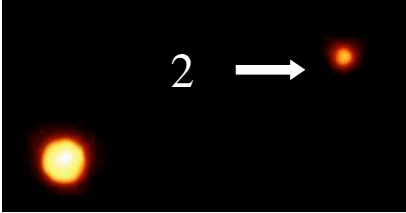

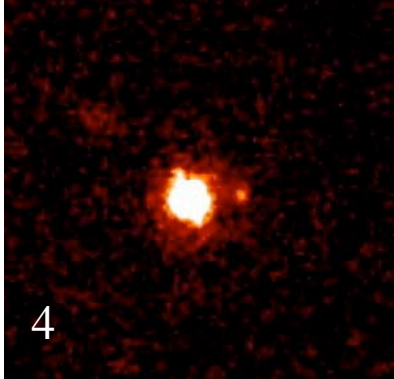




 <p>1</p> <p><u>Diameter:</u> 590 miles (950 km) <u>Distance to Sun:</u> 257 million miles (414 million km) <u>Orbits:</u> # 18 <u>Composition:</u> Outer layer probably ice and frozen ammonia, no atmosphere</p>	 <p>2</p> <p><u>Diameter:</u> 750 miles (1200 km) <u>Distance to Sun:</u> 4 billion miles (6 billion km) <u>Orbits:</u> #16 (also shown here) <u>Composition:</u> Unknown, but surface likely covered in ice, no atmosphere</p>	 <p>3</p> <p><u>Diameter:</u> 8,000 miles (13,000 km) <u>Distance to Sun:</u> 93 million miles (150 million km) <u>Orbits:</u> #18 <u>Composition:</u> Rock, minerals, surface water, oxygen & nitrogen atmosphere</p>	 <p>4</p> <p><u>Diameter:</u> 1,500 miles (2400 km) <u>Distance to Sun:</u> 4–9 billion miles (6–14 billion km) <u>Orbits:</u> #18 <u>Composition:</u> Probably covered in some kind of ice, frozen atmosphere</p>
 <p>5</p> <p><u>Size:</u> 21 x 8 miles (33 x 13 km) <u>Distance to Sun:</u> 145 million miles (233 million km) <u>Orbits:</u> #18 <u>Composition:</u> Rocky, but exact composition unknown, no atmosphere</p>	 <p>6</p> <p><u>Diameter:</u> 1,940 miles (3,122 km) <u>Distance to Sun:</u> 484 million miles (779 million km) <u>Orbits:</u> #10 <u>Composition:</u> Rock, covered in thin layer of ice, thin atmosphere</p>	 <p>7</p> <p><u>Diameter:</u> 10 x 5 miles (16 x 8 km) <u>Distance to Sun:</u> 46 million-3 billion miles (74 million – 4.8 billion km) <u>Orbits:</u> #18 <u>Composition:</u> Ices and minerals</p>	 <p>8</p> <p><u>Diameter:</u> 2.5 miles (4 km) <u>Distance to Sun:</u> 23 million miles (37 million km) to about 1 light year (6 trillion miles; 10 trillion km) <u>Orbits:</u> #18 <u>Composition:</u> Ices and minerals</p>



9

Size: 36 x 14 miles (58 x 23 km)
Distance to Sun: 266 million miles (428 million km)
Orbits: #18
Composition: Rocky, no atmosphere



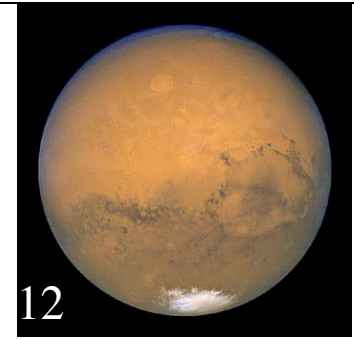
10

Diameter: 89,000 miles (143,000 km)
Distance to Sun: 483 million miles (777 million km)
Orbits: #18
Composition: Hydrogen & helium gas



11

Diameter: 2,159 miles (3,474 km)
Distance to Sun: 93 million miles (150 million km)
Orbits: #3
Composition: Rock, no atmosphere



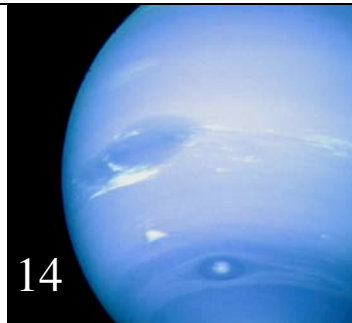
12

Diameter: 4,222 miles (6,795 km)
Distance to Sun: 142 million miles (229 million km)
Orbits: #18
Composition: Rock, iron, thin carbon dioxide atmosphere



