically smaller than terrestrial planets and therefore have a smaller gravity, diameter and mass. Sometimes, dwarf planetoids can be found as moons orbiting larger planets (especially large gas giants) and in these cases, if conditions are right, may be able to support life.

To determine the planetary characteristics of a dwarf planetoid, roll or select values for gravity and diameter, then calculate mass by multiplying gravity by the diameter squared:

Dwarf Planetoid Table

Item	Calculation	Min	Max
Gravity	d100 / 30	0.03	3.33
Diameter	6d10 x 0.01	0.06	0.60
Mass	Gravity x Diameter x Diameter	0.00012	1.20

If the Mass is 0.1 or greater, make a roll on the Moon Table later in this step. Optionally use the Precious Resource Table found later in this step to populate the planet with mineable resources.

Jovian: Ice

Ice Jovians are large planets primarily composed of water, ammonia and methane. Although they have a solid core they lack a clearly defined surface. Their proportion of hydrogen and helium is lower than gas giants due to their greater distance from the star. Note that most ice giants masses are between 10 and 100 although it's not impossible for an ice giant to have a lower or greater mass. Ice giants located in Zone 1 of a star system are called "Hot Jovians" and are always gas giants.

Ice Jovian Table

Item	Calculation	Min	Max
Gravity	(d100 x 0.05) + 0.25	0.30	5.25
Diameter	(1d10+12) /4	3.25	5.50
Mass	Gravity x Diameter x Diameter	3.17	158.81

Next roll on Jovian Composition Table. Finally roll on the Moon Table. Both of these tables are found later in this step.

Jovian: Gas

Gas giants are primarily composed of hydrogen and helium, have a solid core but lack a clearly defined surface. Jovian's located in Zone 1 of a star system are called "Hot Jovians" and are always gas giants. As a general rule gas giants have a mass of 95 or greater although it's not impossible for lower masses.

A great benefit of spaceships in this game is that they can deploy hydrogen scoops to gather hydrogen from gas jovians found in a star system. Since gas giants are somewhat abundant, and most of them have at least some level of hydrogen in their chemical reaction process, these naturally-occurring fuel sources help a thriving interstellar community.

Gas Jovian Table

Item	Calculation	Min	Max
Gravity	(d100 x 0.05) + 0.3	0.35	5.30
Diameter	(1d10+15) / 2	8.00	12.50
Mass	Gravity x Diameter x Diameter	22.40	828.12

Next roll on Jovian Composition Table. Finally roll on the Moon Table. Both of these tables are found later in this step.

Terrestrial Planet

These types of planets all have roughly the same structure: a central metallic core (mostly iron) with a surrounding silicate mantle. These planets have canyons, craters, mountains and volcanoes. Some terrestrial planets possess atmospheres cable of supporting life.

To determine the planetary characteristics of a terrestrial planet, roll or select values for gravity and diameter, then calculate mass as shown below.

Terrestrial Planet Table

Item	Calculation	Min	Max
Gravity	2d10 / 10	0.20	2.00
Diameter	(1d100+40) / 70	0.59	2.00
Mass	Gravity x Diameter x Diameter	0.07	4.00

If the Mass is 0.1 or greater, make a roll on the Moon Table later in this step. Optionally use the Precious Resource Table found later in this step to populate the planet with mineable resources.

Important: *Don't think you have to define all of this for every star system you envision. If all of your adventuring will take place on the surface of a planet, you may find that it's simplest to ignore the other planets in your system, or simply note them with a few words. Just because these tables exist, don't be intimidated. Also, if you have astrophysics training and want to give more (or more realistic) detail to your stars and planets, go ahead! These simplifications are for easy use by Referees needing fast results and don't always represent reality.*

Jovian Composition Tables

Roll on these tables (once on each) to specify the main and trace gasses present in a Jovian, as well as the makeup of its core. These tables add some variety to the Jovian concept, and are most certainly not scientific in nature (in fact, most giants will have hydrogen and helium with variances being present as trace elements).

d10	Main Gases
1	Hydrogen 90%, Helium 10%
2	Water 45%, Ammonia 15%, Methane 40%
3	Carbon dioxide 20%, Hydrogen 60%, Helium 20%
4	Hydrogen 90%, Methane 10%
5	Water 10%, Ammonia 30%, Methane 60%
6	Fluorine 33%, Methane 33%, Ammonia 33%
7	Water 20%, Ammonia 40%, Methane 40%
8	Neon 25%, Argon 75%
9	Hydrogen 80%, Helium 20%
10	Water 30%, Ammonia 30%, Methane 40%

d10	Trace Gases
1	Water, Methane, Ammonia
2	Helium, Water, Methane, Ammonia
3	Ammonia, Fluorine, Argon
4	Hydrogen deuteride
5	--
6	Water, Ethane, Hydrogen
7	Water, Ammonia
8	Water, Methane, Ethane, Ammonia, Fluorine, Hydrogen
9	Water, Methane, Ammonia
10	Hydrogen

d10	Core Makeup
1	Small core of rock and ice, surrounded by a thick layer of metallic hydrogen.
2	Solid inner core surrounded by a liquid outer core.
3	Small core consisting of a conducting liquid rotating around an iron outer core causing convection.
4	A dense lead core littered with uranium deposits and fissures that spout metallic hydrogen beyond the planet's surface.
5	Ferrous rocky chunks floating in a metallic hydrogen core causing a strong magnetic field.
6	Small iron core enriched with gold, platinum and other iron-loving elements.
7	Mostly frozen rock.
8	Large liquid magnesium core surround by a uranium crust enriched with palladium veins.
9	A single iron crystal surrounded by zinc-sulfide encasement.
10	Solid iron core mixed with nickel and trace amounts of lighter elements.

Moon Tables

Use this table to determine the natural satellites orbiting a planet. The number of moons is dependent on the mass of a planet. The greater the mass the more likely it will have one or more moons. An optional moon size table is provided to define the relative size of each moon (if you want to provide such detail).

Planetary Mass	d10	Result
0.1-0.6	1-5	--
	6-8	A single moon
	9	1d5 moons
	10	1d5 moons + Feature Table
0.7-2.5	1	--
	2-4	1d5 moons
	5	1d5 +1 moons + 20% chance of a ring
	6-7	1d5 moons + Feature Table
	8-10	1d10 moons + Feature Table
2.51-25	1-2	1d10 x 2 moons
	3-6	2d10 x 2 moons + 30% of a ring of 1d5 rings
	7-9	2d10 x 3 moons + Feature Table
	10	3d10 x 2 moons + 30% 1d5 rings + Feature Table
26-130	1-5	4d10 x 2 moons + 30% chance of 1d5 rings
	6-9	5d10 x 2 moons + 1d10 rings
	10	Feature Table + 4d10 x 2 Moon + 1d10 Ring
130+	1-5	4d10 x 2 moons + 1d10 rings
	6-9	Feature Table + 4d10 x 2 Moon + 1d10 Ring
	10	5d10 x 2 moons + 1d10 rings

Moon Size Table

d10	Result*	Gravity (min – max)	Diameter (min – max)
1-3	Tiny	d100 / 800 (negligible!)	d10 x 0.001 (0.001 – 0.010)
4-6	Small	d100 / 400 (0.0025 – 0.25)	(d10+5) x 0.01 (0.06 – 0.15)
7-8	Medium	d100 / 200 (0.005 – 0.50)	(d10+5) x 0.02 (0.12 – 0.30)
9	Large	d100 x 0.01 (0.01 – 1.00)	(d10+5) x 0.03 (0.18 – 0.45)
10	Huge	d100 x 0.02 (0.02 – 2.00)	(d10+5) x 0.04 (0.24 – 0.60)

**Note that a moon cannot be larger than the host planet.*

Also notice that a moon orbiting a planet in the habitable zone might have a chance of being habitable. Refer to the Planet Generation chapter to see the criteria for making a world habitable.

