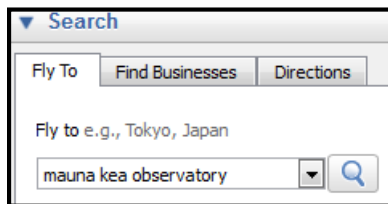
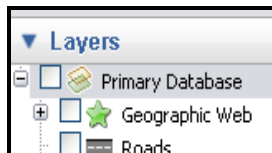


EXPLORING THE GOONIVERSE

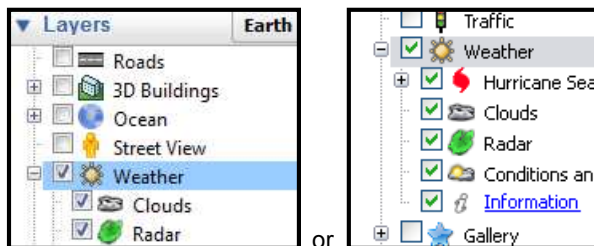
Carefully follow the directions below. Avoid taking shortcuts! Record your answers onto your answer sheet.

Part A: Google Earth I

1. Turn on the computer. Login using “student” as the ID and “Generic1” as the password. Note the number written on the computer. **What is the number of the computer you are using?**
2. Open Google Earth. Close the “Start Up Tip” window if it appears. Turn OFF all layers by unchecking the “Primary Database” box in the lower lefthand section of the display. Search for “Subaru Telescope, Mauna Kea” and double-click the first link. Turn ON the “Borders and Labels” layer. Zoom out (using the minus sign key) so you can see the entire island. **What state is the Subaru Telescope found in?**



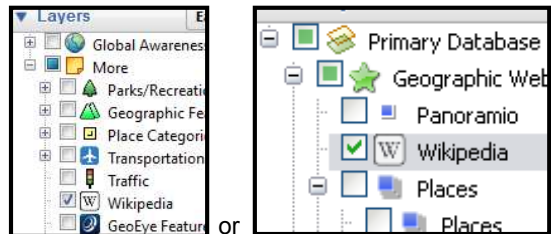
3. Turn ON the “Weather” layer (and all sub-layers). Zoom out (using the minus sign key) so you can see the entire island. **Describe the weather that Mauna Kea is having right now?**



4. Turn OFF the “Weather” layer. Turn ON the “Terrain” layer. If “Terrain” does not show up as a layer, turn it on by going to *Tools > Options > 3D View tab* and checking the “Show terrain” box. Turn on the “3D Buildings” layer. Also, turn ON the “3D Buildings” layer. Fly back to “Subaru Telescope, Mauna Kea”. Look for the twin Keck telescope domes at the top of Mauna Kea that we have studied in class. Zoom in to the twin telescopes. Tilt the view by holding the “Shift” key and pressing the “Down” arrow. **What do you notice**

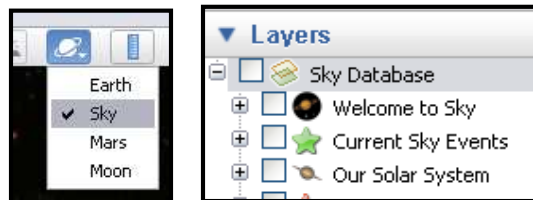
about the surface that the twin telescopes are built on?

5. The Mauna Kea Observatory is located at the summit of the volcanic island. **What side of the volcano (north, south, east, or west) do you see some snow on?**
6. Press the “R” key on the keyboard to return the view to normal. Turn ON the “Wikipedia” layer under “More” or “Geographic Web”. Hover over the “W” symbols to see the names of other telescopes that have been built around the Keck Telescope. **Name three of the other telescopes that are located adjacent to the W. M. Keck Observatory.**



Part B: Google Sky Galaxies I

7. Click on the tool that looks like the planet Saturn and select “Sky”. Close the “Start Up Tip” window if it appears. The night sky should appear. Turn OFF all layers except for the “Imagery” layer. Search for “M101”. **What kind of celestial object (e.g. galaxy, star, planet, nebula, quasar, etc.) is M101 and what is its nickname?**



