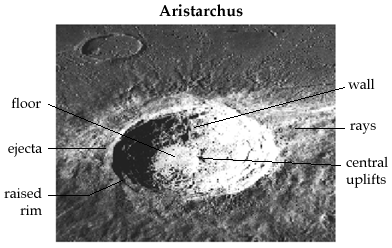
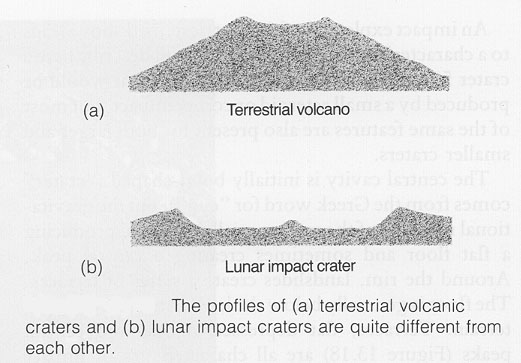
**Planetary Geology**

**Purpose:** Identify surface features of selected planets (and our moon) and understand the geologic processes and geologic history that shaped these surface features.

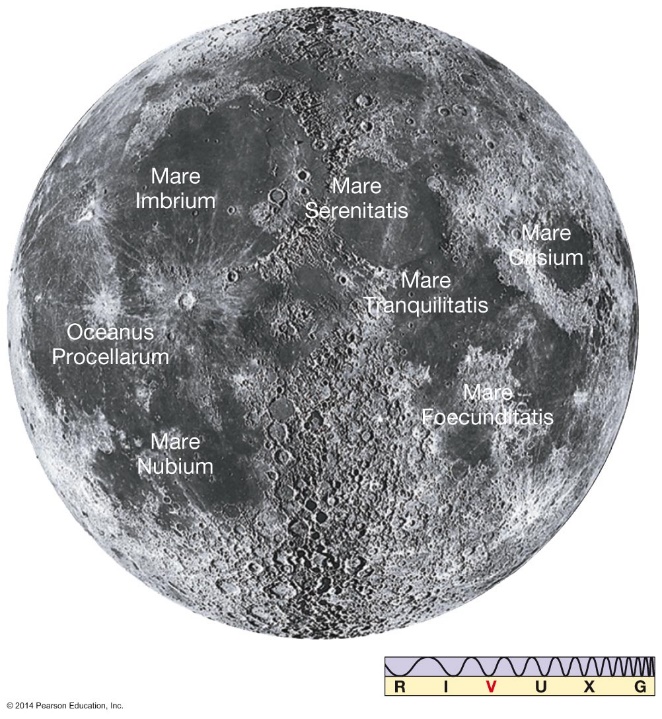
**Items:** Computer

**Introduction:** At a global scale, the largest planetary landforms and regions are visible and can be identified. Such landforms include large volcanoes, canyons, impact craters, plains regions, mountains, and highlands. Although the Moon and planets formed at the same time (about 4.5 billion years ago) their surfaces differ in age. This difference is due to variation in the levels of geologic activity on each body since their formation. **The four main geologic processes (**[**volcanism, tectonism, gradation, and impact cratering**](http://www.spacegrant.hawaii.edu/class_acts/GeologyChartNotes.html)**)** have worked to alter the original surfaces. In comparing planetary surfaces, relative ages are usually determined from impact craters. In general, older surfaces show more craters, larger craters, and more degraded craters than younger surfaces.

