Week 5 lab part (A) can be done in this file, or printed out. Part (B) can also be done in the sheet for example using a pdf editing tool, something like https://smallpdf.com/edit-pdf or in the sheet printed out.

Week 5 lab part (A): Black body radiation

Go to the https://phet.colorado.edu/sims/html/blackbody-spectrum/latest/blackbody-spectrum_en.html You can change the temperature of the star by moving the slider to the right (thermometer) up and down. With the camera icon you can record a particular curve (to compare to others). You can switch the graph labels and values on and off with the check boxes above the camera icon.

(1) What temperature of star has most of its light being emitted at red wavelengths? At green wavelengths? At blue wavelengths?

red: 4100k, green: 5500k, blue: 6300k

(2) Which is hotter, a red star or a blue star?

Blue star

(3) What is the mathematical relationship between temperature and peak wavelength: Is it proportional (wavelength proportional to T) or inversely proportional (wavelength proportional to 1/T) ? Explain.

They are inversely proportional, 1/T such that as T goes up, wavelength goes down

(4) The Sun's photosphere (layer where most visible light is emitted) is 5800K. To what color of light does this temperature correspond?

In between blue and green

(5) Vary the temperature of the star. Assuming the stars are the same size, which is brighter, a red star or a blue star?

Blue star since they are hotter

Now change the temperature of the star to 6000K and measure the amount of red light emitted by such a star (you should use the camera icon to move another curve up and down to measure the right value). Then change the temperature to 4000K and measure the amount of red light emitted.

(6) Which emits more red light, the star at 6000K, or the star at 4000K?

6000K start

(7) If you were to see the 4000K star in the night sky, what color would it appear?

Red

(8) If you were to see the 6000K star in the night sky, what color would it appear?

Blue-Green

Lab (B): Planetology

SURFACE FEATURES

A phenomenal amount of information about the planets in our Solar System is gathered using only pictures. In this activity we will use Google Maps™, Google Mars™, and Google Moon™ to learn about the surface features on these different worlds.

There are many types of surface features seen on different worlds. For this activity, consider the following types of surface features:

- *Craters*—are bowl-shaped holes in the ground. Use shadows to differentiate craters from mountains. Some large craters have a central peak. Some craters show rays, created by ejecta from the impact. All craters in this activity are created by the impacts of meteors.
- *Mountains*—are caused either by cooling and buckling of the surface (as on the Moon) or by tectonics or volcanism (as on Earth and Mars).
- *Lava flows*—are large, smooth areas (on the Moon they are darker in color) created by lava.
- *Faults*—are a long, narrow channel in the land. These are typically created by tectonics, but can also be created by stress, such as *Vallis Marinaris* on Mars.