FEATURE TABLE

This table provides an imagination outlet for Referees. Feel free to create your own or ignore this table completely. Normally, it is only used when called out by the moon tables, but you might wish to roll on this table (or create your own idea) to add some interesting detail to the star system in general. This is just a tool – use it as desired.

d10	Result	
1	Alien deep-space life form	*Some unknown creature, able to live in deep-space without the need for life-support is found. It may live on a planet or a moon, and may not be hostile.*
2	Ancient Ruins	*Ruins and remnants of ancient civilization that predates current cultures by (roll 1d100x100) years. The remnants may be on a planet or moon, but might be found on an asteroid.*
3	Alien artifact	*An alien device floats in space. Possibilities are mines, ships, hulks, probe, etc. It may be rigged to detonate or repair itself, and might hold valuable information about the alien race that left it.*
4	Doomsday planet	*A large comet or rogue world passes by every (1d100x10) years. It is calculated that in (1d100x100) years, it will collide with the either the planet or its moon, either of which is disastrous for this world.*
5	Artificial moon	*The moon has been drastically altered or manufactured by unknown beings. There is a 10% chance this is a Dyson moon (a Dyson sphere has a hollow center and may be able to be entered at the poles).*
6	Ringed Moon	*The moon collided with a large meteor several thousand years ago. The debris from it has been caught by the mass of the moon and looks like a ring when viewed from the planet's surface. The debris may be of value (50% chance to roll on the precious resource table).*
7	Derelict ship	*A spacecraft in deep space. Possibilities include a ship abandoned after a pirate attack, a lost STL (slow than light) ship configured as a colony, research or probe. It may have smaller ships onboard that the characters might learn how to operate. What happened to the crew?*
8	Electromagnetic atmospheric conditions	*The planet has atmospheric reactions to the presence of one or more of its moons. As the moon streaks across the sky, the atmosphere produces aurora borealis-like light shows.*
9	Glowing Moon	*Natural photo luminescent aluminates minerals are present on one of this world's moon's surfaces. It glows in the dark rather than just reflecting light, never letting the world see complete darkness.*
10	Ancient Robot	*A previous civilization (or perhaps a lost ship from a bygone era) left a lone robot behind, which has picked up some very strange and intriguing habits.*

PRECIOUS RESOURCE TABLE

This table lists the various resources that could be found on moons, dwarf planets, terrestrial planets and asteroid belts. Roll on this table whenever you wish to specify some type of valuable mineral. Characters who have a spaceship equipped with mining rigging might be able to make some money! Of course, when something is of value, others seem to like it too…

d10	Result
1	Metal Ore (low grade)
2	Precious Metal(s)
3	Radioactive Ore
4	Metal ore (high grade)
5	Precious Gem(s)
6	Silicates (no mineral value)
7	Raw crystals
8	Minerals (high grade)
9	Metal Ore (low grade)
10	Roll twice more

Optionally you can roll d10x10 to determine how many CU's (cargo units) are present at any given site. Of course, first they must be found and time must be spent loading up (Referee's decision).

Example: Joshua has a lot of work to do. He knows he has to generate stats on a lot of planets and objects: three Dwarves located at 0.95AU, 11.8AU, and 35.5AU; four Terrestrials located at 3.3AU, 4.2AU, 55.1AU, and 155AU; a single Ice Jovian at 15.1AU, and one Gas Jovian at 343AU, not to mention an asteroid belt at 228AU. He considers ignoring all but the terrestrial world in the habitable zone, but then reconsiders.

Joshua decides to go ahead and roll it all up, just to see what he gets. He starts with the dwarf planetoids. For the first one (in the Near Region), he consults the Dwarf Planetoid Table and sees he must roll d100/30 for gravity, then 6d10x0.01 for Diameter, then calculate mass using gravity x diameter x diameter. He does this for all three dwarf planetoids. The second dwarf comes up with a mass greater than 0.1, but when Joshua rolled on the Moon Tables, he rolled a 5, which resulted in no moons.

Next, he tackles the Terrestrial planets using 2d10/10 for gravity and (1d100+40)/70 for diameter. He initially rolled a very high gravity in his habitable region, but then opted to re-roll until he got a value more appropriate for a habitable planet.

He then rolls up the two Jovians, the ice giant in the outer region and the gas giant in the far region. The ice Jovian uses (d100 x 0.05) + 0.25 for gravity and (1d10+12)/4 for diameter, while the gas Jovian uses (d100 x 0.05)+0.3 for gravity and (1d10+15)/2 for diameter. Additionally, he rolls on the Jovian Composition Tables to breathe more life into his star system.

Finally, there exists an asteroid belt located in the Far Region whose orbit averages out to 228AU. For fun, he rolls on the precious resource table and notes the results.

Region	Type	Distance	Gravity	Diameter	Mass	Moons
Near	Dwarf	0.95AU	0.27	0.33	0.029	--
Inner	Terrestrial	3.3AU	1.7	0.58	0.58	1
Habitable	Terrestrial	4.2AU	1.1	1.81	3.62	3
Outer	Dwarf	11.8AU	1.13	0.32	0.116	--
Outer	Dwarf	35.5AU	0.23	0.36	0.03	--
Outer	Terrestrial	55.1AU	1.2	1.44	2.49	--
Outer	Ice*	15.1AU	4.55	4.25	82.2	62, 5 rings
Far	Terrestrial	155AU	0.5	0.64	0.207	2
Far	Asteroid**	228AU	--	--	--	--
Far	Gas***	343AU	4.4	9.5	397.1	38, 2 rings

** Ice jovian is 45% water, 15% ammonia, 40% methane, with trace hydrogen deuteride. Its core is mostly frozen rock.*

*** Large asteroids moderately spaced. Raw crystals growing in the icy deposits in fissures of the larger asteroids. Any given asteroid might possess 1d10x10 tons of cargo for sale on open market*

*** Gas Jovian is 90% hydrogen, 10% helium, with few other trace gasses. It has a dense lead core littered with uranium deposits and fissures that spout metallic hydrogen beyond the planet's surface.*

STEP 4: Determine FTL Horizon Distance

The FTL Horizon of a star system is located a specific distance from the star. The exact location can be calculated, though for simplicity sake you can just use the first number in the range of distances in the fourth zone of your star system. Thus, to use the FTL drive, a ship must travel from wherever it is, out into the Outer Region of a star system.

> *Example: Joshua's primary star is of type F8-IV with a mass of 2.7, and looking at the Zone Distance Table, a star with that mass has a range of 7.5–14.9 for zone 4. It therefore has a FTL Horizon located at 7.5AU.*

Knowing the position of the FTL Horizon is important, but more helpful is knowing how long it will take to reach that distance from each star's planet. Of course, this only applies to any planets found in the Near, Inner, or Habitable Region since any worlds located outside of these regions are already at a safe distance from the star to initiate FTL drives.

It probably isn't necessary to detail the distance to the FTL Horizon for every single planet. There is very little reason for a spaceship to get much closer to a star than whatever planet is in the Habitable Region, though rare situations prove that statement wrong.

> *Example: Joshua's habitable planet is located at 4.2AU. That means if a ship was in orbit around that world, it would have to travel a distance of (7.5AU – 4.2AU =) 3.3AU before going FTL.*

However, it's not always so helpful to just record the distance (in AU) to the FTL Horizon. Since most ships accelerate at 1g at slower-than-light speeds (to create a simulated gravity effect within the vertically-aligned deck plans of the ship), most worlds in the frontier list their distance to the FTL Horizon in terms of time, not distance. This can be determined by doing the math for acceleration over time, converted for the sake of units to t = 48.1125*sqrt(d/a), where "t" is time (in hours) and d is distance (in AU) and acceleration is 1g. For those who despise math, use the following lookup table to determine how many hours to the FTL Horizon:

FTL Distance Table

AU	Hours	AU	Hours	AU	Hours
0.1	15.3	**14**	181.5	**350**	907.7
0.2	21.7	**16**	194.1	**400**	970.4
0.3	26.6	**18**	205.9	**450**	1029.3
0.4	30.7	**20**	217.0	**500**	1084.9
0.5	34.3	**22**	227.6	**600**	1188.5
0.6	37.6	**24**	237.7	**700**	1283.7
0.7	40.6	**26**	247.4	**800**	1372.3
0.8	43.4	**28**	256.7	**900**	1455.6
0.9	46.0	**30**	265.8	**1000**	1534.3
1.0	48.5	**40**	306.9	**1200**	1680.8
2.0	68.6	**50**	343.1	**1400**	1815.4
2.5	76.7	**60**	375.8	**1600**	1940.8
3.0	84.0	**70**	405.9	**1800**	2058.5
3.5	90.8	**80**	434.0	**2000**	2169.9
4.0	97.0	**90**	460.3	**2200**	2275.8
4.5	102.9	**100**	485.2	**2400**	2377.0
5.0	108.5	**120**	531.5	**2600**	2474.0
6.0	118.8	**140**	574.1	**2800**	2567.4
7.0	128.4	**160**	613.7	**3000**	2657.5
8.0	137.2	**180**	651.0	**3500**	2870.4
9.0	145.6	**200**	686.2	**4000**	3068.6
10	153.4	**250**	767.2		
12	168.1	**300**	840.4		

Divide large numbers by 24 to determine distant to FTL Horizon in days.

