



# LEARN - How are asteroids designated before getting their final name?



## Learning Objective:

Learn about the history of provisional asteroid designation and how the currently adopted system works.

## Overview:

With the growing number of asteroids discovered in the 19th century, astronomers quickly ran out of symbols for primary asteroid designations. They had to come up with a more elaborated system of numbers and letters that indicate when an asteroid was discovered and its discovery order in a given period of time. In this blog post, you will find out how the provisional asteroid designation system evolved over time.

## Specifics

### Use of symbols

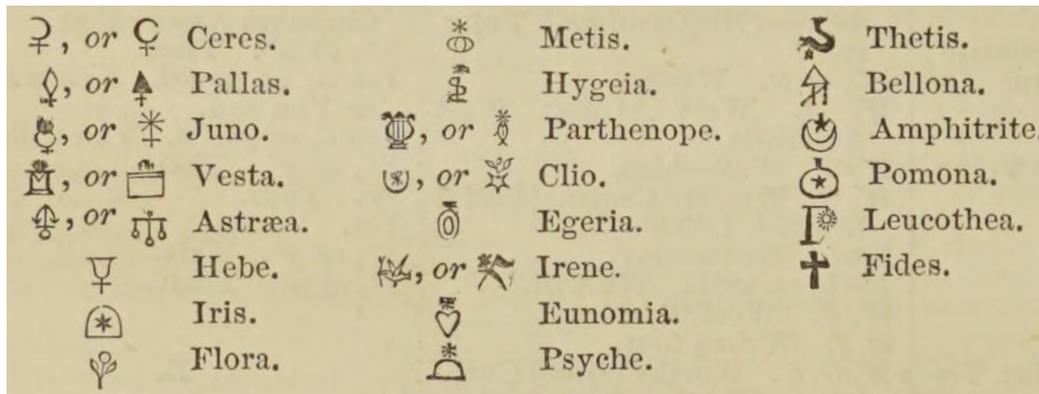
In the first half of the 19th century, asteroids were only referred to by name (see how in [this lesson](#)). At that time, astronomers did not imagine that there would be a large number of these objects in the solar system. Initially, astronomers decided to assign symbols to asteroids just like to planets. It was because the first asteroids discovered had been considered planets and later minor planets before they actually were considered asteroids.

The symbols used for designation were inspired by mythological characters. For example, Ceres was designated with the symbol of a stylised sickle, related to the Roman goddess of agriculture. Pallas, an asteroid discovered soon after, got the symbol of a stylised spear because its name was derived from the Roman goddess of battles.

## Bezeichnung der Himmelskörper.

☉ Sonne.	♃ Jupiter.
☾ Mond.	♄ Saturn.
☿ Merkur.	♅ Uranus.
♀ Venus.	♆ Neptun.
♁ Erde.	♁ Asträa.
♂ Mars.	♃ Hebe.
♃ Vesta.	♁ Iris.
♁ Juno.	♁ Flora.
♁ Pallas.	♁ Metis.
♁ Ceres.	

After a few decades of hiatus with new asteroids discovered, additional new symbols were introduced to represent them. However, these symbols were difficult to draw and astronomers couldn't come to a consensus regarding their use. This pushed scientists to come up with simpler and more practical alternatives.



### Use of numbers

In 1851, astronomer Johann Franz Encke proposed a system that used circled numbers for asteroids. It was quickly adopted by the astronomical community. At this time with no modern technology yet in place, the information about asteroids and other celestial bodies was published in almanacks and magazines.

In the first publication editions after the adoption of this new system, the first four discovered asteroids (Ceres, Pallas, Juno and Vesta) were still designated only by their symbols, while Astræa, the fifth asteroid discovered in history, was assigned the number 1.

Shortly thereafter, astronomer Benjamin Apthorp Gould improved this system by assigning the number 1 to Ceres and keeping the numerical sequence within circles in later publications of the almanacks. Later, the circles were replaced by a pair of parentheses - (1) Ceres, (2) Pallas... - until they were completely omitted. Currently, only a number is placed next to the official name of an asteroid. For example 6 Hebe, 9 Metis, 14 Irene, etc.

