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| **Discovery Sheet : The Chemistry of Planets and their Satellites**(Student worksheet for "[Cosmic Chemistry](http://can-do.com/uci/ssi2000/cosmicchemistry.html)" Web Quest") http://can-do.com/uci/ssi2000/divider.gif |
| http://can-do.com/uci/ssi2000/nineplanets32.gif   Directions: Use the Internet web sites below along with any text resources that you have to answer the questions. Some of the questions require only that you locate specific information, other questions (a bit more challenging) involve more critical thinking, requiring you to make inferences and draw conclusions about the information you find. http://can-do.com/uci/ssi2000/divider.gifhttp://can-do.com/uci/ssi2000/nineplanets32.gif   Web Resources: Use these links as your primary resources for finding the answers to the questions below. * [Web Elements--excellent](http://www.webelements.com/index.html) resource for finding information on elements
* [Chemistry OnLine Textbook--good](http://library.thinkquest.org/3310/higraphics/textbook/u01s01.html#Introduction) source for review of basic concepts; chapter one contains (bottom of page) info on classification of matter
* [The Nine Planets--outstanding](http://www.seds.org/billa/tnp/) comprehensive resource on the planets
* [Astronomy](http://solarviews.com/eng/toc.htm)--great resource for your research
* [Astronomy-A Brief Edition](http://www.astro.uiuc.edu/~kaler/AstroBrief/FramesIdx.html)--refer to chapters on planets
* [The Nature of the Stars](http://www.astro.uiuc.edu/~kaler/sow/star_intro.html)--another good resource
* [Planetary Fact Sheet--includes](http://nssdc.gsfc.nasa.gov/planetary/factsheet/venusfact.html) tables of information on planets
* [Ice Mountains on Titan--article](http://www.spaceviews.com/2000/08/17a.html) on the composition of Titan (a Saturn moon)
* [Oily Ocean Found on Distant Moon--article](http://news.bbc.co.uk/hi/english/sci/tech/newsid_406000/406859.stm) on possible hydrocarbon seas on Titan
* [Liquid water on Mars surface?--very](http://www.solarviews.com/eng/marspr3.htm) recent discoveries and ideas about water on Mars
* Stardate Online--outstanding resource--short articles on many astronomy subjects; provides good info on planetary chemistry; the links below are all from this site:
	+ [Venus--good](http://stardate.utexas.edu/resources/ssguide/venus.html) site on Venus' greenhouse effect and surface composition
	+ [Pluto--good](http://stardate.utexas.edu/resources/ssguide/pluto.html) site on Pluto's composition
	+ [Mercury--provides](http://stardate.utexas.edu/resources/ssguide/mercury.html) information on composition of Mercury's surface and the possibility of water ice on its hot surface!
	+ [Jupiter--this](http://stardate.utexas.edu/resources/ssguide/jupiter.html) site presents info on the chemistry of Jupiter's atmosphere, "surface", and core; it also is a great source for chemistry info on Jupiter's moons
	+ [Saturn--similar](http://stardate.utexas.edu/resources/ssguide/saturn.html) to the format of previous links from Stardate Online; includes a nice overview of the current Casssini mission
	+ [Mars--interesting](http://stardate.utexas.edu/resources/ssguide/mars.html) info on the chemistry of Mars
	+ [Neptune--emphasis](http://stardate.utexas.edu/resources/ssguide/neptune.html) is given on atmosphere composition
	+ [Uranus--brief](http://stardate.utexas.edu/resources/ssguide/uranus.html) summary of properties, including chemistry of the atmosphere
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| http://can-do.com/uci/ssi2000/divider.gifhttp://can-do.com/uci/ssi2000/nineplanets32.gif    Discovery questions: Answer the following using the web resources above. A. A brief chemistry review (pertinent to Cosmic Chemistry) 1. Explain the differences between elements, compounds, and mixtures. Give three examples of each.
2. How many elements occur naturally on our earth? Do most of these exist in their elemental form (the pure, uncombined element) or are they usually combined into compounds? Which elements are more likely to be found in their elemental form--stable elements or reactive elements?
3. No unknown elements were found when we explored the surfaces of the moon or mars. Why is it not likely that any new *elements* would be discovered? Why is it much more possible that new compounds could be discovered on other worlds.
4. State the three phases of matter. Explain how the arrangement of particles (atoms or molecules) differ in each phase.
5. What is a phase change? Name three phase changes.
6. What is sublimation?
7. Explain the effect of atmospheric pressure on the boiling point of water (or any liquid)?
8. How can water be made to boil *above* its normal boiling point of 100 C? How could it be made to boil *below* its normal boiling point?