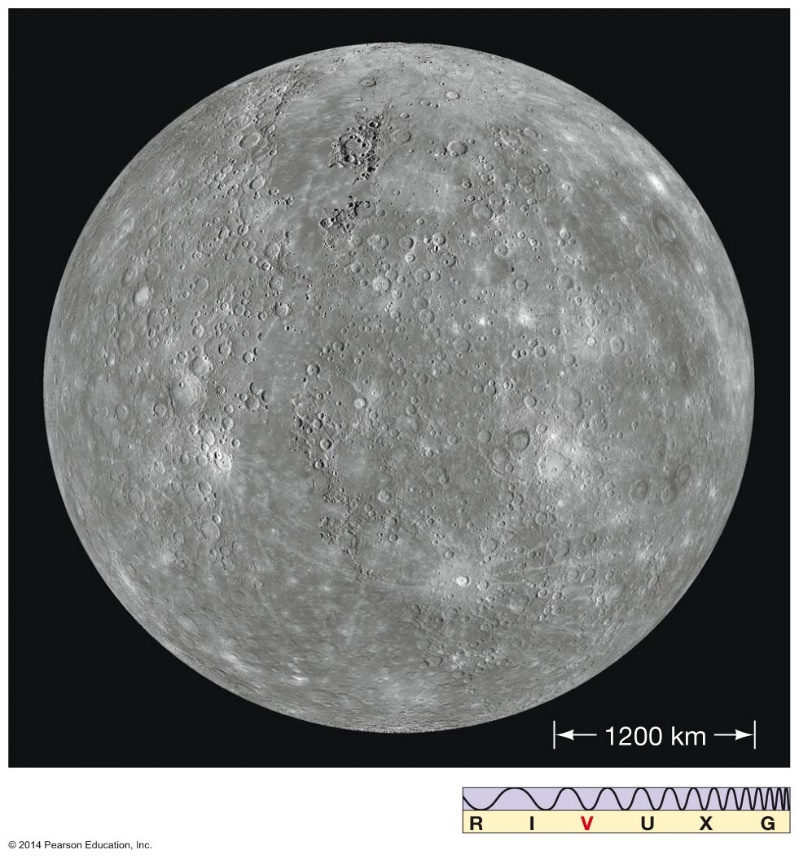
Both volcanism and impact cratering can cause large bowl-shaped cavities on the surface called craters. However, craters from impact (bottom in the picture) show different features comparing to those from volcanism. Impact craters may have **central peaks, ejecta, raised rims, rays and floors that are lower in elevation than the surrounding terrain.** While the collapse of the top of a volcano creating a crater termed caldera, which may have a cone or flanks associated and usually higher in elevation than the surrounding terrain (top in the picture).



**Procedure:**

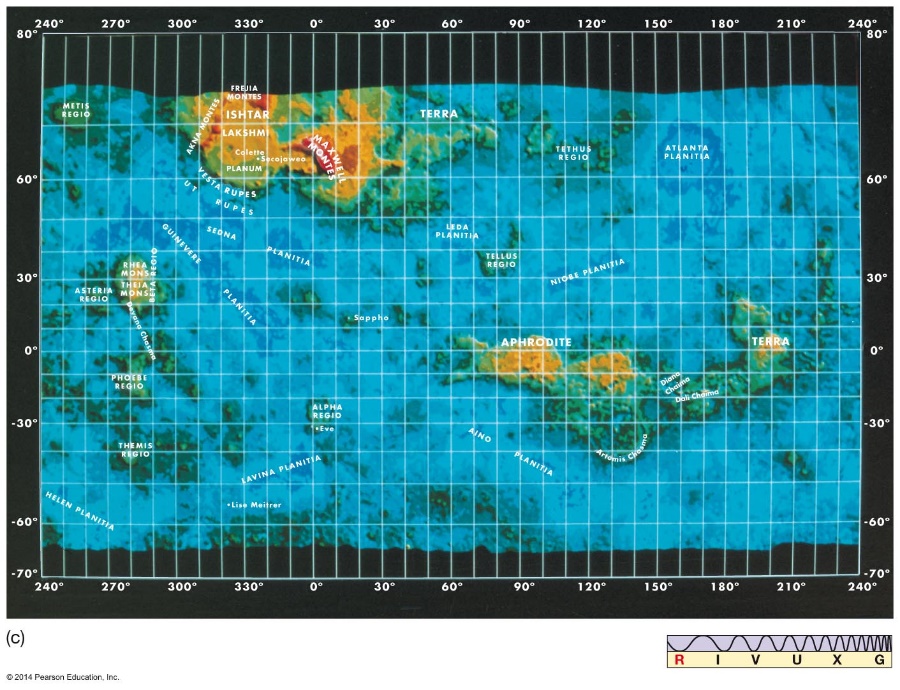
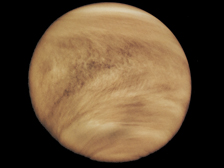
**Part I: The Moon,** The satellite photograph shows the near side of the Moon. The dark flat areas are called maria and lighter elevated areas are called highlands.