Planet.	New Symbol.	Date of Discovery.	Old Symbol.
<i>Ceres</i> ,	①	1801, January 1,	♁
<i>Pallas</i> ,	②	1802, March 28,	♁
<i>Juno</i> ,	③	1804, September 1,	♁
<i>Vesta</i> ,	④	1807, March 29,	♁
<i>Astræa</i> ,	⑤	1845, December 8,	♁
<i>Hebe</i> ,	⑥	1847, July 1,	♁
<i>Iris</i> ,	⑦	" August 13,	♁
<i>Flora</i> ,	⑧	" October 18,	♁
<i>Metis</i> ,	⑨	1848, April 25,	♁
<i>Hygea</i> ,	⑩	1849, April 12,	♁
<i>Parthenope</i> ,	⑪	1850, May 13,	♁
<i>Clio</i> ,	⑫	" September 13,	♁
<i>Egeria</i> ,	⑬	" November 2,	♁
<i>Irene</i> ,	⑭	1851, May 20,	♁
<i>Eunomia</i> ,	⑮	" July 29,	♁

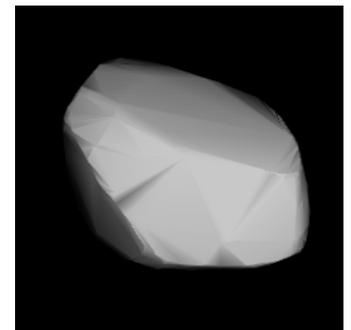
In the first decades of the 20th century, publications using the old system of symbols for asteroids could still be found, however, the use of numbers together with names grew very popular. Finally, International Astronomical Union made this designation system official.

### Designation with numbers and letters

Before a discovered asteroid gets its definitive number, it is necessary to employ a provisional designation for the time of its orbital data confirmation. The provisional designation currently used includes the year of discovery, letters, and numbers as the main reference.

This system first appeared in 1892 in the German astronomical journal *Astronomische Nachrichten*, [still published today](#). The designation consists of the year of discovery followed by a letter indicating the sequence of discovery. These letters belong to the Latin or Roman alphabet, but the letter "I" has been omitted to avoid confusion due to the similarity with "1".

In August 1892, German astronomer Max Wolf discovered the asteroid and named it *Badenia*, in honour of Baden, the Grand Duchy of the German Empire that existed until 1918. This was the first asteroid to receive a provisional designation in history: 1892 A.



With the next designation, the first coincidence took place. Wolf discovered another asteroid in September that was given the provisional designation 1892 B. Still, orbital calculations for this object led to the conclusion that it was an asteroid previously discovered by another astronomer, making that specific designation out of use.

The number of asteroids discovered was growing rapidly and in the following year, the new system already had to be revised, with the inclusion of double letters (AA, AB, AC...) regardless of the year of discovery (1894 AQ was a sequence of 1893 AP, for example). In 1916, all possible combinations of double letters (keeping the exception of the letter I) were used, and the sequence had to be restarted. The asteroid *Stateira*, discovered in September of that year, was given the provisional designation 1916 AA.

Undoubtedly, this naming system was useful, but it had some limitations, which caused a lot of confusion. Finally, in 1924, astronomer Ernest Clare Bower from the Washington Naval Observatory suggested an adaptation that allowed a chronological ordering of the discovered asteroids. His idea was officially accepted the following year and is used to this day.

### How and when an asteroid receives its provisional designation?

The first detection of an asteroid is made through a sequence of images of the same area of the sky that astronomers take within a small time interval. This makes it easier to identify the asteroid because it will move in the image sequence when compared to stars and galaxies that appear in the background.

After a verification to filter out known objects, a report is sent to the [Minor Planet Center \(MPC\)](#), an entity linked to the International Astronomical Union responsible for information on asteroids and comets. An observatory or astronomer has its own designation for monitoring purposes. This designation can be up to 7 characters, defined by the observer.

The MPC receives the information, sets the orbital parameters of the new object and confirms them, and then announces the object in the circulars for other observers to track. It is at this stage that the asteroid receives its provisional designation improved by Bower and officially adopted almost 100 years ago.

