Film

Terra Firma

Objectives
• The relationship between heat sources and volcanism;
• Volcanic activities (including cryovolcanism) on terrestrial planets and terrestrial-like planetary bodies
• Impact cratering on terrestrial planets and terrestrial-like planetary bodies.

Questions
1. Fill out the blank:
Mars    Earth    Venus    Saturn    Jupiter    Moon
Martian    Lunar

2. Arrange the following in the order of increasing technical difficulties:
A. Sample-return mission
B. Lander probe
C. Flyby
D. Orbiter
E. Manned mission

*** What are the new challenges for each higher-level mission?

3. What observation(s) suggests that the Earth is an active planetary body, whereas the Moon is not?

4. Did Viking find any on-going geological activities on Mars?

5. What is the main challenge Russian engineers and scientists have to deal with in order to see through Venus’ “veil” in their Venera mission? What new approach did Magellan take to solve the problem?

6. Venus’ surface is dominated by
A. Impact craters
B. Volcanic activities
C. Hydrological processes
D. Plate tectonics

7. Mercury’s surface is dominated by
A. Impact craters  
B. Volcanic activities  
C. Hydrological processes  
D. Plate tectonics  

8. Active volcanoes were found on Venus. True or False?  

9. Why do we say that “there is no geology on Jupiter”?

10. Thousand-mile long channels were found on Venus’ surface. What are they? How are they formed?

**Advanced Questions**

1. How can you determine the age of a planetary surface? Is the age of the planet the same everywhere (e.g. the core and the surface)?  
2. How do impact craters and volcanic craters differ on an aerial photograph?  
3. Instead of being a simple bowl-shaped depression, some impact craters have central peaks and terraces. How did the central peaks and terraces form?

**Keys**

1. Terrestrial, Venusian, Saturnian, Jovian or Galilean  
2. C, D, B, A, E  
3. Earth has active volcanoes, plate tectonics, weathering and erosion processes, etc. The Moon does not (one indication is the abundant craters on lunar surface).  
4. No, only records of past activities.  
5. An optical probe has to penetrate through Venus’ heavy cloud in order to see its surface. Due to the high pressure (about 100 bars, or 100 times of the atmospheric pressure on Earth) and high temperature (about 500 °C) on Venusian surface, in Venera missions, probes were crushed and optical lens were molten within a couple of hours. Magellan used Radar (radio detection and ranging) imaging technique instead of optical probes. Radar signals can penetrate Venus’ “veil” from above the heavy cloud.  
6. B  
7. A  
8. False  
9. Jupiter is a gas giant. It does not have a solid surface.  
10. It has been proposed that these long channels are lava tubes. It is very unlikely that basaltic lava on Earth can travel for that long. However, we know that carbonatite (rich in calcium carbonate, CaCO₃) lava has a much lower eruption temperature than basaltic lava. The surface temperature of Venus can be as high as nearly 500 °C. If carbonatite lava erupted on the surface of Venus, it may stay molten for a long time, travel great distances, and cut channels in much the same manner as rivers do on Earth.