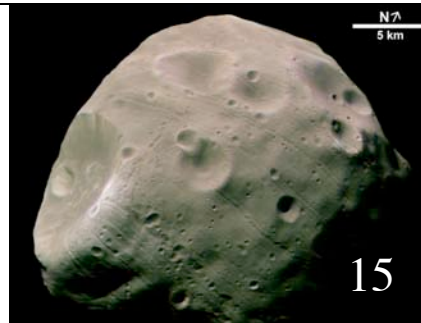
13

Diameter: 37 x 29 (59 x 47 km)
Distance to Sun: 245 million miles (394 million km)
Orbits: #18
Composition: Carbon, rock, no atmosphere



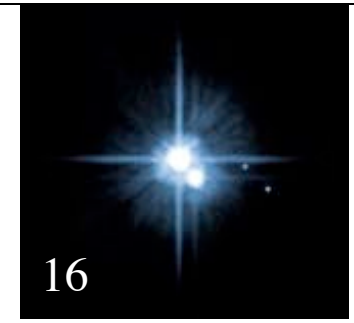
14

Diameter: 31,000 miles (50,000 km)
Distance to Sun: 2.8 billion miles (4.5 billion km)
Orbits: #18
Composition: Methane ice in the interior and methane gas in the atmosphere





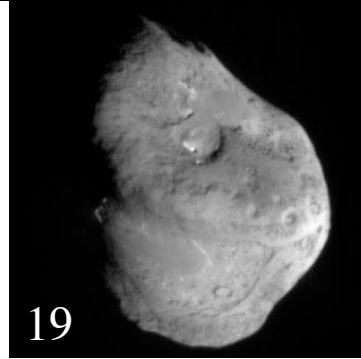



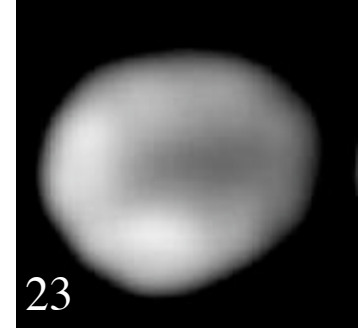

15

Diameter: 13 miles (21 km)
Distance to Sun: 142 million miles (229 million km)
Orbits: #12
Composition: Rock, carbon, ice, no atmosphere



16

Diameter: 1,423 miles (2,290 km)
Distance to Sun: 3-5 billion miles (5-8 billion km)
Orbits: #18
Composition: Probably rock and frozen nitrogen, thin nitrogen atmosphere

 <p>17</p> <p><u>Diameter:</u> 75,000 miles (121,000 km) <u>Distance to Sun:</u> 886 million miles (1.4 billion km) <u>Orbits:</u> #18 <u>Composition:</u> Hydrogen and helium gas, sulfur atmosphere</p>	 <p>18</p> <p><u>Diameter:</u> 870,000 miles (1.4 million km) <u>Distance to Sun:</u> n/a <u>Orbits:</u> center of the Milky Way Galaxy <u>Composition:</u> Hydrogen gas</p>	 <p>19</p> <p><u>Diameter:</u> 5 x 3 miles (8 x 5 km) <u>Distance to Sun:</u> about 140 million miles (225 million km) <u>Orbits:</u> #18 <u>Composition:</u> Ices and minerals</p>	 <p>20</p> <p><u>Diameter:</u> 3,200 miles (5,150 km) <u>Distance to Sun:</u> 886 million miles (1.4 billion km) <u>Orbits:</u> #17 <u>Composition:</u> Ice & rock, thick nitrogen atmosphere</p>
 <p>21</p> <p><u>Diameter:</u> 1,700 miles (2,700 km) <u>Distance to Sun:</u> 2.8 billion miles (4.5 billion km) <u>Orbits:</u> #14 <u>Composition:</u> Ice, probably no atmosphere</p>	 <p>22</p> <p><u>Diameter:</u> 7,500 miles <u>Distance to Sun:</u> 67 million miles (107 million km) <u>Orbits:</u> #18 <u>Composition:</u> Rock & minerals, thick carbon dioxide atmosphere with clouds of sulfuric acid</p>	 <p>23</p> <p><u>Diameter:</u> 330 miles (531 km) <u>Distance to Sun:</u> 219 million miles (353 million km) <u>Orbits:</u> #18 <u>Composition:</u> Rock, no atmosphere</p>	 <p>24</p> <p><u>Diameter:</u> 3 miles (5 km) <u>Distance to Sun:</u> 140-480 million miles (225-772 million km) <u>Orbits:</u> #18 <u>Composition:</u> Ices & minerals, no atmosphere</p>