PART 1: GETTING ACQUAINTED WITH SURFACE FEATURES

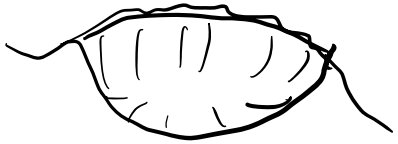
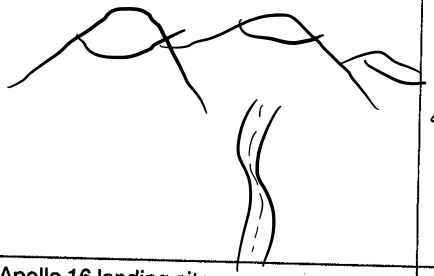
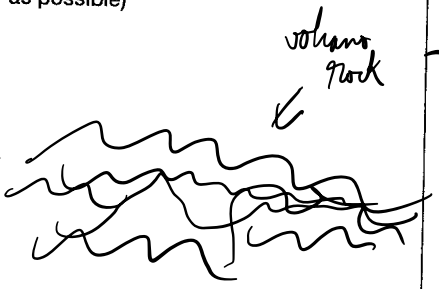
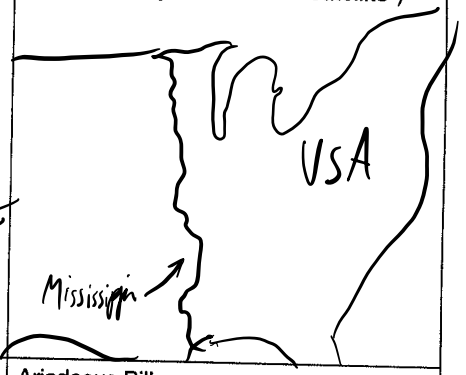
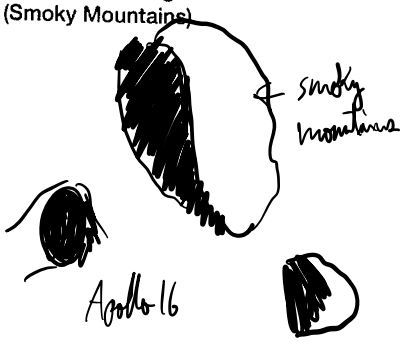
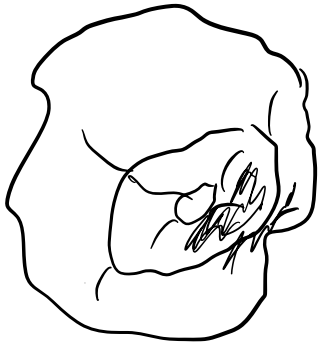
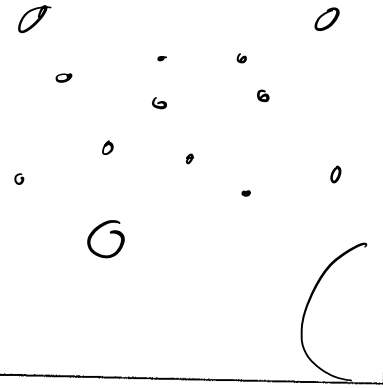
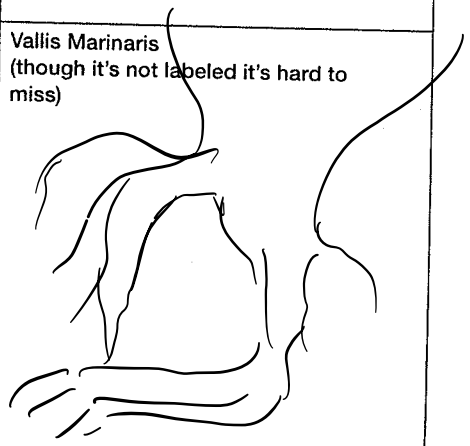
For this activity we'll be using images from the following websites:

- Google Maps™: www.google.com/maps
- Google Mars™: www.google.com/mars
- Google Moon™: www.google.com/moon

For several types of surface features, you will need to find and sketch an example of that feature from each of the three worlds we're examining. In Google Maps™, use the "Satellite" view for Earth. Google Mars™ has categories listed in the top navigation area to help you find various types of features. Google Moon™ does not always display imagery at the highest possible resolution; therefore, for one of the features, *Ariadaeus Rille*, you will need to find a better image online than the one provided by Google Moon™ from which to complete your sketch.

Remember to zoom to the appropriate scale for your feature before sketching. For example, if you are drawing the Mississippi River, zoom to a scale where you can see as much of it as possible before sketching. If you are sketching the Sea of Tranquility on the Moon, zoom to a scale where you can see the whole thing (mare on the Moon are dark grey, and this one is very large).

Fill out the following table by sketching the requested features using Google Maps™, Google Mars™, and Google Moon™.