> *Example: Joshua knows his habitable world is 3.3AU from the FTL Horizon, so looking on the FTL Distance Table he knows that it should take somewhere between 84 and 90.8 hours. He arbitrarily picks 87 hours, which results in 3.6 days. He records that the habitable planet is 3.6 days from FTL Horizon. This is a bit of a long journey at sublight speed, but he likes it because it forces his adventurers to be stranded for at least this much time in tonight's game, until help can arrive!*
>
> *While he's at it, he decides the characters might take interest in the terrestrial world in the Inner zone as well, and figures the distance using the same process. FTL Horizon is at 7.5AU, planet is at 3.3AU, so the distance is (7.5 – 3.3 =) 4.2AU… which is approximately 99 hours, or 4.1 days.*

Note that it is helpful to list the FTL distance in both hours at 1g and distance, especially if you plan on sharing your star system with others. Some Referees will use variant methods for slower-than-light travel, and may need to know the distance (in AU) rather than the time. Additionally, some Referees might force players to keep track of fuel use, which in this game is done in terms of "thrust hours at 1g" for simplicity.

Multiple Star Systems

Using the process of creating a star system is fun and challenging. Sometimes, you'll end up with a companion star in one or more of the orbital zones. When this happens, some additional consideration is warranted.

It is not the intent of this system to present actual scientifically calculated results, but with a little imagination and some interesting randomizations, your star systems can be interesting and memorable to your players.

If you are uncomfortable with the complexities of adding multiple stars in your star system, simply treat any result of "Companion Star" in the Star Type Determination Table as an "Empty Zone" and move on.

It's totally up to you, as Referee, if you want to detail a complete star system for the companion star(s) you rolled. In some cases it makes sense, in others it just takes a lot of extra time away from the focus of game preparation.

Asteroid belts in one of the star systems may have been formed by collisions of worlds from both systems. Planets – once habitable – might be orbiting iceballs after its orbit expanded enough that it settled into orbit around the other star. Moons from a planet of one star system might have orbits which are far from regular – reflecting the influence imposed by the gravity well of companion stars. Use your imagination and develop some interesting systems!

Some possible configurations to consider:

- If the companion star comes up in the first zone (the Near Region), then the two stars might possibly orbit one another, with the rest of the stars orbiting around the pair. In such a configuration, simply use the orbit zone distances appropriate to the primary (more massive) star, ignoring the secondary star. Figure one shows an example of such a binary star.
- In other cases, the companion star might be out in one of the far regions. In a situation like this, consider rolling up full populations for both star systems. Then, wherever their distances would interfere with one another (whenever a zone's distances encroach on one another), assume the remainder are empty zones. This makes an effect like shown in figure 2, where we actually have two fully-generated star systems in tight orbit around one another.
- Sometimes, one star system can fit within another to form a binary star. Refer to figure 3 to see such an example.
- In all cases, consider any additional ramifications of the binary (or trinary, if there are three stars) configuration. Even though the primary star's influence is by far the most dramatic in the star system, it may result in some warming effects on worlds which are considered in the outer or even far regions of the primary star but are in fairly close proximity (at least for a portion of their stellar year) to one or more companion stars.

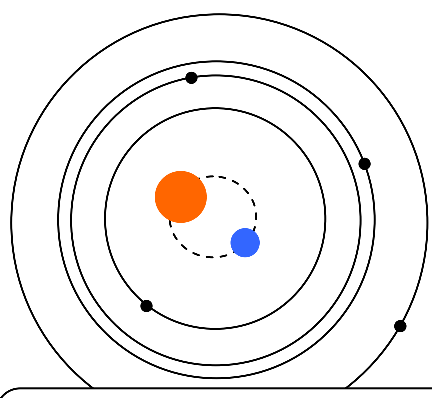

Figure 1 is a simple binary system where the stars orbit each other while the planets orbit the stars. Use the larger star to determine the orbital zone distances.

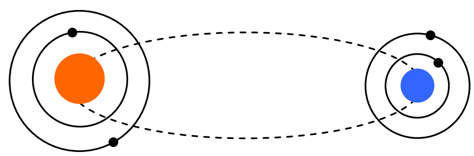

Figure 2 is also a binary system with a slightly different configuration. Each star has its own planets. The stars are far enough apart that neither stars zones interfere with its companion star.

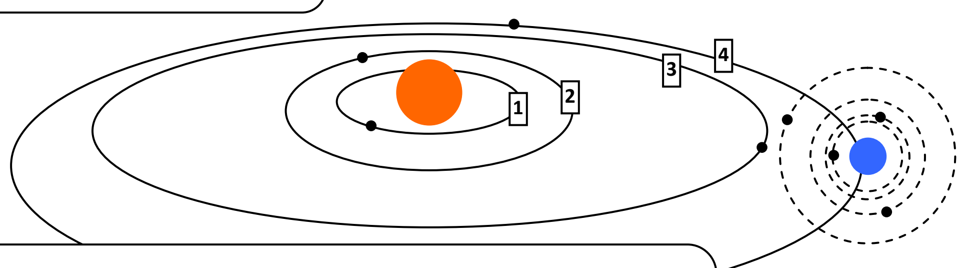

Figure 3 is a complex binary system where the smaller blue star is located in zone 4 of the larger orange star. Although the blue star has its own planets, if a zone of the blue star intersects with the orange star it becomes the zone of the orange star. For example zone 3 contains a planet that is trapped by the orange star, not the blue star.

O-Class	Mass	Luminosity	Diameter	Temperature
O0Ia0	160.0	34,100,000	160.4	50,000
O0Ia	150.0	2,590,000	44.2	50,000
O0Ib	140.0	2,150,000	40.4	50,000
O0II	130.0	2,150,000	40.4	50,000
O0III	120.0	2,150,000	40.4	50,000
O0IV	110.0	1,360,000	32.0	50,000
O0V	100.0	1,240,000	30.6	50,000
O0VI	60.0	940,000	26.6	50,000
O1Ia0	159.7	27,100,000	157.6	47,600
O1Ia	149.3	2,250,000	45.4	47,600
O1Ib	139.0	1,870,000	41.4	47,600
O1II	128.6	1,730,000	39.6	47,800
O1III	118.2	1,580,000	37.8	47,800
O1IV	107.9	1,090,000	31.4	47,800
O1V	97.5	994,000	30.0	47,800
O1VI	37.0	754,000	26.2	47,800
O2Ia0	159.4	21,400,000	155.4	45,200
O2Ia	148.6	2,140,000	49.2	45,200
O2Ib	137.9	1,620,000	42.8	45,200
O2II	127.2	1,520,000	40.6	45,600
O2III	116.5	1,260,000	37.0	45,600
O2IV	105.7	872,000	30.8	45,600
O2V	95.0	795,000	29.4	45,600
O2VI	30.0	603,000	25.6	45,600
O3Ia0	159.0	16,800,000	153.8	42,800
O3Ia	148.0	1,850,000	51.0	42,800
O3Ib	136.9	1,400,000	44.4	42,800
O3II	125.8	1,210,000	40.0	43,400
O3III	114.7	917,000	35.0	43,400
O3IV	103.6	696,000	30.4	43,400
O3V	92.5	634,000	29.0	43,400
O3VI	23.0	481,000	25.2	43,400
O4Ia0	158.7	13,200,000	152.8	40,400
O4Ia	147.3	1,740,000	55.4	40,400
O4Ib	135.8	1,200,000	46.2	40,400
O4II	124.4	960,000	39.6	41,200
O4III	112.9	728,000	34.6	41,200
O4IV	101.5	552,000	30.0	41,200
O4V	90.0	504,000	28.8	41,200
O4VI	20.0	382,000	25.0	41,200
O5Ia0	158.4	10,300,000	152.4	38,000
O5Ia	142.0	1,480,000	58.0	38,000
O5Ib	125.6	1,030,000	48.2	38,000
O5II	109.2	759,000	39.4	39,000
O5III	92.8	525,000	32.8	39,000
O5IV	76.4	437,000	29.8	39,000
O5V	60.0	398,000	28.4	39,000
O5VI	17.5	302,000	24.8	39,000
O6Ia0	136.7	7,810,000	153.2	35,400
O6Ia	120.1	1,360,000	63.8	35,400
O6Ib	103.5	781,000	48.4	35,400
O6II	86.9	654,000	41.0	36,800
O6III	70.2	376,000	31.2	36,800
O6IV	53.6	313,000	28.4	36,800
O6V	37.0	260,000	25.8	36,800
O6VI	14.2	180,000	21.6	36,800
O7Ia0	115.1	5,880,000	154.8	32,800
O7Ia	100.9	1,120,000	67.6	32,800
O7Ib	86.7	588,000	49.0	32,800
O7II	72.5	510,000	41.0	34,600
O7III	58.4	294,000	31.0	34,600
O7IV	44.2	223,000	27.0	34,600
O7V	30.0	154,000	22.6	34,600
O7VI	10.9	107,000	18.7	34,600
O8Ia0	93.4	4,370,000	157.4	30,200
O8Ia	81.7	913,000	72.0	30,200
O8Ib	69.9	437,000	49.8	30,200
O8II	58.2	360,000	39.2	32,400
O8III	46.5	207,000	29.8	32,400
O8IV	34.7	157,000	26.0	32,400
O8V	23.0	99,100	20.6	32,400
O8VI	7.6	57,000	15.6	32,400
O9Ia0	71.8	3,190,000	161.0	27,600
O9Ia	63.1	731,000	77.0	27,600
O9Ib	54.5	319,000	51.0	27,600
O9II	45.9	276,000	39.6	30,200
O9III	37.3	159,000	30.0	30,200
O9IV	28.6	110,000	25.0	30,200
O9V	20.0	57,600	18.1	30,200
O9VI	6.7	33,100	13.7	30,200