Solar System Card Sorting: Key to the Images

1. **Ceres, dwarf planet** – The largest member of the Asteroid Belt, Ceres is now classified as a dwarf planet. Ceres' round shape suggests that its interior is layered like those of terrestrial planets, such as Earth. Ceres may have a rocky inner core, an icy mantle, and a thin, dusty outer crust. The Dawn mission will tell us more about Ceres.
Image credit: NASA, ESA, J. Parker (Southwest Research Institute), P. Thomas (Cornell University), L. McFadden (University of Maryland, College Park), and M. Mutchler and Z. Levay (STScI)
2. **Charon, satellite of Pluto** – Charon is not currently classified as a dwarf planet, like Pluto. The Pluto-Charon system has a center of gravity outside of the surface of either object, making it a unique case of a gravitational double system, or a binary planet. This is an issue that was not clearly resolved by the IAU vote. If Pluto is a dwarf planet is Charon one too?
Image credit: Dr. R. Albrecht, ESA/ESO Space Telescope European Coordinating Facility; NASA
3. **Earth, planet** – Earth is one of the four terrestrial (rocky) planets of the inner solar system (like Mercury, Venus, and Mars) and the only planet known to have life. *Image credit: NASA Goddard Space Flight Center*
4. **Eris, dwarf planet** – Eris was formerly known as 2003 UB313, also sometimes called the “tenth planet” and is now considered a dwarf planet. Its discovery in 2003 is part of what sparked the latest debate over the definition of a planet, since it is larger than Pluto and orbiting beyond Pluto’s orbit in the region of the Solar System known as the Kuiper Belt.
Image credit: W.M. Keck Observatory
5. **Eros, asteroid** – Eros is a member of the asteroid belt. In February 2000, it was visited by the robotic spacecraft NEAR-Shoemaker, which showed that Eros is a single uniform body and probably formed in the very early years of the Solar System.
Image credit: NEAR Project, NLR, JHUAPL, Goddard SVS, NASA
6. **Europa, satellite of Jupiter** – Europa is Jupiter’s 4th largest moon. When the Galileo spacecraft visited Jupiter, the orbiter sent back hundreds of images of the moons, showing evidence of liquid water under the surfaces of Europa, Ganymede and Callisto. *Image credit: NASA/JPL*
7. **Halley, comet** – The nucleus of a comet is like a dirty snowball. Comets come from a very cold region in the far reaches of our Solar System, called the Oort Cloud, and spend most of their time far from the Sun. When they do come close to the Sun, some of the ice in the nucleus burns off, producing the bright tail that we can see from Earth. The tail can reach 6 million miles in

length! The Giotto spacecraft produced this image. Its mission was to approach Halley and send back the first images of a comet's nucleus. *Image credit: ESA*

8. **Hyakutake, comet** – This image shows Hyakutake as seen from Earth. For an explanation of comets, see Halley above. *Image credit: Adam Block/NOAO/AURA/NSF*
9. **Ida, asteroid** – The Asteroid Belt is a region between the orbits of Mars and Jupiter. Ida is one of the over 100,000 asteroids found there. This image was taken by the Giotto spacecraft on its way to Jupiter. *Image credit: NASA/JPL*
10. **Jupiter, planet** – Jupiter is the largest planet in the Solar System. It is one of the four gas giants (like Saturn, Uranus, and Neptune), meaning it has no solid surface on which you could walk. There are many storms in the clouds of its atmosphere, including the famous Great Red Spot. *Image Credit: NASA/JPL/Space Science Institute*
11. **Luna, satellite of Earth** – The Moon is the Earth's only natural satellite. It is made of rock, covered in craters, and has no atmosphere. *Image credit: T.A.Rector, I.P.Dell'Antonio/NOAO/AURA/NSF*
12. **Mars, planet** – Like Mercury, Venus, and Earth, Mars is one of the four terrestrial (rocky) planets in the inner solar system and has the largest volcanoes in the solar system. It gets its reddish color from the iron oxide (rust) on its surface. *Image credit: NASA, J. Bell (Cornell U.) and M. Wolff (SSI)*
13. **Mathilde, asteroid** – Mathilde has probably been involved in some major collisions with meteoroids and other asteroids, producing many craters, including the large central one seen in this image. The Near Earth Asteroid Rendezvous (NEAR) spacecraft produced this image while on its way to Eros. *Image credit: NEAR Spacecraft Team, JHUAPL, NASA*
14. **Neptune, planet** – Like Jupiter, Saturn, and Uranus, Neptune is one of the four gas giants. Its bluish color comes from the methane gas in its atmosphere. *Image credit: JPL, NASA*
15. **Phobos, satellite of Mars** – This is one of Mars' two small moons (the other is Deimos), which were probably asteroids that were trapped by Mars' gravity. Phobos orbits so close to Mars (5,800 km above the surface – our Moon orbits 400,000 km from the Earth!) that it will spiral in toward the planet and eventually (in about 100 million years) crash into Mars or be crushed by the force. The debris will create a ring around Mars. *Image credit: G. Neukum (FU Berlin) et al., Mars Express, DLR, ESA*