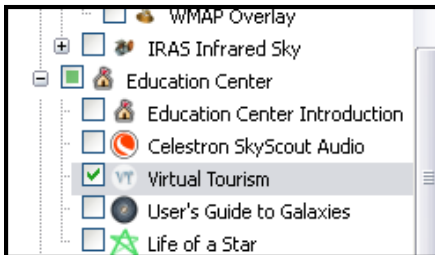
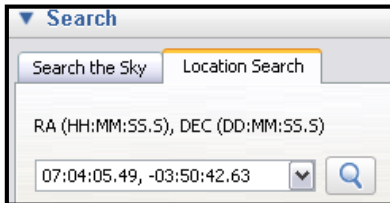
8. Turn ON the “Hubble Showcase” layer found under “Featured Observatories”. Search for “Hubble Deep Field”. Zoom in close. Click on the “Hubble Showcase” icon and read about the Deep Field. **What is the Hubble Deep Field?**



9. Search for “mrk771” and zoom in until you can see it. Click on the “Hubble Showcase” icon to read about it. **What is MRK771?**
10. Search for “Sombrero Galaxy”. Zoom in and click on the “Hubble Showcase” icon to read about it. **How far away is the Sombrero Galaxy from Earth?**
11. Search for “M87” and zoom in until you can see it. Click on the “Hubble Showcase” icon to read about it. **What is streaming out of the center of M87 and what is causing this incredible release of energy?**

Part C: Google Sky Nebulae

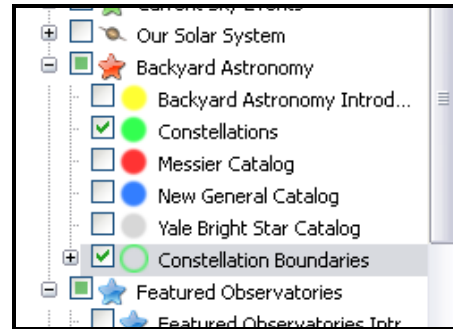
12. Conduct a sky location search by entering the right ascension and declination into the “Location Search” tab. Enter “07:04:05.49, -03:50:42.63” and click the search button. Turn on the “Virtual Tourism” layer found under “Education Center”. Click on the “VT” icon to read about this beautiful nebula. **What is name of the “aging” red star found at the center of the nebula?**



13. Search for the nebula “Cassiopeia A”. Zoom in and click on the “Hubble Showcase” icon to read about this nebula. **When did this nebula form and when did humans first see it?**
14. Search for “M57”. Zoom in and click on the “Hubble Showcase” icon to read about this nebula. **What lies at the center of this Ring Nebula?**
15. Search for “CRL 2688”. Zoom in until you can see the object and then click on the “Hubble Showcase” icon to read about it. **What is another name for “CRL 2688”?**
16. Search for “Ant Nebula”. Zoom in and click on the “Hubble Showcase” icon to read about it. **How is this nebula related to our Sun?**
17. Search for “NGC 6751” and zoom in until you can see it. Click on the “Hubble Showcase” icon to read about it. **What constellation does this nebula glow in?**

Part D: Google Sky Stars

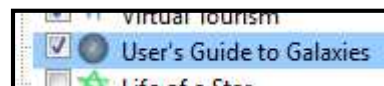
18. Search for “M80” and zoom in until you can see it. Click on the “Hubble Showcase” icon to read about it. **How many stars make up this globular cluster?**
19. Search for “Vega”. **What color is Vega?**
20. Turn ON the “Constellations” and “Constellation Boundaries” layers found under “Backyard Astronomy”. Zoom out from Vega until you can see the names of the constellations. **What constellation is Vega a part of?**



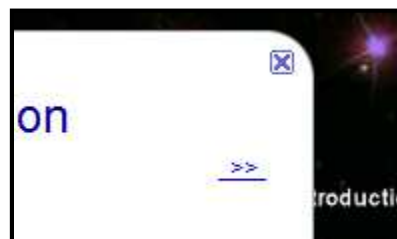
21. Search the sky for the constellation you are doing your project on. **What constellation are you doing your project on and how many stars has Google connected together to form your constellation?**

