SPASH ASTRONOMY
CHAPTER 9: VENUS
OVERHEAD LECTURE NOTES

1. Why is Venus regarded as Earth's sister planet?
Venus has about 95% of the Earth's diameter and about 82% of its mass, thus is about the same size as Earth but has no moon.

2. Why isn't Venus one of the best-observed planets? It is the closest.
Venus is completely covered by clouds. The brilliant, yellowish-white, nearly blank cloud layer is the first feature to impress a telescopic observer.

3. Distinguish between Retrograde rotation and Prograde rotation. Which does Venus have and why?
Mercury, Earth, and Mars all have prograde rotation (as they spin from west to east), however, Venus has retrograde rotation as it spins from east to west. The cause of the unusual reverse spin may involve tidal forces between the Earth and Venus or an ancient collision with a body larger than our Moon.

4. Name at least six interesting statistics about Venus.
Venus' spin takes 243 days to make a complete turn on its axis. Like Mercury however, the length of the day (from sunrise until the next sunrise) on Venus is complicated by the combination of the rotation and the period required to go around the Sun (225 days). Thus sunrise until the next on Venus is 117 Earth days. Daylight lasts 58.5 days, followed by a hot night of 58.5 days.
Atmosphere of Carbon Dioxide, constant Temps. over 890° F, 90 times the surface pressure, and very high clouds rain sulfuric acid, WOW!
Venus' atmosphere is about 96% CO_2 where Earth has 0.03% and Earth has 78% N_2 and 21% O_2 where Venus is 3.5% N_2 and < 0.002% O_2.
Venus' lower atmosphere has a temperature of about 750 K (891°F) hardly conducive to liquid water or life as we know it. This temperature remains roughly constant, both day and night.
In 1970, Venera 7 (a Soviet probe), confirmed the high temperature and revealed an atmospheric pressure about 90 times as great as Earth's! (1320 lb/sq. inch compared to our 14.7 lb/sq. inch).
In 1972-73 astronomers discovered that the clouds of Venus consist of tiny droplets of sulfuric acid (H_2SO_4) 48 to 58 km above the surface compared to Earths' less than 10 km
In 1985 two balloons dropped by Russian probes found 150 mph winds in the clouds but 95° F and pressure like Earth's at the clouds altitude.

5. How does the clouds and rain on Venus compare to Earth?
The clouds of Venus and Earth form in a similar way, in atmospheric layers where the temperature and pressure cause condensation of some relatively minor atmospheric constituent. On Venus, it is H_2SO_4 droplets, which begin to fall as they grow. If a droplet gets big enough, it falls out of the

cloud deck, where it encounters much higher temps. and evaporates. Thus on Venus the rain never touches the ground. This explains why the clouds have a well-defined bottom surface, and why the lower atmosphere and surface are clear. Probes suggest lightning on Venus but still unconfirmed.

6. Does Venus have a greenhouse effect?

Venus has an extremely strong greenhouse effect, explaining the extraordinarily high temperature of the air near Venus' surface. Studies of Venus confirm that the greenhouse effect is a real planetary effect. In effect, Venus acts as a valuable natural laboratory for testing our understanding of potential environmental changes on Earth.

7. Why does Venus Have of CO2 atmosphere?

On Earth the water condensed into oceans and the carbon dioxide dissolved in the oceans and was consumed by plant life then buried in deposits of plant and animal remains and ended up in carbonate-rich sediment deposits such as limestone.

The Earth has just as much carbon dioxide as Venus but it is in the rocks instead of the atmosphere. The primordial volcanoes on Venus emitted carbon dioxide and water also but it was too hot for the water to condense into rain to form oceans. Instead of being dissolved in oceans the carbon dioxide simply accumulated in the atmosphere to a crushing 90 times our surface pressure. The water was easily broken into H which drifted into space and O. With the loss of H, Venus lost its chance to have water.