16. **Pluto, dwarf planet** – Pluto, smaller than the Earth’s Moon and with a highly eccentric and tilted orbit, is classified as a dwarf planet. It is also one of the largest Kuiper Belt Objects (KBOs). The Kuiper Belt is a disk-shaped region beyond the orbit of Neptune. Over 800 KBOs have been discovered so far.
Image credit: NASA, ESA, H. Weaver (JHU/APL), A. Stern (SwRI), and the HST Pluto Companion Search Team
17. **Saturn, planet** – Saturn is also a gas giant (like Jupiter, Uranus, and Neptune). It is known for its magnificent ring system, though the other gas giants have rings as well.
Image credit: CICLOPS, JPL, ESA, NASA
18. **Sol, star** – Sol, our Sun, is the only star in our solar system. The planets and other solar system objects orbit the Sun.
Image credit: SOHO
19. **Tempel 1, comet** – The Deep Impact spacecraft produced this image about 5 minutes before smashing into the comet’s surface. NASA sent the spacecraft to find out more about the comet and the craters on its surface. For more about comets, see Halley above. *Image credit: NASA/JPL-Caltech/UMD*
20. **Titan, satellite of Saturn** – Titan is Saturn’s largest moon. Its diameter is 3,200 miles, the size of the United States! It is the only moon in the solar system with a thick atmosphere. *Image credit: NASA/JPL/University of Arizona*
21. **Triton, satellite of Neptune** – Triton is covered in ice and may have a weak atmosphere, meaning it could possibly be suitable for life. *Image credit: NASA*
22. **Venus, planet** – Venus, like Mercury, Earth, and Mars, is one of the terrestrial (rocky) planets in the inner solar system.
Image credit: Magellan Project, JPL, NASA
23. **Vesta, asteroid** – Vesta has an interesting surface with clear light and dark regions, unlike most other asteroids, meaning that it is made up of many different elements. *Image credit: STScI, B.Zellner(GA Southern Univ.), NASA*
24. **Wild 2, comet** – The Stardust mission spacecraft produced this image of Wild (pronounce “Vilt”) 2, while passing close to the comet in order to collect samples of the interstellar dust from the comet. *Image credit: Stardust/NASA/JPL*

Solar System Object Categories

Star – A star is a giant ball of gas that gives off energy (light) due to thermonuclear reactions. Our Sun is the only star in the Solar System, but is one of about 200 billion stars in the Milky Way Galaxy.

Planet – According to the resolution passed by the International Astronomical Union (IAU) in 2006:

A planet is a celestial body that

- (a) is in orbit around the Sun,
- (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape, and
- (c) has cleared the neighborhood around its orbit.

Dwarf Planet - According to the resolution passed by the IAU in 2006:

A "dwarf planet" is a celestial body that

- (a) is in orbit around the Sun,
- (b) has sufficient mass for its self-gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape,
- (c) has not cleared the neighborhood around its orbit, and
- (d) is not a satellite.

Moon / Satellite – A satellite (moon) is an object that orbits around a planet or dwarf planet.

Comet – A comet is a small body that orbits the Sun, usually with a highly elliptical orbit, and that exhibits a coma (atmosphere) and tail when it approaches the Sun. Comets belong to a bigger category known as “Small Solar System Bodies,” a term introduced by the IAU in 2006.

Asteroid – An asteroid is a small body that orbits the Sun, usually within the Asteroid Belt, a region of the Solar System between the orbits of Mars and Jupiter. Asteroids also belong to the category “Small Solar System Bodies” (see “Comet” above) and have also been referred to as minor planets. All the asteroids put together would only have a diameter about half that of the Earth’s Moon.