B-Class	Mass	Luminosity	Diameter	Temperature
B0Ia0	50.1	2,280,000	166.0	25,000
B0Ia	44.7	573,000	83.2	25,000
B0Ib	39.2	228,000	52.4	25,000
B0II	33.8	190,000	38.2	28,000
B0III	28.4	109,000	29.0	28,000
B0IV	22.9	75,700	24.2	28,000
B0V	17.5	36,200	16.7	28,000
B0VI	5.9	19,000	12.1	28,000
B1Ia0	45.1	2,020,000	172.4	23,790
B1Ia	40.0	507,000	86.4	23,790
B1Ib	34.8	184,000	52.0	23,790
B1II	29.7	134,000	36.6	26,190
B1III	24.5	53,400	23.2	26,190
B1IV	19.4	37,000	19.3	26,190
B1V	14.2	19,400	13.9	26,190
B1VI	5.2	10,200	10.1	26,190
B2Ia0	40.1	1,620,000	171.4	22,580
B2Ia	35.2	446,000	90.0	22,580
B2Ib	30.4	162,000	54.2	22,580
B2II	25.5	93,600	35.4	24,380
B2III	20.6	28,300	19.4	24,380
B2IV	15.8	19,600	16.2	24,380
B2V	10.9	9,360	11.2	24,380
B2VI	4.5	5,390	8.5	24,380
B3Ia0	35.1	1,420,000	179.0	21,370
B3Ia	30.5	428,000	98.4	21,370
B3Ib	25.9	129,000	54.0	21,370
B3II	21.4	64,500	34.2	22,570
B3III	16.8	13,500	15.6	22,570
B3IV	12.2	9,320	13.0	22,570
B3V	7.6	4,890	9.4	22,570
B3VI	3.8	2,570	6.8	22,570
B4Ia0	30.1	1,230,000	187.4	20,160
B4Ia	26.2	338,000	98.4	20,160
B4Ib	22.3	112,000	56.6	20,160
B4II	18.4	43,700	33.4	20,760
B4III	14.5	6,930	13.3	20,760
B4IV	10.6	4,790	11.0	20,760
B4V	6.7	2,290	7.6	20,760
B4VI	3.4	1,320	5.8	20,760
B5Ia0	25.1	965,000	187.8	18,950
B5Ia	21.9	291,000	103.2	18,950
B5Ib	18.7	88,000	56.8	18,950
B5II	15.5	29,100	32.6	18,950
B5III	12.3	3,190	10.8	18,950
B5IV	9.1	2,210	9.0	18,950
B5V	5.9	1,160	6.5	18,950
B5VI	2.9	667	4.9	18,950
B6Ia0	23.2	758,000	204.0	17,140
B6Ia	20.2	229,000	111.8	17,140
B6Ib	17.2	63,100	58.8	17,140
B6II	14.2	17,400	30.8	17,140
B6III	11.2	1,740	9.7	17,140
B6IV	8.2	1,200	8.1	17,140
B6V	5.2	692	6.1	17,140
B6VI	2.7	363	4.5	17,140
B7Ia0	21.4	533,000	214.0	15,330
B7Ia	18.6	193,000	128.6	15,330
B7Ib	15.8	44,300	61.6	15,330
B7II	12.9	11,100	30.8	15,330
B7III	10.1	1,010	9.3	15,330
B7IV	7.3	640	7.4	15,330
B7V	4.5	404	5.9	15,330
B7VI	2.5	193	4.1	15,330
B8Ia0	19.5	367,000	228.0	13,520
B8Ia	16.9	160,000	150.4	13,520
B8Ib	14.3	33,400	68.8	13,520
B8II	11.7	6,990	31.4	13,520
B8III	9.0	530	8.7	13,520
B8IV	6.4	334	6.9	13,520
B8V	3.8	211	5.5	13,520
B8VI	2.4	101	3.8	13,520
B9Ia0	17.7	273,000	262.0	11,710
B9Ia	15.3	131,000	181.0	11,710
B9Ib	12.9	22,700	75.4	11,710
B9II	10.5	4,320	33.0	11,710
B9III	8.1	299	8.7	11,710
B9IV	5.7	172	6.6	11,710
B9V	3.4	119	5.5	11,710
B9VI	2.1	52	3.6	11,710

A-Class	Mass	Luminosity	Diameter	Temperature
A0Ia0	15.8	186,000	302.0	9,900
A0Ia	13.7	107,000	228.0	9,900
A0Ib	11.5	15,400	87.0	9,900
A0II	9.4	2,680	36.2	9,900
A0III	7.2	154	8.7	9,900
A0IV	5.1	88.8	6.6	9,900
A0V	2.9	67.4	5.8	9,900
A0VI	1.9	26.8	3.6	9,900
A1Ia0	15.2	198,000	324.0	9,707
A1Ia	13.1	114,000	246.0	9,707
A1Ib	11.0	15,000	89.2	9,707
A1II	8.9	2,350	35.8	9,650
A1III	6.9	124	8.2	9,650
A1IV	4.8	71.1	6.2	9,650
A1V	2.7	49.2	5.2	9,650
A1VI	1.8	19.6	3.3	9,650
A2Ia0	14.5	210,000	348.0	9,513
A2Ia	12.5	121,000	264.0	9,513
A2Ib	10.5	13,300	87.4	9,513
A2II	8.5	2,070	35.4	9,400
A2III	6.5	99	7.7	9,400
A2IV	4.5	57	5.9	9,400
A2V	2.5	39.4	4.9	9,400
A2VI	1.8	15.7	3.1	9,400
A3Ia0	13.9	224,000	374.0	9,320
A3Ia	12.0	129,000	284.0	9,320
A3Ib	10.0	12,900	89.8	9,320
A3II	8.1	1,660	33.4	9,150
A3III	6.2	87.1	7.7	9,150
A3IV	4.3	41.7	5.3	9,150
A3V	2.4	28.9	4.4	9,150
A3VI	1.8	11.5	2.8	9,150
A4Ia0	13.2	239,000	404.0	9,127
A4Ia	11.4	138,000	306.0	9,127
A4Ib	9.5	11,400	88.2	9,127
A4II	7.7	1,460	33.2	8,900
A4III	5.8	70	7.3	8,900
A4IV	4.0	33.5	5.0	8,900
A4V	2.1	23.2	4.2	8,900
A4VI	1.7	9.23	2.6	8,900
A5Ia0	12.6	255,000	434.0	8,933
A5Ia	10.8	161,000	346.0	8,933
A5Ib	9.0	11,100	90.8	8,933
A5II	7.2	1,290	33.0	8,650
A5III	5.4	56.4	6.9	8,650
A5IV	3.7	27	4.8	8,650
A5V	1.9	17	3.8	8,650
A5VI	1.6	6.78	2.4	8,650
A6Ia0	12.6	249,000	448.0	8,740
A6Ia	10.8	189,000	390.0	8,740
A6Ib	9.0	10,900	93.8	8,740
A6II	7.2	1,140	33.0	8,400
A6III	5.4	45.5	6.6	8,400
A6IV	3.6	21.8	4.5	8,400
A6V	1.8	15.1	3.8	8,400
A6VI	1.6	5.47	2.3	8,400
A7Ia0	12.6	267,000	486.0	8,547
A7Ia	10.8	222,000	442.0	8,547
A7Ib	9.0	10,600	96.8	8,547
A7II	7.2	1,110	34.4	8,150
A7III	5.4	36.8	6.3	8,150
A7IV	3.6	19.3	4.5	8,150
A7V	1.8	12.2	3.6	8,150
A7VI	1.5	4.43	2.2	8,150
A8Ia0	12.6	260,000	502.0	8,353
A8Ia	10.8	238,000	480.0	8,353
A8Ib	9.0	10,400	100.2	8,353
A8II	7.2	990	34.6	7,900
A8III	5.4	32.8	6.3	7,900
A8IV	3.6	15.7	4.4	7,900
A8V	1.8	10.9	3.6	7,900
A8VI	1.5	3.59	2.1	7,900
A9Ia0	12.6	280,000	546.0	8,160
A9Ia	10.8	233,000	498.0	8,160
A9Ib	9.0	10,200	104.0	8,160
A9II	7.1	970	36.6	7,650
A9III	5.3	26.7	6.1	7,650
A9IV	3.5	14	4.4	7,650
A9V	1.7	8.85	3.5	7,650
A9VI	1.4	2.93	2.0	7,650