1. Which of the two regions, maria or highlands appears to be mostly heavily cratered?
2. Which region on the Moon is younger – maria or highland? Explain your reasoning.
3. Some large, young craters have bright ejects deposits that form a star-like pattern of rays around them. Circle one of such craters on the map. Is this crater older or younger than maria? Explain your reasoning.

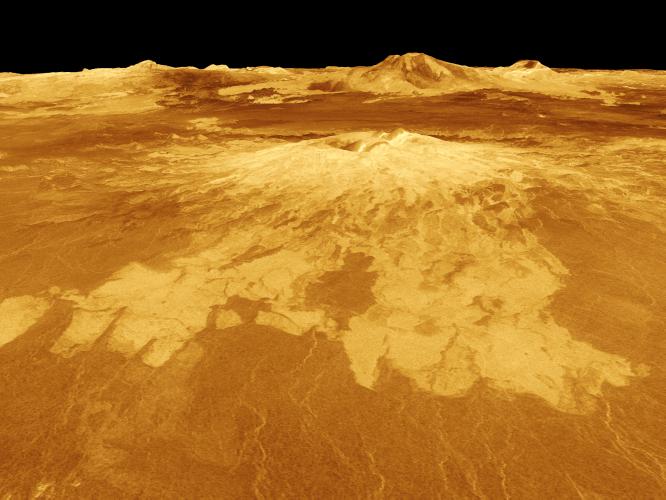


**Part II: Mercury,** The satellite photograph shows almost a half of Mercury’s surface.

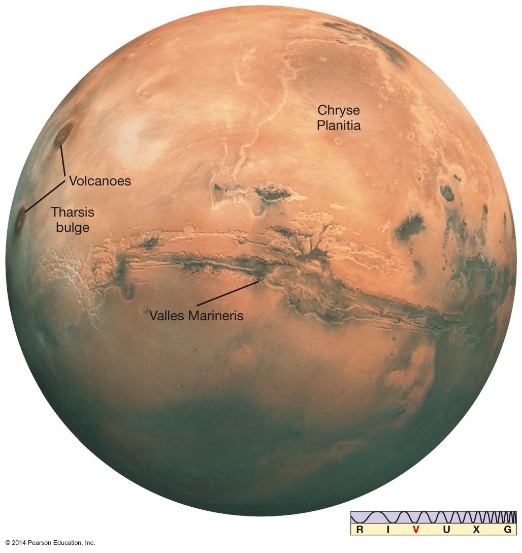
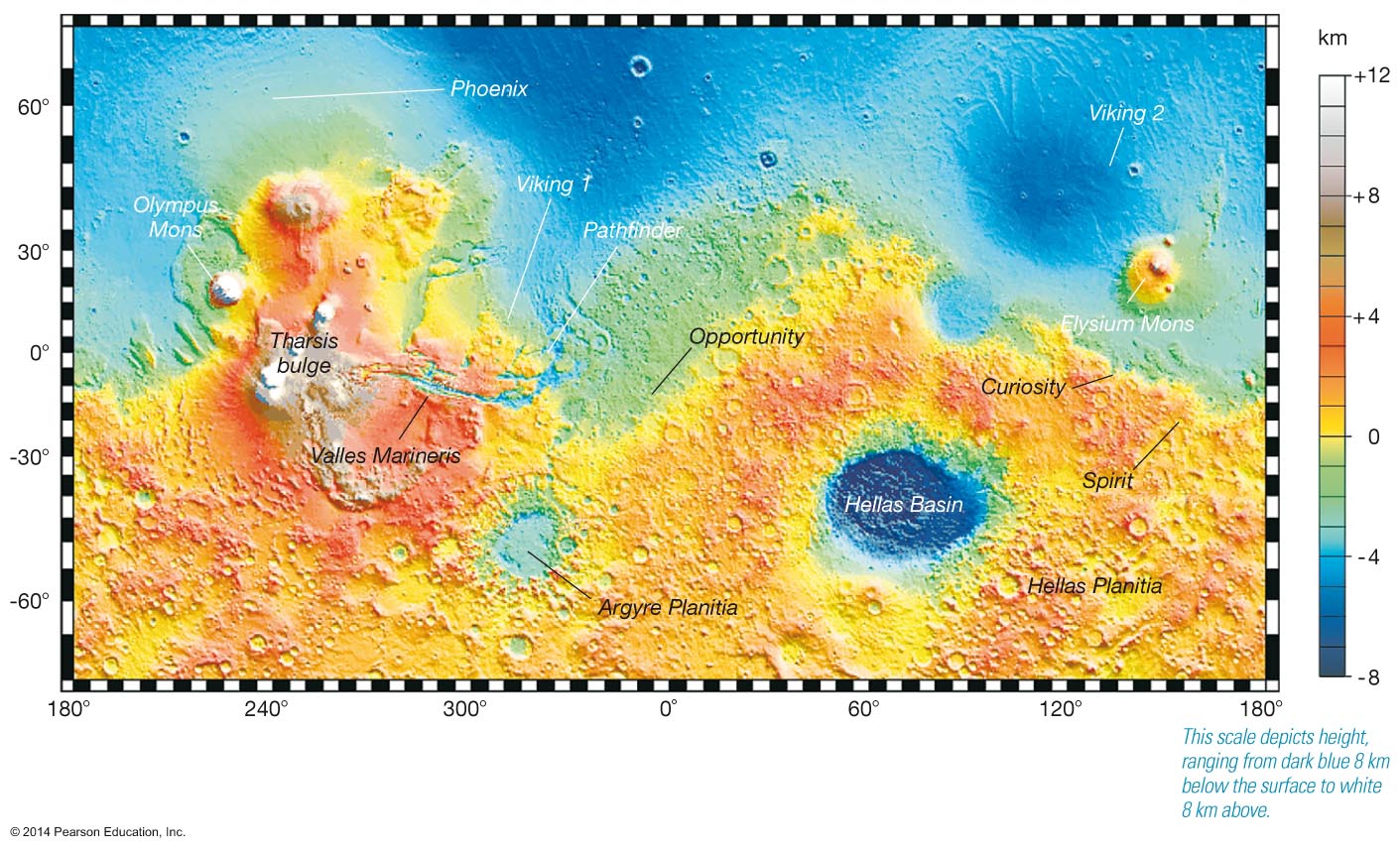
1. Any evidence of an atmosphere? Describe the evidence you do see, or would expect to see but don’t?
2. Which of the four major geological processes was mostly involved in creating the surface features on Mercury?
3. What does the almost complete coverage of Mercury's crust by impact craters tell you about the history of geological activity on this planet? Keep in mind heavy bombardment creating most of these craters have occurred approximately 4.1 to 3.8 billion years ago.
4. Bases on the number of craters, do you think the surface of Mercury is older, younger, or about the same age as the maria on the Moon?
5. Take a look at the crater circled at the bottom of the image. Describe at least two pieces of evidence which suggest that it probably formed by meteorite impact.