Part E: Google Sky Galaxies II

22. Turn ON the “User’s Guide to Galaxies” layer found under “Education Center”. After it is checked, double-click the swirl icon next to the “User’s Guide to Galaxies” check box. You should be taken to a new galaxy and you will begin a tour. Click on the icon to the left of the galaxy that says “User’s Guide to Galaxies Introduction”. A reading will pop up. **What two questions can be used to neatly sort most galaxies?**



23. Click the underlined arrow in the upper right-hand corner of the reading to continue the tour. When you arrive, click the galaxy icon to open the Ellipticals I” reading. **What kind of galaxy is found here and what is its name?**



24. Click the double arrow in the upper right-hand corner of the reading to continue the tour. Click the galaxy

icon to open the “Ellipticals II” reading. **How far away is the Virgo cluster of galaxies?**

25. Click the double arrow in the upper right-hand corner of the reading to continue the tour. Click the galaxy icon to open the “Lenticulars” reading. **What kind of galaxy is the Spindle Galaxy?**
26. Continue the tour to “Spirals I”. Click the galaxy icon to open the “Spirals I” reading. Read the whole page. **What did Vera Rubin discover in 1975 regarding the orbital speeds of stars in spiral galaxies?**
27. Continue the tour to “Spirals II”. Click the galaxy icon to open the “Spirals II” reading. **M96 is the brightest galaxy in what constellation?**
28. Continue the tour to “Spirals III”. Click the galaxy icon to open the “Spirals III” reading. **What is the name of this galaxy?**
29. Continue the tour to “Spirals IV”. Click the galaxy icon to open the reading. **What is the process of stripping matter from smaller galaxies often called?**
30. Continue the tour to “Barred Spirals”. Click the galaxy icon to open the reading. **How many barred spiral galaxies are in Charles Messier’s original star catalog?**
31. Continue the tour to “Irregulars”. Click the galaxy icon to open the reading. **What kind of galaxy is the Large Magellanic Cloud and what galaxy does it orbit around and occasionally pass through?**
32. Continue the tour to “The Milky Way”. Click the galaxy icon to open the final reading of the tour. **What is Sagittarius A* thought to be and why is it such a bright radio wave source?**

Part F: Google Mars

33. Close the last reading and click on the tool that looks like the planet Saturn and switch from “Sky” to “Mars”. Mars should appear. Close the “Start Up Tip” window if it appears. Turn off all layers other than “Terrain” and “Rovers and Landers” found under “Mars Gallery”. Search for “Husband Hill”. Click on the camera icon to open an article. Read the article and then click on the link at the top of the page that says “Fly into this high resolution photo”. Pan around and enjoy the view. **Describe what you see in the panoramic photo.**



34. Search for “Valles Marineris”. Zoom in until you are close to the surface and then tilt the view by clicking

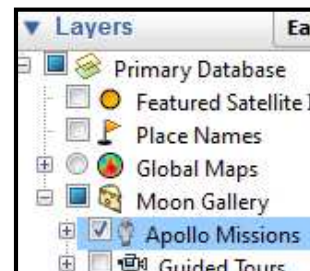
Shift and the *down arrow*. Pan around and explore the area. **What is Valles Marineris?**

35. Hit “R” to return your view back to normal. Search for “Olympus Mons”. Turn on the layer called “A Traveler’s Guide to Mars” and then double-click the green icon of the two hikers. **What is Olympus Mons the largest of?**



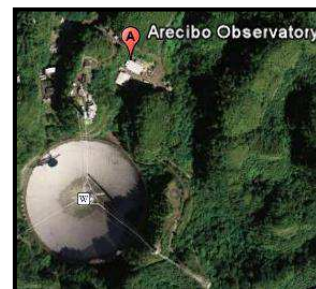
Part G: Google Moon

36. Click on the tool that looks like the planet Saturn and switch from “Mars” to “Moon”. The Moon should appear. Close the “Start Up Tip” window if it appears. Turn off all layers other than “Terrain” and “Apollo Missions” found under “Moon Gallery”. Search for “Apollo 11” and then “Apollo 12”. Zoom in and toggle OFF the “Apollo Missions” layer to view the unobstructed surface. **What do you see that is evidence of humans landing on the moon?**