F-Class	Mass	Luminosity	Diameter	Temperature
F0Ia0	12.6	274,000	566.0	7,967
F0Ia	10.8	228,000	516.0	7,967
F0Ib	8.9	9,960	108.0	7,967
F0II	7.1	870	37.0	7,400
F0III	5.3	21.9	5.9	7,400
F0IV	3.4	11.5	4.2	7,400
F0V	1.6	7.94	3.5	7,400
F0VI	1.4	2.4	1.9	7,400
F1Ia0	12.1	296,000	618.0	7,773
F1Ia	10.3	224,000	538.0	7,773
F1Ib	8.6	9,790	112.4	7,773
F1II	6.8	865	38.4	7,260
F1III	5.1	21.7	6.1	7,260
F1IV	3.3	12.5	4.6	7,260
F1V	1.6	6.56	3.3	7,260
F1VI	1.3	1.98	1.8	7,260
F2Ia0	11.6	291,000	646.0	7,580
F2Ia	9.9	202,000	536.0	7,580
F2Ib	8.2	8,800	112.2	7,580
F2II	6.5	860	39.8	7,120
F2III	4.9	19.7	6.0	7,120
F2IV	3.2	14.9	5.2	7,120
F2V	1.5	5.95	3.3	7,120
F2VI	1.3	1.64	1.7	7,120
F3Ia0	11.0	316,000	708.0	7,387
F3Ia	9.4	199,000	562.0	7,387
F3Ib	7.9	8,700	117.4	7,387
F3II	6.3	782	39.4	6,980
F3III	4.7	19.6	6.2	6,980
F3IV	3.1	16.3	5.7	6,980
F3V	1.5	4.94	3.1	6,980
F3VI	1.2	1.49	1.7	6,980
F4Ia0	10.5	343,000	778.0	7,193
F4Ia	9.0	180,000	564.0	7,193
F4Ib	7.5	7,860	117.8	7,193
F4II	6.0	781	41.0	6,840
F4III	4.5	19.6	6.5	6,840
F4IV	3.0	19.6	6.5	6,840
F4V	1.4	4.5	3.1	6,840
F4VI	1.1	1.24	1.6	6,840
F5Ia0	10.0	374,000	858.0	7,000
F5Ia	8.6	163,000	566.0	7,000
F5Ib	7.1	7,820	124.0	7,000
F5II	5.7	783	42.8	6,700
F5III	4.3	21.6	7.1	6,700
F5IV	2.8	21.6	7.1	6,700
F5V	1.4	3.75	3.0	6,700
F5VI	1.1	1.03	1.6	6,700
F6Ia0	10.0	374,000	920.0	6,760
F6Ia	8.6	149,000	580.0	6,760
F6Ib	7.1	7,820	132.8	6,760
F6II	5.7	786	44.8	6,560
F6III	4.2	23.7	7.8	6,560
F6IV	2.8	16.4	6.5	6,560
F6V	1.3	3.13	2.8	6,560
F6VI	1.0	0.862	1.5	6,560
F7Ia0	10.0	413,000	1038.0	6,520
F7Ia	8.5	137,000	598.0	6,520
F7Ib	7.1	7,180	136.8	6,520
F7II	5.6	791	46.8	6,420
F7III	4.2	26.2	8.5	6,420
F7IV	2.7	12.5	5.9	6,420
F7V	1.3	2.62	2.7	6,420
F7VI	1.0	0.791	1.5	6,420
F8Ia0	10.0	419,000	1128.0	6,280
F8Ia	8.5	127,000	620.0	6,280
F8Ib	7.1	7,290	148.6	6,280
F8II	5.6	729	47.0	6,280
F8III	4.1	29	9.4	6,280
F8IV	2.7	10.5	5.7	6,280
F8V	1.2	2.41	2.7	6,280
F8VI	1.0	0.665	1.4	6,280
F9Ia0	10.0	473,000	1308.0	6,011
F9Ia	8.5	130,000	686.0	6,011
F9Ib	7.0	6,840	157.2	6,011
F9II	5.6	739	49.6	6,140
F9III	4.1	32.2	10.3	6,140
F9IV	2.6	8.1	5.2	6,140
F9V	1.1	2.03	2.6	6,140
F9VI	0.9	0.614	1.4	6,140

G-Class	Mass	Luminosity	Diameter	Temperature
G0Ia0	10.0	495,000	1464.0	5,743
G0Ia	6.3	124,000	734.0	5,743
G0Ib	2.5	7,150	176.2	5,743
G0II	2.1	784	58.4	5,743
G0III	1.8	37.5	12.8	5,743
G0IV	1.4	6.25	4.8	6,000
G0V	1.1	1.72	2.5	6,000
G0VI	0.9	0.52	1.4	6,000
G1Ia0	10.5	527,000	1664.0	5,474
G1Ia	6.6	132,000	834.0	5,474
G1Ib	2.6	7,620	200.0	5,474
G1II	2.2	835	66.2	5,474
G1III	1.8	43.8	15.2	5,474
G1IV	1.4	6.35	5.0	5,890
G1V	1.0	1.46	2.4	5,890
G1VI	0.9	0.44	1.3	5,890
G2Ia0	11.0	573,000	1918.0	5,206
G2Ia	6.9	131,000	918.0	5,206
G2Ib	2.8	8,290	230.0	5,206
G2II	2.3	909	76.4	5,206
G2III	1.9	52.3	18.3	5,206
G2IV	1.4	6.48	5.2	5,780
G2V	1.0	1.23	2.3	5,780
G2VI	0.9	0.373	1.3	5,780
G3Ia0	11.5	703,000	2360.0	4,937
G3Ia	7.2	147,000	1080.0	4,937
G3Ib	2.9	8,460	260.0	4,937
G3II	2.4	1,110	94.0	4,937
G3III	1.9	70.3	23.6	4,937
G3IV	1.5	6.04	5.3	5,670
G3V	1.0	1.15	2.3	5,670
G3VI	0.8	0.348	1.3	5,670
G4Ia0	12.0	813,000	2840.0	4,669
G4Ia	7.5	170,000	1298.0	4,669
G4Ib	3.0	9,770	312.0	4,669
G4II	2.5	1,290	113.0	4,669
G4III	2.0	89.1	29.8	4,669
G4IV	1.5	6.2	5.5	5,560
G4V	0.9	0.982	2.2	5,560
G4VI	0.8	0.297	1.2	5,560
G5Ia0	12.5	1,070,000	3680.0	4,400
G5Ia	7.8	186,000	1532.0	4,400
G5Ib	3.2	11,800	384.0	4,400
G5II	2.6	1,550	139.8	4,400
G5III	2.0	118	38.4	4,400
G5IV	1.5	6.38	5.8	5,450
G5V	0.9	0.841	2.1	5,450
G5VI	0.8	0.254	1.2	5,450
G6Ia0	12.5	1,120,000	3860.0	4,343
G6Ia	7.9	195,000	1608.0	4,343
G6Ib	3.3	12,300	404.0	4,343
G6II	2.7	1,620	146.6	4,343
G6III	2.1	123	40.4	4,343
G6IV	1.5	6.59	6.2	5,340
G6V	0.9	0.792	2.1	5,340
G6VI	0.8	0.218	1.1	5,340
G7Ia0	12.5	1,180,000	4060.0	4,286
G7Ia	8.0	205,000	1692.0	4,286
G7Ib	3.5	12,900	424.0	4,286
G7II	2.8	1,700	154.2	4,286
G7III	2.2	129	42.4	4,286
G7IV	1.5	6.84	6.6	5,230
G7V	0.9	0.684	2.1	5,230
G7VI	0.7	0.206	1.1	5,230
G8Ia0	12.5	1,130,000	4080.0	4,229
G8Ia	8.1	196,000	1702.0	4,229
G8Ib	3.6	14,900	468.0	4,229
G8II	2.9	1,960	170.2	4,229
G8III	2.2	124	42.8	4,229
G8IV	1.5	6.5	6.7	5,120
G8V	0.8	0.65	2.1	5,120
G8VI	0.7	0.179	1.1	5,120
G9Ia0	12.5	1,190,000	4320.0	4,171
G9Ia	8.1	207,000	1796.0	4,171
G9Ib	3.8	15,700	494.0	4,171
G9II	3.0	2,070	179.6	4,171
G9III	2.3	131	45.2	4,171
G9IV	1.6	6.8	7.1	5,010
G9V	0.8	0.566	2.1	5,010
G9VI	0.7	0.171	1.1	5,010