The first part of this designation is the year of discovery, always with four digits. Then the first capital letter indicates the half-month of the year in which the discovery was made. The letter A corresponds to the first half-month of the year, which runs from January 1 to 15. The letter B indicates the half-month that corresponds to the period from January 16 to 31 and so on. This way, we can divide the year into 24 half-months. The letter I continues to be omitted to avoid confusion with the number 1 and the letter Z is of no use. Therefore, the letters corresponding to the half-months are distributed as follows:

Month	Half-month	Letter
JANUARY	1-15	A
	16-31	B
FEBRUARY	1-15	C
	16-28(29)	D
MARCH	1-15	E
	16-31	F
APRIL	1-15	G
	16-30	H
MAY	1-15	J
	16-31	K
JUNE	1-15	L
	16-30	M

Month	Half-month	Letter
JULY	1-15	N
	16-31	O
AUGUST	1-15	P
	16-31	Q
SEPTEMBER	1-15	R
	16-30	S
OCTOBER	1-15	T
	16-31	U
NOVEMBER	1-15	V
	16-30	W
DECEMBER	1-15	X
	16-31	Y

Then another capital letter is added to the designation. This time, the letter indicates the order of discovery in that half-month. The letters "A" to "Z" are used, also excluding the letter "I", which provides 25 options for discoveries in that period.

Let's use the example of the asteroid Didymos, which is a small moon that was targeted by the [DART mission](#). Didymos was given the provisional designation 1996 GT, meaning that the asteroid was discovered in the year 1996, the seventh half-month of that year (between April 1st and 15th) and was the 19th object discovered in that period.

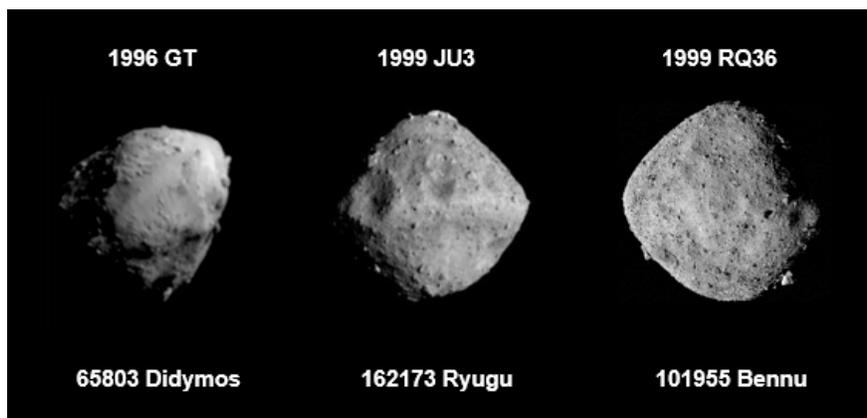
In recent decades, the increase in the number of astronomers and observatories dedicated to asteroids together with the use of new technologies has caused a boom in discoveries, making the 25-letter limit for each half-month of the year insufficient.

To work around this problem, a number is placed after the second letter, indicating the cycle of letters used. So if a 26th asteroid is discovered in that period, the designation A1 is used. For the 27th asteroid uses B1 and so on until Z1. This allows to designate up to 50 asteroids, but if it is still insufficient, a new cycle (A2 to Z2) is used and so on.

Order of discovery	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	1st.
Letter	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	Cycle
Order of discovery	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	2nd.
Letter	A1	B1	C1	D1	E1	F1	G1	H1	J1	K1	L1	M1	N1	O1	P1	Q1	R1	S1	T1	U1	V1	W1	X1	Y1	Z1	Cycle
Order of discovery	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	3rd.
Letter	A2	B2	C2	D2	E2	F2	G2	H2	J2	K2	L2	M2	N2	O2	P2	Q2	R2	S2	T2	U2	V2	W2	X2	Y2	Z2	Cycle
Order of discovery	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	4th.
Letter	A3	B3	C3	D3	E3	F3	G3	H3	J3	K3	L3	M3	N3	O3	P3	Q3	R3	S3	T3	U3	V3	W3	X3	Y3	Z3	Cycle

For example, when the asteroid Ryugu was discovered, it was given the provisional designation 1999 JU3. It means that Ryugu was discovered in 1999, in the first half-month of May, and the 95th asteroid to be discovered in that period.

Asteroid Bennu was also discovered in 1999, and given the provisional designation 1999 RQ36. We can understand that this asteroid was discovered in the first half-month of September and the 916th object discovered in that period.



Learn more about this subject by visiting these websites:

[Asteroid Numbers and Names \(ESA\)](#)

[How Are Asteroids Discovered? - Scott Manley](#)

[Minor Planet Center Circulars - Latest asteroid discovered](#)