	CRATERS	MOUNTAINS	LAVA FLOWS	FAULTS
EARTH	Barringer Crater: 35°02'N, 111°01'W 	Mauna Kea, Hawai'i 	Volcanoes National Park, Hawai'i (19.338 N 155.032 W—zoom in as much as possible) 	Mississippi River (36 N 89.71 W) (zoom halfway out and use "Satellite") 
MOON	Cone Crater 	Apollo 16 landing site (Smoky Mountains) 	Sea of Tranquility–Apollo 11 (look for smooth gray region) 	Ariadaeus Rille (http://antwrp.gsfc.nasa.gov/apod/ap021029.html) 
MARS	Arandas Crater (include rays) 	Olympus Mons 	Meridiani (zoomed in halfway) 	Vallis Marinaris (though it's not labeled it's hard to miss) 

PART 2: COMPARATIVE PLANETOLOGY

1. Compare the craters you saw on the Earth and Moon to the ones you saw on Mars. What is similar? What is different?

The ones on the moon are much more contrasted because of no atmosphere

2. Compare the mountains you saw on these three worlds. What is similar? What is different?

The mountains on mars are way bigger than the other two

3. Compare the lava flows (mare) you saw on these three worlds. What is similar? What is different?

Earth is the only one with fresh volcanic rock and geological activity

4. Look at the elevation map of Mars. What's strange about the distribution of elevations on Mars?

The northern hemisphere is lower than the southern

5. Look at the entire map of the Moon's surface, zoomed out. What's strange about the distribution of lava flows on the Moon?

The moon only has deep craters at the poles so the middle is nice a smooth

6. How does the amount of cratering on the far side of the Moon compare to the near side? (Note: All *Apollo* missions landed on the near side.)

more craters on the far side

From pictures alone it is difficult to determine absolute knowledge about different worlds. But it is possible to do comparisons in order to gauge relative differences. Spend some time looking around at the terrain on each of these three worlds.

7. Assume that every planet or moon in the Solar System gets struck by asteroids at about the same rate (which is a decent assumption). How does the amount of cratering on these three worlds differ?

Earth is the only one with protection by a thick atmosphere to burn up craters so moon and mars will be more affected

8. Why do you think these three bodies show different amounts of cratering?

Because of the different thicknesses of atmosphere

9. On which worlds do you see evidence for past geological activity (i.e., lava flowing)? What evidence do you see?

On all 3 planets there is clear evidence of lava by the formation of the rock

10. On which worlds do you see evidence for current geological activity? What evidence do you see?

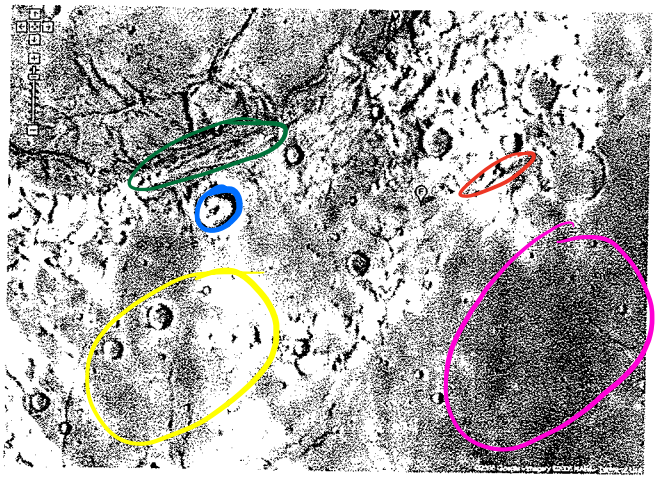
Only earth has current activity from active volcanos

11. On which worlds do you see evidence for erosion from wind or water? What evidence do you see?

Both Earth and Mars have canyons carved by glaciers while

PART 3: STRATIGRAPHY

Below is an image of the *Apollo 17* landing site. Use colored pencils to trace out craters, faults, lava flows, and mountains directly on the image, and complete the legend for these different types of surface features with your color coding.



Feature	Color
Crater	Blue
Rille	red
Wrinkle Ridge	green
Mare	pink
Highlands	yellow

12. Geologists use the "stratigraphic principle" to determine the history of a surface. This principle basically states that things on the bottom happened earlier than things on the top. Using the stratigraphic principle, rank the types of features you found in the image above in order from oldest to youngest:

wrinkleridge, mare, rille, highlands, crater