K-Class	Mass	Luminosity	Diameter	Temperature
K0Ia0	12.5	1,260,000	4560.0	4,114
K0Ia	8.2	219,000	1900.0	4,114
K0Ib	3.9	16,600	524.0	4,114
K0II	3.1	2,190	190.0	4,114
K0III	2.3	138	47.8	4,114
K0IV	1.6	7.16	7.7	4,900
K0V	0.8	0.543	2.1	4,900
K0VI	0.7	0.15	1.1	4,900
K1Ia0	12.5	1,220,000	4600.0	4,057
K1Ia	8.3	212,000	1920.0	4,057
K1Ib	4.1	17,600	554.0	4,057
K1II	3.3	2,320	202.0	4,057
K1III	2.4	161	52.8	4,057
K1IV	1.6	7.71	8.4	4,760
K1V	0.8	0.443	2.0	4,760
K1VI	0.6	0.134	1.1	4,760
K2Ia0	13.3	1,300,000	4880.0	4,000
K2Ia	8.8	225,000	2040.0	4,000
K2Ib	4.3	20,600	616.0	4,000
K2II	3.4	2,470	214.0	4,000
K2III	2.5	206	61.6	4,000
K2IV	1.6	8.38	9.3	4,620
K2V	0.7	0.401	2.0	4,620
K2VI	0.6	0.121	1.1	4,620
K3Ia0	14.2	1,460,000	5440.0	3,900
K3Ia	9.4	253,000	2280.0	3,900
K3Ib	4.6	25,300	718.0	3,900
K3II	3.6	2,770	238.0	3,900
K3III	2.6	253	71.8	3,900
K3IV	1.7	9.22	10.4	4,480
K3V	0.7	0.335	2.0	4,480
K3VI	0.6	0.101	1.1	4,480
K4Ia0	15.0	1,650,000	6120.0	3,800
K4Ia	9.9	262,000	2440.0	3,800
K4Ib	4.8	31,500	844.0	3,800
K4II	3.8	3,150	266.0	3,800
K4III	2.7	345	88.4	3,800
K4IV	1.7	10.3	11.7	4,340
K4V	0.7	0.31	2.0	4,340
K4VI	0.5	0.0936	1.1	4,340
K5Ia0	15.8	1,900,000	6920.0	3,700
K5Ia	10.4	301,000	2760.0	3,700
K5Ib	5.0	39,600	998.0	3,700
K5II	3.9	3,620	302.0	3,700
K5III	2.8	435	104.6	3,700
K5IV	1.8	10.6	12.7	4,200
K5V	0.7	0.266	2.0	4,200
K5VI	0.5	0.088	1.2	4,200
K6Ia0	15.8	1,850,000	6760.0	3,717
K6Ia	10.6	294,000	2700.0	3,717
K6Ib	5.3	42,400	1024.0	3,717
K6II	4.2	3,530	296.0	3,717
K6III	3.0	465	107.2	3,717
K6IV	1.8	12.2	14.5	4,060
K6V	0.6	0.211	1.9	4,060
K6VI	0.5	0.0767	1.2	4,060
K7Ia0	15.8	1,810,000	6640.0	3,733
K7Ia	10.7	262,000	2520.0	3,733
K7Ib	5.7	45,500	1052.0	3,733
K7II	4.4	3,450	290.0	3,733
K7III	3.1	499	110.0	3,733
K7IV	1.9	14.2	16.9	3,920
K7V	0.6	0.187	1.9	3,920
K7VI	0.4	0.068	1.2	3,920
K8Ia0	15.8	1,770,000	6500.0	3,750
K8Ia	10.9	256,000	2460.0	3,750
K8Ib	6.0	44,400	1030.0	3,750
K8II	4.6	3,690	296.0	3,750
K8III	3.3	534	112.8	3,750
K8IV	1.9	17	19.8	3,780
K8V	0.6	0.155	1.9	3,780
K8VI	0.3	0.0562	1.1	3,780
K9Ia0	15.8	1,830,000	6700.0	3,725
K9Ia	11.1	265,000	2540.0	3,725
K9Ib	6.3	50,400	1112.0	3,725
K9II	4.9	3,830	306.0	3,725
K9III	3.4	606	121.8	3,725
K9IV	2.0	20.7	23.6	3,640
K9V	0.5	0.144	2.0	3,640
K9VI	0.3	0.0433	1.1	3,640

M-Class	Mass	Luminosity	Diameter	Temperature
M0Ia0	15.8	1,900,000	6920.0	3,700
M0Ia	13.3	274,000	2620.0	3,700
M0Ib	10.7	57,300	1200.0	3,700
M0II	8.2	3,960	316.0	3,700
M0III	5.6	689	131.6	3,700
M0IV	3.1	26	28.6	3,500
M0V	0.5	0.125	2.0	3,500
M0VI	0.2	0.0376	1.1	3,500
M1Ia0	15.1	2,560,000	8920.0	3,510
M1Ia	12.7	337,000	3240.0	3,510
M1Ib	10.2	77,300	1550.0	3,510
M1II	7.8	5,860	426.0	3,510
M1III	5.3	929	170.0	3,510
M1IV	2.9	35.5	36.8	3,333
M1V	0.5	0.0618	1.5	3,333
M1VI	0.2	0.0186	0.8	3,333
M2Ia0	14.5	3,650,000	11900.0	3,320
M2Ia	12.1	481,000	4320.0	3,320
M2Ib	9.8	110,000	2060.0	3,320
M2II	7.4	8,360	570.0	3,320
M2III	5.1	1,210	216.0	3,320
M2IV	2.7	50.9	48.8	3,167
M2V	0.4	0.0321	1.2	3,167
M2VI	0.2	0.00885	0.6	3,167
M3Ia0	13.8	5,070,000	15780.0	3,130
M3Ia	11.6	733,000	6000.0	3,130
M3Ib	9.3	168,000	2880.0	3,130
M3II	7.1	14,000	828.0	3,130
M3III	4.8	1,840	300.0	3,130
M3IV	2.6	77.6	67.2	3,000
M3V	0.3	0.0178	1.0	3,000
M3VI	0.2	0.0049	0.5	3,000
M4Ia0	13.2	8,380,000	23000.0	2,940
M4Ia	11.0	1,100,000	8360.0	2,940
M4Ib	8.9	277,000	4180.0	2,940
M4II	6.7	23,100	1208.0	2,940
M4III	4.6	2,770	418.0	2,940
M4IV	2.4	127	96.6	2,833
M4V	0.3	0.0106	0.9	2,833
M4VI	0.1	0.00266	0.4	2,833
M5Ia0	12.5	15,300,000	35600.0	2,750
M5Ia	10.5	2,020,000	12900.0	2,750
M5Ib	8.4	507,000	6460.0	2,750
M5II	6.4	46,200	1952.0	2,750
M5III	4.3	5,070	646.0	2,750
M5IV	2.3	207	138.8	2,667
M5V	0.2	0.00624	0.8	2,667
M5VI	0.1	0.00172	0.4	2,667
M6Ia0	12.4	28,800,000	56200.0	2,560
M6Ia	10.3	4,170,000	21400.0	2,560
M6Ib	8.3	955,000	10240.0	2,560
M6II	6.3	95,500	3240.0	2,560
M6III	4.2	9,550	1024.0	2,560
M6IV	2.2	410	222.0	2,500
M6V	0.2	0.0045	0.7	2,500
M6VI	0.1	0.00163	0.4	2,500
M7Ia0	12.3	69,600,000	102000.0	2,370
M7Ia	10.2	9,180,000	37000.0	2,370
M7Ib	8.2	2,100,000	17740.0	2,370
M7II	6.2	253,000	6140.0	2,370
M7III	4.2	21,000	1774.0	2,370
M7IV	2.1	926	384.0	2,333
M7V	0.1	0.00369	0.8	2,333
M7VI	0.1	0.00194	0.6	2,333
M8Ia0	12.1	205,000,000	206000.0	2,180
M8Ia	10.1	27,000,000	75200.0	2,180
M8Ib	8.1	5,150,000	32800.0	2,180
M8II	6.1	744,000	12460.0	2,180
M8III	4.1	51,500	3280.0	2,180
M8IV	2.1	2,440	722.0	2,167
M8V	0.1	0.00353	0.9	2,167
M8VI	0.1	0.00244	0.7	2,167
M9Ia0	12.0	711,000,000	462000.0	1,990
M9Ia	10.0	103,000,000	175800.0	1,990
M9Ib	8.0	17,900,000	73400.0	1,990
M9II	6.0	2,830,000	29200.0	1,990
M9III	4.1	179,000	7340.0	1,990
M9IV	2.1	7,910	1528.0	2,000
M9V	0.1	0.00415	1.1	2,000
M9VI	0.1	0.00415	1.1	2,000

