

Introduction to the Geology of the Terrestrial Planets

Names: _____

1. On which of the five objects are large meteorite impact craters obvious? **(1 point)**

2. Does Venus or the Earth show any signs of large, round maria (like those seen on the Moon or Mercury)? **(1 point)**

3. Which planet seems to have the most impact craters? **(1 point)**

4. Compare the surface of Mercury to the Moon. Are they similar? **(3 points)**

5. Using the above information, make an educated guess on why Mercury does not have as many large maria as the Moon, even though both objects have been around for the same amount of time. [Hint: Maria are caused by the impacts of *large* bodies.] **(3 points)**

Mercury and the Moon do not have atmospheres, while Mars has a thin atmosphere. Venus has the densest atmosphere of the terrestrial planets.

6. Does the presence of an atmosphere appear to reduce the number of impact craters? Justify your answer. **(3 points)**

7. Which planet seems to have the least amount of relief (relief = high and low features)? **(2 points)**

8. Which planet seems to have the deepest/lowest regions? **(2 points)**

9. Which planet seems to have the highest mountains? **(2 points)**

On both the Venus and Mars topographic maps, the polar regions are plotted as separate circular maps so as to reduce distortion.

10. Looking at these polar plots, Mars appears to be a very strange planet. Compare the elevations of the northern and southern hemispheres of Mars. If Mars had an abundance of surface water (oceans), what would the planet look like? **(3 points)**

Exercise #3:

11. Compare the impact craters seen on Mercury, Venus, Earth, and Mars. How are they alike, how are they different? Are central mountain peaks common to craters on all planets? Of the sets of craters shown, does one planet seem to have more lava-filled craters than the others? **(4 points)**

12. Which planet has the sharpest, roughest, most detailed and complex craters? [Hint: details include ripples in the nearby surface caused by the crater formation, as well as numerous small craters caused by large boulders thrown out of the bigger crater. Also commonly seen are “ejecta blankets” caused by material thrown out of the crater that settles near its outer edges.] **(2 points)**

13. Which planet has the smoothest, and least detailed craters? **(2 points)**

14. What is the main difference between the planet you identified in question #12 and that in question #13? [Hint: what processes help erode craters?] **(2 points)**

15. Describe the differences between young and old craters on the Earth. What happens to these craters over time? **(4 points)**

Exercise #4:

16. Do the sand dunes of Earth and Mars appear to be very different? Do you think you could tell them apart in black and white photos? Given that the atmosphere of Mars is only 1% of the Earth's, what does the presence of sand dunes tell you about the winds on Mars? **(3 points)**

Exercise #5:

17. The drainage pattern for streams and rivers on Earth has been termed “dendritic”, which means “tree-like”. In the first photo at this station (#23) is a dendritic drainage pattern for a region in Yemen. Why was the term dendritic used to describe such drainage patterns? Describe how this pattern is formed. **(3 points)**

18. The next photo (#24) is a picture of a sediment-rich river (note the brown water) entering a rather broad and flat region where it becomes shallow and spreads out. Describe the shapes of the “islands” formed by this river. **(3 points)**

19. Describe what you see in this image from Mars (Photo #26). **(2 points)**

20. What is going on in this photo (#27)? How were these features formed? Why do the small craters not show the same sort of “teardrop” shapes? **(2 points)**

21. Here are some additional images of features on Mars. The second one (Photo #29) is a close-up of the region delineated by the white box seen in Photo #28. Compare these to the Nile. **(2 points)**

22. While Mars is dry now, what do you conclude about its past? Justify your answer. What technique can we use to determine when water might have flowed in Mars' past? [Hint: see your answer for #20.] **(4 points)**

Exercise #6:

23. Identify and describe several apparent tectonic features on the topographic map of the Earth. [Hint: North and South America are moving away from Europe and Africa]. **(2 points)**

24. Now, examine the topographic maps for Mars and Venus (ignoring the grey areas that are due to a lack of spacecraft data). Do you see any evidence for large scale tectonic activity on either Mars or Venus? **(3 points)**

25. Here are some images of Martian volcanoes (Photos #37 to #41). What one type of volcano does Mars have? How did you arrive at this answer? **(2 points)**

26. In the next set (Photos #42 to #44) are some false-color images of Venusian volcanoes. Among these are both overhead shots, and 3D images. Because Venus was mapped using radar, we can reconstruct the data to create images as if we were located on, or near, the surface of Venus. *Note, however, that the vertical elevation detail has been exaggerated by a factor of ten!* It might be hard to tell, but Venus is also dominated by one main type of Volcano. What is it? **(5 points)**