Part H: Google Earth II

37. Switch back to Google Earth from Google Moon. Search for “Arecibo Radio Telescope, Arecibo, Puerto Rico”. You will see a list of possible matches that have red markers. Ignore the “Sponsored Links”. Double-click on the first one in the list. It should read “Arecibo Observatory”. Click on the Wikipedia “W” at the center of the radio dish. **How large (in meters) is the dish of this telescope, according to Wikipedia?**

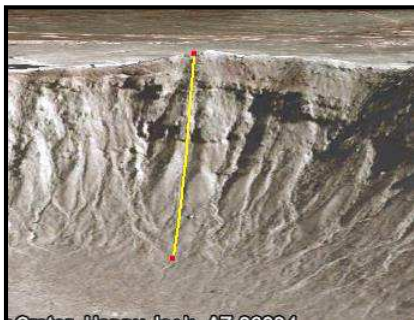


38. Click on the “Show Ruler” tool. Set the line length to be “feet”. Measure the diameter of the telescope dish

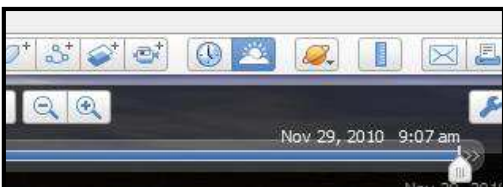
by clicking once to begin measuring and then again to stop measuring. **What is the diameter in feet?**



39. Fly to "Fermilab LINAC, IL". Double click on the first entry (A) listed in the results window. Zoom in and click on the Wikipedia "W" near the center of the large ring. Click on the blue hyperlink for "particle accelerator" in the second paragraph. Your internet browser should open and take you to Wikipedia.org. Read the first paragraph of the web page. **What is a particle accelerator?**
40. Remain on the Wikipedia web page from the last step. Find section 5.1 in the "Contents" box and click on it to read that section. **What is a concern that people have about high-energy particle accelerators?**
41. Fly to "Meteor Crater, Happy Jack, Arizona". Zoom in to the surface and tilt the view so that you can see the topography of the terrain. Use the ruler tool to measure the height of the crater walls from the base of the wall to the top. **How many feet high is the highest wall of Meteor Crater?**



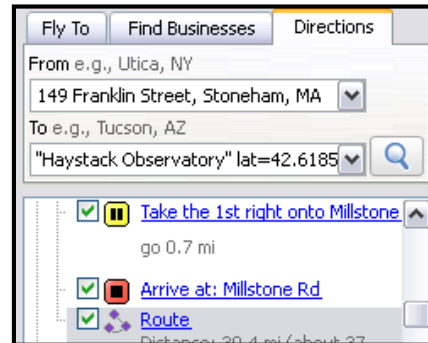
42. Click on the "Show sunlight across the..." tool. Drag the slider back and forth and observe what happens to the image of the crater. **Describe what this tool this does.**



43. Search for "Millstone Road, Groton, MA". Turn on the "Roads" layer. Zoom in to an altitude of about 1900 feet and follow Millstone Road north until you see the radio telescopes. Click on the Wikipedia "W" labeled

"Haystack Observatory". **What university owns the observatory?**

44. Right-click on the Wikipedia icon from the last step and select "Directions to here" from the menu. Enter "149 Franklin Street, Stoneham, MA" for the "From" address in the "Directions" tab. Scroll through the directions until you see "Route". **How long does it take to drive to this observatory from the high school?**



45. Click on the "Fly to" tab and enter "Stoneham, MA". Without moving the screen, zoom to an altitude of about 1000 feet (the altitude is shown at the bottom right of the screen). You should see the Winter Street parking lot and a park. Click on the 'Show Historical Imagery' tool (it looks like a clock). Move the slider left to the year "1995". **What do you notice about the park?**



EARTH SCIENCE

Gooniverse

20 Points

Overall Score:	Overall Grade:
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