The ordinary H drifted in space but the heavy H (one extra neutron) stayed around. Venus has 150 times as much heavy hydrogen (relative to ordinary hydrogen) as on Earth.

8. Name at least four things Russia found out about Venus?

Russian scientists made Venus "their planet", so to speak. Venera 4 crashed on Venus in 1967. The intense heat caused instrument failures but before they failed they sent back interesting information. The photos revealed stark, dramatic landscapes under a high, bright sky.

The varied states of erosion, with weathered soils at some sites, suggest ongoing geologic erosion processes. The surface is primarily volcanic lava (basaltic lava)

The seventh probe (Venera 8) showed a more granite composition. The high clouds had high winds but the surface only had a 0.5 to 3 mph wind. Detected dunes in scattered locations, proving that occasional winds are strong enough to blow dust around. The landscape of Venus has orange-brown tones because it is bathed in orange like light that filters through the clouds.

9. What has radar told us about Venus?

Radar waves that have been bounced off Venus, first from Earth and later from spacecraft, allow us to "see" below Venus' clouds!

Radar shows: 1) 60% of the planet is covered by low, rolling plains, with only about a kilometer (3000 feet) of relief. 2) The other 40% is covered by uplands, including a few Australia-sized continent-like plateaus (24% of the planet) standing a few kilometers above the surface. 3). A third type of surface structure comprises a few huge volcanic peaks (16% of the planet) that tower as high as 10.6 km (34,5000 ft). These peaks rise higher than our Mt. Everest rises above sea level.

10. ON VENUS WHAT ARE MOST OF THE SURFACE STRUCTURES NAMED AFTER AND WHY?

Because Venus is named for the goddess of beauty and love, and because its symbol is also the biological symbol for female, scientists named most of its surface features after historical and mythical women. The largest plateau is called Aphrodite Terra. Other features include an impact crater named Eve, which marks the zero meridian on maps.

11. Are Venus' mountains like Earths?

No, Venus lacks long, folded mountain ranges like the Himalayas, Andes, and Rockies. Their absence on Venus convinces most scientists that Venus does not have as much active plate tectonic activity as Earth. There seems to be less continental drift on Venus than on Earth.

12 Name one surface structure found on Venus that is found on no other planet.

Coronas (Page 177 figure 9-9) are depressed or raised circular features, sometimes flooded with lavas. They seem to be sites where upwelling currents in the mantle have ascended under the crust and pushed up the surface, causing lavas to break out. (pimples)

13. Could Astronauts visit Venus?

Designers of Venus probes have been unable to build instruments that last more than tens of minutes under the infernal surface conditions of nearly 900°F and 90 times our atmospheric pressure but the upper atmosphere conditions are mild, and it might be possible for humans to fly into the atmosphere just below cloud level.

14. Name three general principles about planets that comparative planetologist have discovered:

1. The largest planets are most likely to have internal geological activity.

Internal heat is the energy source that drives geological activity such as tectonic faulting, earthquakes, and volcanism; the larger a planet, the more radioactive minerals it contains and the more radioactivity there is to release heat. Also, the larger a planet, the better insulated the interior and the harder it is for the heat to escape. Small planets, on the other hand, cool rapidly and lose whatever heat they may have generated. The Earth, unlike Mercury and the Moon, has enough internal energy to drive plate tectonics.

2. The larger a planet is, the younger its surface features are likely to be.

Scientist estimate that the surface of most of Venus averages 500 to 800 million years old. This young age is believed to result from continual resurfacing of the planet by lava flows. Remember, of course, that the planet as a whole is far older; it formed 4.5 billion years ago, at the same time as the Earth. Small planets that cooled long ago retain very ancient surface features. The Earth and probably Venus retain fewer ancient craters than Mercury and the Moon.

3. The larger and cooler a planet is, the more likely it is to have an atmosphere, and the more likely his atmosphere is to have retained its original gases.