Zone Distance Table

Stellar Mass	Near Zone 1	Inner Zone 2	Habitable Zone 3	Outer Zone 4*	Outer Zone 5	Outer Zone 6	Far Zone 7	Far Zone 8	Far Zone 9	Far Zone 10
...0.5	0.02 - 0.05	0.05 - 0.09	0.09 - 0.18	0.18 - 0.36	0.36 - 0.73	0.73 - 1.46	1.46 - 2.92	2.92 - 5.84	5.84 - 11.67	11.67 - 23.35
0.6-1.5	0.2 - 0.4	0.4 - 0.8	0.8- 1.5	1.5 - 3.0	3.0 - 6.0	6.0 - 12.0	12.0 - 24.0	24.0 - 48.0	48.0 - 96.0	96.0 - 192.0
1.6-3.0	0.8 - 1.9	1.9 - 3.7	3.7- 7.5	7.5 - 14.9	14.9 - 29.8	29.8 - 59.6	59.6 - 119.3	119.3 - 238.6	238.6 - 477.2	477.2 - 954.3
3.1-5.0	1.9 - 4.2	4.2 - 8.5	8.5 - 17.0	17.0 - 33.9	33.9 - 67.9	67.9 - 135.8	135.8 - 271.5	271.5 - 543.1	543.1 - 1,086.1	1,086.1 - 2,172.2
5.1-8.0	4.4 - 9.9	9.9 - 19.8	19.8 - 39.7	39.7 - 79.4	79.4 - 158.8	158.8 - 317.5	317.5 - 635.1	635.1 - 1,270.1	1,270.1 - 2,540.2	2,540.2 - 5,080.4
8.1-12.0	9 - 21	21 - 42	42 - 84	84 - 169	169 - 337	337 - 675	675 - 1,350	1,350 - 2,699	2,699 - 5,398	5,398 - 10,797
12.1-20.0	21 - 48	48 - 96	96 - 192	192 - 384	384 - 768	768 - 1,536	1,536 - 3,072	3,072 - 6,144	6,144 - 12,288	12,288 - 24,576
20.1-36.0	57 - 128	128 - 256	256 - 511	511 - 1,022	1,022 - 2,045	2,045 - 4,090	4,090 - 8,180	8,180 - 16,359	16,359 - 32,719	32,719 - 65,438
36.1-68.0	168 - 378	378 - 755	755 - 1,510	1,510 - 3,021	3,021 - 6,042	6,042 - 12,083	12,083 - 24,167	24,167 - 48,333	48,333 - 96,667	96,667 - 193,333
68.1-132.0	527 - 1,186	1,186 - 2,372	2,372 - 4,743	4,743 - 9,487	9,487 - 18,974	18,974 - 37,947	37,947 - 75,895	75,895 - 151,789	151,789 - 303,579	303,579 - 607,157
132.1...	1,072 - 2,411	2,411 - 4,822	4,822 - 9,644	9,644 - 19,288	19,288 - 38,575	38,575 - 77,151	77,151 - 154,302	154,302 - 308,604	308,604 - 617,207	617,207 - 1,234,414
Comment	Inferno	Hot	Temperate	Cold	Cold	Cold	Frigid	Frigid	Frigid	Frigid

** The FTL Horizon is located at the beginning of the range of Zone 4 (the entry point to the Outer Region of a star system). For example, a star with a mass of 2.2 has a FTL Horizon at 7.5AU.*

PRE-ROLLED STAR SYSTEMS

If you're in a hurry and don't want to spend a lot of time rolling on tables, consider starting with a pre-rolled complete star system. Just add imagination and any details you desire, relevant to the mass of the primary star and the purpose for this star system in your campaign. None of these randomized results have companion stars – but if a binary or trinary star is in your plans, simply replace any result you wish with a complete star system of one or two classes lower (for instance, if you have a B-class star and roll a 4, you could replace one of the terrestrials in the Far Region with a roll on the class M table. Viola! Instant binary star system).

M	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	--	Terrestrial	--	Terrestrial	--	Ice Giant	--	--	--	Terrestrial
2	--	--	--	Dwarf	Dwarf	--	--	Terrestrial	Ice Giant	--
3	Gas Giant	--	--	Asteroid Belt	--	Asteroid Belt	Asteroid Belt	--	Terrestrial	--
4	Asteroid Belt	--	--	Gas Giant	Dwarf	Asteroid Belt	Ice Giant	--	--	Dwarf
5	Dwarf	Terrestrial	Ice Giant	Ice Giant	--	Dwarf	Dwarf	Dwarf	--	--
6	Gas Giant	--	--	--	--	Dwarf	--	Terrestrial	--	Terrestrial
7	Terrestrial	--	Terrestrial	Gas Giant	Ice Giant	Terrestrial	Terrestrial	--	Gas Giant	--
8	Gas Giant	--	--	--	Dwarf	Terrestrial	Gas Giant	--	Asteroid Belt	--
9	--	--	--	--	--	Dwarf	Terrestrial	--	Terrestrial	--
0	Gas Giant	--	Gas Giant	--	Dwarf	Gas Giant	Gas Giant	Dwarf	--	--

K	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	Terrestrial	--	Gas Giant	Terrestrial	--	--	Ice Giant	Asteroid Belt	Asteroid Belt	--
2	--	Asteroid Belt	Asteroid Belt	--	--	--	Gas Giant	Terrestrial	Ice Giant	--
3	Dwarf	--	Asteroid Belt	Ice Giant	--	Dwarf	Gas Giant Ice Giant	Terrestrial	--	Terrestrial
4	Dwarf	--	--	Asteroid Belt	--	--	Gas Giant	Asteroid Belt	--	Gas Giant
5	Terrestrial Dwarf	--	Gas Giant	Dwarf	--	--	--	--	--	Terrestrial
6	Gas Giant	--	Ice Giant	--	--	Dwarf	Terrestrial	--	Gas Giant Ice Giant	Dwarf
7	Gas Giant	Dwarf	Dwarf	Ice Giant	--	Asteroid Belt	Dwarf Dwarf	Terrestrial	--	Terrestrial
8	Dwarf Dwarf	Gas Giant	Dwarf	Ice Giant	--	--	Ice Giant Terrestrial	Dwarf	--	Ice Giant
9	--	Ice Giant	--	--	--	--	Asteroid Belt	--	Terrestrial	--
0	Gas Giant	--	Gas Giant	--	Gas Giant	Asteroid Belt	Ice Giant	--	Asteroid Belt	--

G	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	--	Dwarf	Asteroid Belt Ice Giant	Dwarf Ice Giant	Dwarf	Terrestrial	Ice Giant	Asteroid Belt	Dwarf	Terrestrial
2	Dwarf	Ice Giant	Gas Giant	Dwarf	Terrestrial Asteroid Belt	Terrestrial	Ice Giant	Ice Giant Asteroid Belt	Dwarf Terrestrial	Asteroid Belt
3	Asteroid Belt Terrestrial	Terrestrial	Terrestrial	Ice Giant	Gas Giant	Terrestrial	Gas Giant	Ice Giant	Terrestrial	Ice Giant
4	Terrestrial	Asteroid Belt	--	Dwarf	Gas Giant	Gas Giant Ice Giant	Dwarf	Terrestrial	Asteroid Belt	Terrestrial
5	Terrestrial	Terrestrial	Dwarf	--	--	--	Dwarf	--	Ice Giant	Asteroid Belt
6	Terrestrial	Terrestrial	Gas Giant Gas Giant	Gas Giant	Dwarf	--	--	Terrestrial	Terrestrial	Terrestrial Ice Giant
7	Dwarf	Asteroid Belt	Dwarf	--	Ice Giant	Dwarf	Gas Giant	Terrestrial	--	Ice Giant
8	Gas Giant	Asteroid Belt Dwarf	Dwarf	Terrestrial	Terrestrial	Ice Giant Gas Giant	Dwarf	Dwarf	Dwarf	Ice Giant
9	2	Terrestrial	Asteroid Belt	Dwarf	Dwarf	Dwarf	Dwarf	Asteroid Belt	Asteroid Belt Asteroid Belt	Dwarf
0	Terrestrial	Asteroid Belt	Dwarf	Terrestrial	Asteroid Belt	Dwarf	Ice Giant	Dwarf	--	--