9. Explain why the following statement is not entirely correct: "Water is a liquid". (hint: can water exist in other phases?)
10. Explain why the following statement is not entirely correct: "Iron is a solid".
11. Explain why the following statement is not entirely correct: "Oxygen is a gas".
12. At room temperature (about 20 C), water is a liquid, nitrogen is a gas, and sodium chloride (table salt) is a solid. Which one of these has the strongest forces of attraction among its particles?  Which one has the weakest?  Explain your answers.
13. On our planet, how is it that water can be found in nature as a liquid, solid, and a gas.
14. Look up information on hydrogen. What temperatures would have to exist on the surface of a planet or moon to have **an ocean of liquid hydrogen**? (Believe it or not, hydrogen seas do exist in our solar system.)
15. Look up information on nitrogen. What temperatures would have to exist on the surface of a planet or moon to have **solid nitrogen rocks**? (you guessed, it solid nitrogen rocks are thought to exist in our solar system)

B. The chemistry of planets and their satellites 1. Which planets are referred to as "terrestrial planets"?
2. Which planets are refereed to as "gaseous planets"?
3. It is thought that water ice may exist on the surface of Mercury. Where on the surface might this water exist?
4. Recently, it has been discovered that the Moon may have water ice on its surface. Where on the surface might this water exist? Name the two probes that lead to this discovery.
5. What elements and/or compounds are found in the clouds of Jupiter?
6. A vast ocean of what element may exist below the clouds of Jupiter?
7. What moon of Jupiter probably has a crust of frozen water up to 500 miles thick?
8. What moon of Jupiter has active volcanoes? What chemical substance is ejected from these volcanoes?
9. Jupiter's moon Europa may have oceans of what substance beneath a layer of ice?
10. What moon of Jupiter may be the best "candidate" for the presence of life in our solar system? Why?
11. What element that is common in Earth's atmosphere may exist as solid rocks on the surface of Pluto?
12. How does the atmosphere of Pluto change from its position farthest from the sun to its position nearest to the sun?
13. Why does Neptune appear blue through a telescope?
14. Discuss the chemical composition of Saturn's rings and Saturn's atmosphere?
15. How deep is the liquid hydrogen ocean on Saturn thought to be?
16. What is the name of the probe currently heading to Saturn? One objective of this probe is to  investigate the moon Titan. What compound is thought to exist in the atmosphere of Titan?
17. Describe the composition of the atmosphere of Mars?
18. Compare the atmospheric pressures on the surfaces of Earth, Mars, and Venus? What causes these differences?
19. Why does Mars appear red? (be sure to describe the chemical reaction that produced the red compound)
20. What is the makeup of the Martian polar ice caps?
21. The surface temperature of Mars can be above 0 C (above the freezing point of water). Given this fact, why is it unlikely that *liquid* water is present on the surface of Mars. (hint: consider the Martian atmospheric conditions)
22. What evidence do we have that liquid water may once have flowed on the surface of Mars?
23. During the Mars summers, the Martian ice caps become smaller? Do they *melt?* If not, where does this material go? (name the phase change)
24. A very recent discovery provides evidence for the possibility of *liquid* water just beneath Mars surface. What surface features lead planet scientists to make this inference? What is the name of the probe that provided pictures of these features that lead to this discovery?
25. What is the composition of Venus's clouds?

C. "What if...?" * *"What if"* the Earth and Jupiter exchanged places . For each planet in its new location, describe changes in the atmosphere and the surface. (For example, what would happen to the earth's oceans?)
* "*What if"* you traveled in a space craft to Saturn's moon Titan. What type of vehicle might you need to move about of the surface of this moon?
* *"What if"* you traveled to the surface of Venus. Why would the walls of your spacecraft (or your spacesuit) need to be structurally very strong?  When our astronauts went to the moon, the Lunar Excursion Module that landed on the moon had very thin, weak walls. Why was this possible on the Moon, but would not be possible on Venus?
* *"What if"* you traveled to Mars (perhaps you may someday--find NASA's timeline for a manned mission to Mars!) Once on the surface would you need a spacesuit that is very structurally strong? Why or Why not?
* *"What if"* you were on the surface of Mars on a warm summer day with the temperature 27 C (about 80 F). You opened a container that contained liquid water.  What would happen to the liquid water? At the same temperature on earth, why does this not take place?
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