**Part III: Venus** The images of Venus was taken using optical camera (left) and radar camera (right)

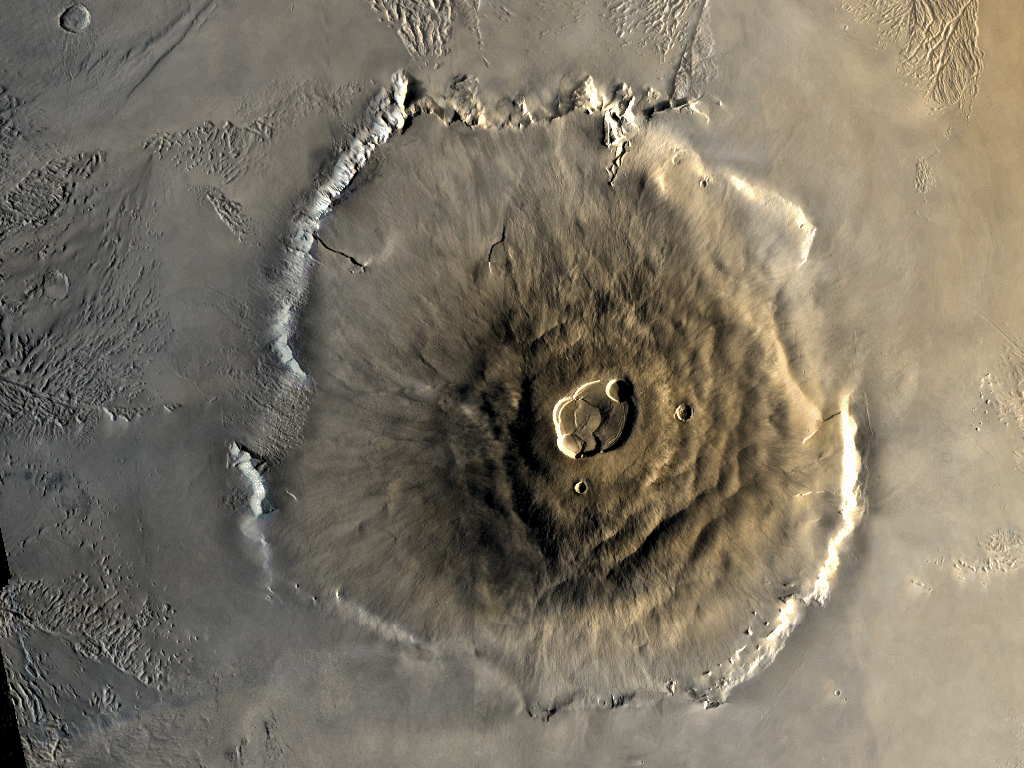
1. Any evidence of an atmosphere? Describe the evidence you do see, or would expect to see but don’t?
2. Which of the four major geological processes was mostly involved in creating the surface features on Venus?
3. Why is the surface of Venus different from Mercury? (list reasons that support your answer)
4. Bases on the number of craters, do you think the surface of Venus is older, younger, or about the same age as Mercury?
5. Why did radar have to be used to get images of the surface of Venus from a satellite? (The answer to this question can’t be seen in the image.)

The picture on the right shows Sapas Mons in the foreground on Venus

1. How can you tell that the crater in Sapas Mons is not an impact crater?
2. Does Venus have any impact craters? (you can refer to the slides used in class to answer this question)

**Part IV: Mars** The images of Mars, mars globe (left) and Mars map (right)

1. Which planet looks more like Mars at the global scale, Mercury or Venus? Explain your reasoning.
2. Bases on the number of craters, which part of Mars is older, the northern or the southern region?

Olympus Mons is a giant shield volcano, with a multiple collapse caldera at its center. A caldera is an extra-wide volcanic crater that is typical of shield volcanoes. Olympus Mons is a volcano, not an impact crater. In the center of Olympus Mons is a wide volcanic crater, or caldera.

1. How can you tell that the crater at the center of Olympus Mons is not an impact crater?
2. Do you see any probable impact crater in the image? circle them on the image.



Valleys west of Chryse Planitia similar to some river systems on Earth, these Martian channels have a branching pattern shown in this image

1. Which of the four major geological processes was mostly involved in creating the flowing, river-channel-like features in this image?
2. Was it wind or a liquid like water? What evidence leads you to think so?
3. Which way was it flowing (towards top or bottom, left or right of the picture)?
4. Based on the number and morphology of craters, is this a relatively old or young region of Mars?
5. Are the craters you observed older or younger than the valleys? Justify your answer.
6. How is the evidence of abundant liquid water in the past history of Mars relevant to the possibility that there may once have been life on Mars?