F	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	Terrestrial Dwarf	Gas Giant	Terrestrial	Gas Giant	Ice Giant Asteroid Belt	Gas Giant Ice Giant	Dwarf Dwarf	Gas Giant Ice Giant	--	Gas Giant
2	--	Terrestrial	Ice Giant		Dwarf Terrestrial	Ice Giant Asteroid Belt	--	Asteroid Belt Asteroid Belt	Dwarf	Dwarf Dwarf
3	Asteroid Belt	Dwarf Dwarf	Asteroid Belt	Asteroid Belt	Gas Giant	Gas Giant	Terrestrial Dwarf Terrestrial	Dwarf	Asteroid Belt	Asteroid Belt
4	Gas Giant	Dwarf	Terrestrial	Dwarf	--	Gas Giant	Dwarf	Terrestrial	Asteroid Belt	Asteroid Belt
5	Dwarf	Ice Giant	Dwarf	Dwarf	Dwarf	Dwarf	Terrestrial	Terrestrial	Dwarf	Dwarf
6	Dwarf	Asteroid Belt Dwarf	Asteroid Belt	Ice Giant	Ice Giant Asteroid Belt	Ice Giant	Asteroid Belt	Dwarf	Ice Giant	Dwarf Dwarf Asteroid Belt
7	Dwarf	Ice Giant	Ice Giant	Asteroid Belt	Terrestrial	Ice Giant	Terrestrial	--	Terrestrial	Terrestrial
8	Terrestrial	--	Terrestrial	Asteroid Belt Dwarf	Terrestrial	Ice Giant	Dwarf	--	--	Dwarf Ice Giant
9	--	--	Gas Giant	Asteroid Belt	Ice Giant	Gas Giant	Terrestrial	Dwarf Dwarf	Dwarf	Dwarf
0	Asteroid Belt	Asteroid Belt	Asteroid Belt Asteroid Belt	--	Gas Giant	Dwarf	--	--	Gas Giant Ice Giant	Asteroid Belt

A	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	Dwarf	Terrestrial	Dwarf	--	--	Dwarf	Gas Giant Gas Giant	Asteroid Belt	Terrestrial Gas Giant	Dwarf
2	Terrestrial	Ice Giant	--	Asteroid Belt Terrestrial	Dwarf	Terrestrial	Dwarf Dwarf	Gas Giant	Terrestrial Terrestrial	Gas Giant Terrestrial
3	Asteroid Belt	Dwarf Asteroid Belt	--	Gas Giant	Gas Giant	Gas Giant	Gas Giant	Terrestrial Asteroid Belt	Dwarf	Dwarf
4	Gas Giant	Dwarf	Dwarf	Dwarf	Gas Giant	--	Terrestrial	Terrestrial	Asteroid Belt	Asteroid Belt Dwarf
5	Asteroid Belt	--	Terrestrial Asteroid Belt	Ice Giant	Asteroid Belt	Asteroid Belt Asteroid Belt	Dwarf	Terrestrial	Asteroid Belt Dwarf	Gas Giant Ice Giant
6	Dwarf	Ice Giant	Gas Giant	Ice Giant	Gas Giant Ice Giant	Asteroid Belt	Dwarf	Ice Giant	Dwarf	Ice Giant Asteroid Belt
7	Asteroid Belt Asteroid Belt	Terrestrial	Terrestrial Ice Giant	Asteroid Belt	Asteroid Belt	Gas Giant Dwarf	Terrestrial Asteroid Belt	Asteroid Belt Dwarf	--	--
8	Terrestrial Dwarf	Terrestrial Asteroid Belt	Terrestrial	Terrestrial	Gas Giant	Asteroid Belt Dwarf	Ice Giant	Asteroid Belt	--	Dwarf
9	Dwarf	Asteroid Belt Gas Giant	Dwarf	--	Terrestrial	Dwarf	--	Ice Giant	Ice Giant Asteroid Belt	Ice Giant
0	Dwarf Dwarf	Gas Giant Terrestrial	Gas Giant Dwarf	Terrestrial	--	Terrestrial Asteroid Belt	Gas Giant	Asteroid Belt Dwarf	Terrestrial	Ice Giant

B	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	Asteroid Belt	Ice Giant	Asteroid Belt	Gas Giant	Terrestrial	Asteroid Belt	Gas Giant Terrestrial	Terrestrial	Terrestrial Ice Giant	Asteroid Belt Asteroid Belt
2	Gas Giant	Asteroid Belt Gas Giant	Gas Giant	Gas Giant	Terrestrial	Dwarf Gas Giant	Terrestrial Asteroid Belt	Terrestrial	Gas Giant	--
3	Terrestrial	Ice Giant	Asteroid Belt	Dwarf Asteroid Belt	--	Terrestrial	Gas Giant Asteroid Belt	Dwarf	Terrestrial	Ice Giant Asteroid Belt
4	Asteroid Belt	Gas Giant	--	Asteroid Belt	Ice Giant Asteroid Belt	Asteroid Belt	Terrestrial Terrestrial	Dwarf	Terrestrial	Gas Giant Ice Giant
5	Dwarf	Ice Giant Ice Giant	Asteroid Belt	Terrestrial Terrestrial	Asteroid Belt Dwarf	Terrestrial	Terrestrial Ice Giant	Ice Giant	Dwarf	Terrestrial Ice Giant
6	Dwarf	Ice Giant	Terrestrial	Terrestrial	Terrestrial	Asteroid Belt Asteroid Belt	Ice Giant	Terrestrial	Ice Giant	Asteroid Belt Dwarf
7	Gas Giant	Terrestrial	Dwarf	Gas Giant	Ice Giant Asteroid Belt Dwarf	Asteroid Belt Gas Giant	Asteroid Belt	Dwarf Dwarf Dwarf	Gas Giant Asteroid Belt	Gas Giant
8	Asteroid Belt Gas Giant	Dwarf	Ice Giant Ice Giant	Ice Giant	Dwarf Dwarf Terrestrial	Gas Giant	Gas Giant Dwarf	Asteroid Belt Dwarf	Ice Giant Asteroid Belt	Asteroid Belt Asteroid Belt Dwarf
9	Dwarf	--	Ice Giant	Dwarf Terrestrial	Asteroid Belt Gas Giant	Asteroid Belt Gas Giant	Asteroid Belt Dwarf	Terrestrial	Dwarf Dwarf	Asteroid Belt
0	Terrestrial	Dwarf	Dwarf Gas Giant	Asteroid Belt Dwarf	Gas Giant	Gas Giant	Terrestrial	Gas Giant	Gas Giant Gas Giant	Dwarf

O	Near	Inner	Habitable	Outer	Outer	Outer	Far	Far	Far	Far
1	Terrestrial	Gas Giant	Ice Giant	Gas Giant	Gas Giant Terrestrial	Gas Giant	Gas Giant Dwarf	Asteroid Belt	Dwarf Dwarf	Terrestrial
2	Asteroid Belt Dwarf	Terrestrial	Ice Giant	Ice Giant Asteroid Belt	Dwarf	Ice Giant Asteroid Belt	Gas Giant Asteroid Belt	Asteroid Belt	Gas Giant	Gas Giant Terrestrial
3	Gas Giant	Asteroid Belt Gas Giant	Dwarf	Gas Giant	Asteroid Belt Gas Giant	Ice Giant	Gas Giant Asteroid Belt Gas Giant	Terrestrial Asteroid Belt	Gas Giant	Dwarf Dwarf
4	Terrestrial Terrestrial	Dwarf Ice Giant	Dwarf Terrestrial Asteroid Belt Gas Giant	Dwarf Asteroid Belt	Terrestrial	Gas Giant Gas Giant Gas Giant	Ice Giant Ice Giant	Dwarf	Asteroid Belt	Terrestrial Dwarf
5	Gas Giant	Dwarf Dwarf	Asteroid Belt Dwarf	Dwarf Gas Giant	Asteroid Belt Asteroid Belt	Terrestrial Dwarf Gas Giant	Terrestrial	Terrestrial	Terrestrial	Gas Giant Gas Giant Gas Giant
6	Asteroid Belt Gas Giant	Dwarf	Dwarf	Dwarf Terrestrial Terrestrial	Gas Giant Ice Giant	Dwarf	Gas Giant	Dwarf Ice Giant	Ice Giant	Terrestrial
7	Dwarf	Gas Giant	Ice Giant	Gas Giant Asteroid Belt	Dwarf Dwarf	Dwarf Asteroid Belt	Asteroid Belt Gas Giant	Terrestrial Terrestrial	Asteroid Belt	Dwarf Terrestrial Asteroid Belt
8	Terrestrial	Asteroid Belt Gas Giant	Dwarf	Terrestrial Dwarf Terrestrial	Dwarf	Dwarf	Dwarf Asteroid Belt Gas Giant	Ice Giant	Terrestrial	Dwarf
9	Terrestrial Dwarf Asteroid Belt	Asteroid Belt	Dwarf	Asteroid Belt	Dwarf Ice Giant	Dwarf	Ice Giant	Dwarf Ice Giant Asteroid Belt	Gas Giant	Dwarf
0	Terrestrial	Dwarf Ice Giant	Terrestrial	Terrestrial	Gas Giant	Asteroid Belt	Asteroid Belt	Dwarf	Terrestrial Asteroid Belt	Dwarf Dwarf