Syllabus subtopic: Awareness in the fields of IT, Space, Computers, robotics, nanotechnology, bio-technology and issues relating to intellectual property rights.

Prelims and mains focus: About NASA’s missions to Mars and their achievements, India’s MOM.

News: Nasa scientists have developed a map detailing the presence of water ice on Mars, with some believed to be as little as 2.5 centimetres below the Red Planet’s surface.

What is it about?

The researchers, including those from Nasa’s Jet Propulsion Laboratory in California, said in a statement that water ice will be a key consideration for any potential landing site on Mars.

In the current study, published in the journal Geophysical Research Letters, the scientists used data from two satellites orbiting the Red Planet—Nasa’s Mars Reconnaissance Orbiter (MRO), and Mars Odyssey orbiter—to locate water ice that could potentially be within reach of astronauts.

The regions noted in the study are near the Martian poles, and have been studied by Nasa’s Phoenix lander, which scraped up ice, and by the MRO, which has taken images from its orbit of meteor impacts that have excavated this ice.

“You wouldn’t need a backhoe to dig up this ice. You could use a shovel,” said study’s lead author, Sylvain Piqueux. “We’re zeroing in on the best places for astronauts to land,” Piqueux said.

About Mars

Mars is known as the red planet because it looks red from Earth. The reddish color comes from the high concentration of iron oxide compounds—that is, rust—in the rocks of the Martian surface. Some key facts about Mars are as follows:

- Martian year is of 687 days and Martian day is 24h 37m.
- Martian atmosphere is very thin—only about 7000th the density of Earth’s atmosphere. The atmosphere is mostly carbon dioxide, with tiny fractions of Oxygen, Nitrogen and other gases.
- At the equator, during the warmest times of the Martian summer, the temperature can reach nearly –18°C at the poles, during the coldest times of the Martian winter, temperatures drop to -85°C and beyond.
- Mars is known for fascinating geologic features on its surface; it is covered with all sorts of mountains, craters, channels, canyons, highlands, lowlands, and even polar ice caps.
- Scientific evidence strongly suggests that once, billions of years ago, Mars was much warmer than it is now, and was an active, dynamic planet.
Polar Ice Caps on Mars

Polar Ice Caps were first observed by Italian astronomer Gian Domenico Cassini, who is known for many important discoveries, including a gap in Saturn’s rings (This is called Cassini division).

He made detailed observations of Mars, and discovered light-colored patches at the Martian north and south poles. These polar caps showed seasonal variations, spreading during the Martian winter and shrinking during the summer.

Martian polar ice caps are made up mostly of frozen carbon dioxide (dry ice). Some frozen water, or just plain ice, may also be embedded within the polar caps. Due to the atmospheric conditions on the surface of Mars, however, neither the ice nor the dry ice would melt to make water or liquid carbon dioxide when the temperatures go up; rather, they would sublime, or turn directly into gas. Thus, polar ice caps on Mars are not a source of liquid water.

Geological features of Mars

Mars has a rich variety of geological features: huge craters, broad plains, tall mountains, deep canyons, and much more, all with colorful names.

The tallest mountain in the solar system, the extinct volcano Olympus Mons, rises 24 kilometers above the Martian surface.

A massive canyon called the Vallis Marineris (Mariner Valley) cuts across the northern hemisphere of Mars for more than 3,200 kilometers; it is three times deeper than the Grand Canyon on Earth.

On the southern hemisphere of Mars is Hellas, an ancient canyon that was probably filled with lava long ago and is now a large, light area covered with dust.

Martian meteorite ALH84001

ALH84001 was so named because it was found in the Allan Hills region of Antarctica in 1984. It is the most famous of a number of meteorites that are thought to have been pieces of the Martian surface millions of years ago.

They were probably knocked loose by a powerful collision from a comet or asteroid, which sent pieces of rock into orbit around the Sun that later landed on Earth.

Mars Exploration Rovers, Spirit and Opportunity, are geological robots that have explored several areas of Mars. Among the many discoveries made with them are minerals that form only in the long term presence of water; microscopic mineral structures nicknamed “blueberries” that only form when moisture is present, along with chemical and isotopic ratios in Martian rocks that would have formed only if liquid water were in the environment.

The strong scientific conclusion is that Mars is currently dry on its surface, but that this was not
always the case. It may even have been awash with liquid water billions of years ago.

**Moons of Mars – Phobos and Deimos**

Phobos and Deimos are irregularly shaped rocky objects. They look very much like asteroids. **Phobos is about 10 miles across, and Deimos is about half that size.** The proximity of Mars to the asteroid main belt, suggests that they were indeed once asteroids whose orbits took them close to Mars. The orbital conditions were just right for Mars to capture them with its gravity, causing them to enter into stable orbits around Mars.

**Note:** to know about all the Mars missions of NASA click on the link below:


**India’s Mars Orbiter Mission (MOM)**